WORKING GROUP ON BIOLOGICAL PARAMETERS (WGBIOP; OUTPUTS FROM 2023 MEETING)
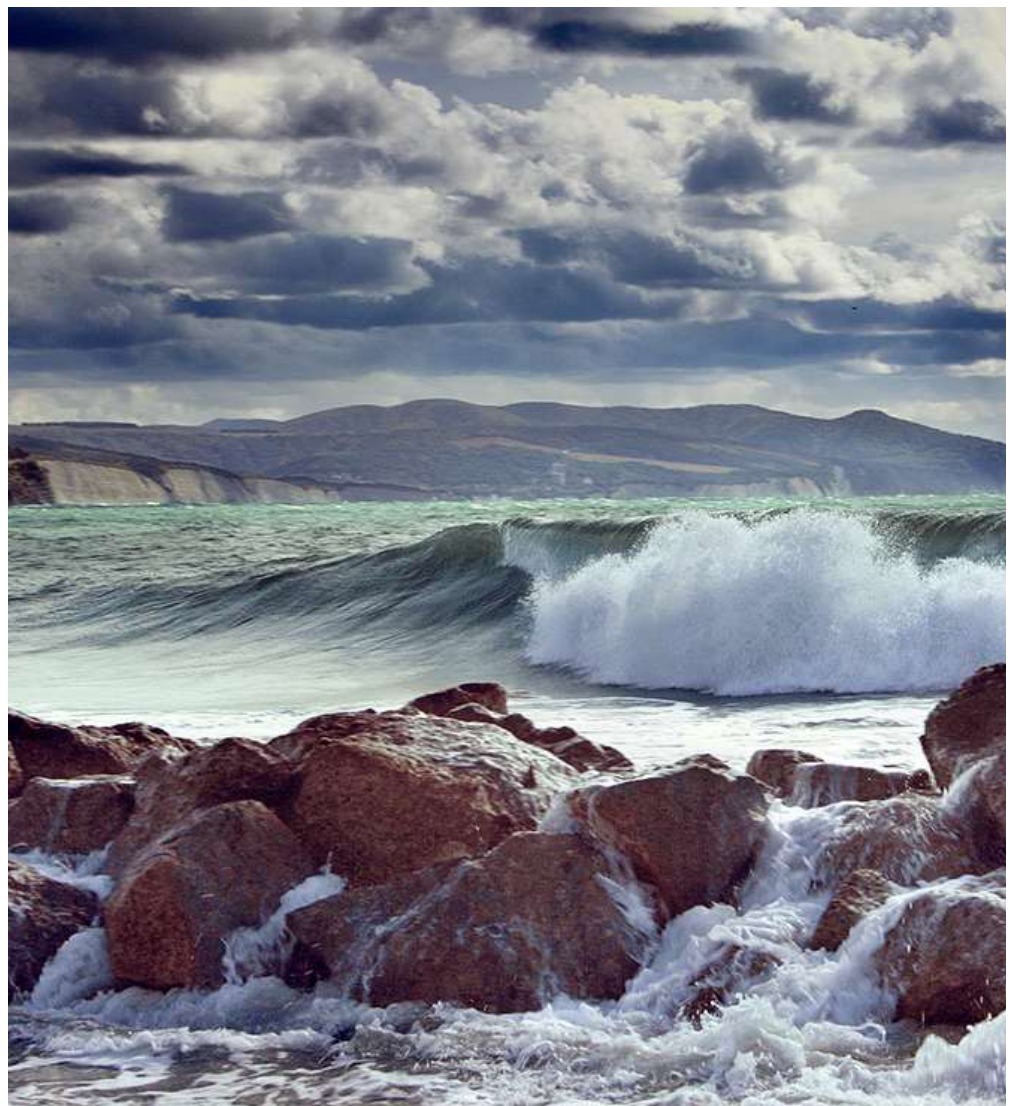
VOLUME 6 | ISSUE 2

ICES Scientific Reports

WORKING GROUP ON BIOLOGICAL PARAMETERS (WGBIOP; OUTPUTS FROM 2023 MEETING)

Recommended format for purpose of citation:

Editors

Maria Cristina Follesa • Annelie Hilvarsson • Sally Songer

Authors

Wim Allegaert • Gualterio Basilone • Ulrika Beier • Karen Bekaert • Florian Berg • Dheeraj Busawon • Ângela Canha • Pierluigi Carbonara • Pedro Torres Cutillas • Julie Coad Davies • Cindy van Damme • Côme Denechaud • Laurent Dubroca • Romain Elleboode • Inês Farias • Rosalia Ferreri • Guðrún Finnbogadóttir • Maria Cristina Follesa • Mandy Gault • Ruadhán Gillespie-Mules • Patricia Gonçalves • Yvette Heimbrand • Annelie Hilvarsson • Maria Korta • Uwe Krumme • Louise Scherffenberg Lundgaard • Kirsteen Mackenzie • Kélig Mahé • Zuzanna Mirny • Larissa Modica • Gráinne Ní Chonchúir • Konstantina Ofridopoulou • Vaso Papantoniou • Annie Pursiainen • Tiit Raid • Jari Raitaniemi • Joanne Smith • Szymon Smoliński • Sally Songer • Valerio Visconti • Francesca Vitale • Dace Zīlniece

Contents

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 stock assessment.

The Group aims to plan workshops, exchanges, and validation studies on a range of biological variables with a view to reviewing the quality of information supplied for stock assessment. The group also investigates data availability and develops documentation and methods to improve communication between data collectors and end users and continues to contribute to new and improved functionality for the SmartDots platform.

Time was spent in plenary discussion on the Sexual Maturity Staging in Fish (the SMSF maturity scale), and its adoption and implementation. The development of the WGBIOP collection on the ICES library reached a conclusion with the collection being launched and steps being put in place to allow the inclusion of all remaining information going forward. This collection will replace the Data Quality Assurance Repository. A Scientific Session was delivered which focused on developing tools such as AI and Machine Learning and how their applications in the fields of age determination and maturity staging can be supported by the Group. A useful discussion also took place around the creation and utilisation of reference collections.

As we move to completion on the majority of tasks under the existing ToRs, a significant part of the meeting was spent in plenary discussion with the aim of shaping the new ToRs for the upcoming three-year term. Agreement was reached on having more emphasis on maturity, new and developing tools and techniques, environment and ecosystems effects and data quality and optimisation. There was also recognition that as the Group moves into new areas of work, it may be necessary to review the membership to ensure that all areas of expertise are covered, but it is expected that this will evolve during the course of the next term. New chairs were nominated, and thoughts were given to how the next three meetings should be run, concluding that the first and last will be hybrid with the middle year being exclusively online. It is hoped that deciding on this format now will give group members the ability to plan attendance more effectively.

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	3/3
Chairs	Maria Cristina Follesa, Italy
	Annelie Hilvarsson, Sweden
	Sally Songer, United Kingdom
Meeting venues and dates	23–26 October 2023, San Sebastian, Spain, hybrid meeting (25 participants in person, 18 participants online)
	30 November 2023, online meeting with incoming Chairs

1   Introduction

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 stock assessment and management. Throughout this three-year term the ongoing challenges of COVID-19 have had an impact. During the first year of the term the meeting was held completely online, which was challenging for new chairs of a large group. The second and third years were hybrid, with approximately half of the participants online and half attending in person. The technological challenges associated with hybrid meetings were overcome effectively, and we endeavoured to make the meetings as inclusive as possible. We also, particularly in the first year, did more intersessional work during the course of the year, rather than focusing entirely on the main October meeting. Going forward we would ideally hold at least one of the three meetings in the next term fully online to reduce the need for participants to travel and maximise the ability of participants to attend in person during the other years.

In 2023 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 support WGSMART in advancing this platform with particular emphasis on developing the Maturity, egg and larvae software modules and providing input on the guidelines for taking high-quality images. A session was held at the WGBIOP meeting covering updates to the reporting module, data licencing, QS scores, training materials, country coordinator roles and responsibilities, reference collections and the potential for future integration of AI methods.

WGBIOP reviewed and approved upcoming exchanges and workshops. Striving to align these events with the benchmark list, the Group is facing challenges concerning the timing of this list release. This temporal constrain limits WGBIOP ability to organise exchanges and workshops promptly enough to contribute with meaningful results. Efforts are underway to overcome these obstacles and ensure a more streamlined coordination of activities.

Work continued in conjunction with the ICES library, resulting in the launch of the WGBIOP library collection (https://ices-library.figshare.com/collections/Biological_Parameters_Calibration_-_Guidelines_and_Reports/6234933). This collection is live, and will be expanded as time progresses, and updated at least annually by WGBIOP, to ensure its ongoing relevance and comprehensiveness.

Work to improve communication between the Group and stock coordinators continues and challenges have been overcome to some extent with the response rate to our questionnaire increasing up to ~ 70% in 2023. We intend to improve this further in coming years by sending a WGBIOP representative to relevant Stock Assessment Working Groups to present information and give an opportunity for stock assessors to feed back any issues they would like the WGBIOP to advise them on.

As we reach the end of this term with many of the existing ToRs coming to a conclusion, effort was put into discussing the direction the group should take going forward with new ToRs being identified and new Chairs nominated. As the Scope of the working group evolves to include emerging tools, for example AI/Machine learning and genetics, the expertise within the group will also need to evolve, and this may lead to changes to the current and future membership.

2 Progress report on ToRs and work plan

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

2.1.1 Progress during WGBIOP 2023

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 2024 and onwards.
- The interactive table of workshops and exchanges "WK, Ex, sg History Master Table" was updated for the current year and format changed to allow a better view.
- The subgroup reported results from workshops and exchanges which took place in 2022 and 2023 as well as some earlier ones, summaries of which are available in **Error! Reference source not found.**.
- Drafted resolutions for workshops and exchanges endorsed by WGBIOP, to be approved by ICES, for 2024 which can be found in **Error! Reference source not found.** The identification of priority species and stocks in need of validation studies based on the criteria and approach approved in 2022 (see Annex 4).
- The status and future input of WGBIOP into the Data Quality Assurance Repository was finalised.
- The contribution of WGBIOP to the new Stock Information Database (SID) platform was further discussed and a final decision was reached.

A full list of exchanges has been proposed this year for 2024 and beyond with associated coordinators (Annex 3). 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 2024/2025 for consideration.

2.1.1.1 Identify and prioritize stock specific targets for validation and accuracy of biological parameters.

The issue list of the stocks up for benchmarks in 2024 was extracted from SID. The issue lists were checked for any age-related and maturity issues, and no problems were highlighted. However, it is not entirely clear whether there are in fact no age-related issues, or if these have not been added to the SID issue list by the stock coordinator and/or assessor.

The list of the 2024 benchmarks was received in May 2023; the timing of the receipt of this list still represents a concern that WGBIOP has tried to overcome for several years now (i.e., obtaining an early release of this list to allow the coordination of proposed events in a timely manner to meet the benchmark workshop deadlines). In 2023, some national coordinators have conducted 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 could later be included in the benchmark list. This has helped to identify earlier the availability of institutes and coordinators to carry out proposed exchanges and workshops (or at least to start the discussion).

2.1.1.2 The new Master table – An interactive table of workshops and exchanges.

A GitHub repository (wg WGBIOP) has been created for all interactive tables produced by WGBIOP. In time, most of the content on the "Data quality assurance repository" will be transferred to the new WGBIOP collection in the ICES library (see section 2.1.1.5) but in the meantime, and for tables that are not possible to publish in the library, the GitHub repository will be used for publishing.

The interactive table of workshops and exchanges was updated and is available on GitHub (Historic master table). This "master table" summarizes all age-reading and maturity workshops and exchanges that have been conducted and provides links to the published reports. However, since this table does not compile the results of the workshops and exchanges, a new table (Results of age-reading exchanges and workshops 2017-2023) was created as discussed during the 2022 meeting (ICES, 2023a). This new table currently summarizes the age-reading results from 2023-2017. The data is complete for those years, and two case studies for eastern Baltic cod and Atlantic mackerel were added going further back. In later years, SmartDots was used for these exchanges and workshops providing easy access to the results. For the coming years, it is planned to update this table extending it back in time where possible for specific species/stocks. Due to the new structure (long format) of the table, it is now possible to conduct statistical analysis investigating temporal changes in age-reading precision.

2.1.1.3 The validation of age estimation

During WGBIOP 2023, an exercise was carried out with the aim of identifying the species most in need of validation based on the criteria and approach approved in 2022. The exercise was based on and facilitated by using the data included, updated, and re-arranged in the new master table (see above). In brief, the following protocol and filters were applied to identify candidate species and stocks:

a) Filter to select only species with age-based analytical assessment (column K).
b) Based on percent agreement (PA in column P) fill all rows with PA < 70 % red.
c) Based on the coefficient of variation (CV, column Q) mark text red in all rows with CV > 15%.
d) Based on average percent error (APE, column R) make text bold in all rows with APE > 15%. (Note: not all species have APE calculated.)

The outputs of this exercise are presented in the Annex 4. While the list of species and stocks highlighted here might reflect the real need for validation studies, the WGBIOP plenary will discuss the results of this exercise during the 2024 meeting. Therefore, species and stocks present in the Annex 4 do not represent a formal recommendation yet.

2.1.1.4 The validation of maturity estimation

During the WGBIOP 2022 meeting, a subgroup of experts met in order 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 as 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 in collecting the most recent

information on ongoing benchmarks, the calibration/validation should start the year of the benchmark in order to be ready for the next one.

3. The identification of the species for which to proceed with validation studies should be performed on the basis 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). Clear communication between WGBIOP and the Stock Assessment Working Groups will help to facilitate the sharing of this information.

On the basis of the steps identified, 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 the near future (2022–2024) was highlighted. Information on current validation studies, including work on similar species will also be considered during this prioritisation exercise. Reports from previous ICES Workshops and Exchanges will be consulted, then, information on quality assurance protocols of maturity data collected at 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 in order 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.

In 2023 it was agreed that more work needs to be done on a number of elements relating to Maturity including the adoption and use of the SMSF stages and guidance on mapping historic stages to these. It is intended that a new ToR focusing on Maturity will be adopted for the next 3-year cycle of WGBIOP meetings to allow more focus to be given to this important area of work.

2.1.1.5 Transitioning from the Data Quality Assurance Repository to the ICES Library – Implications for WGBIOP documents.

Currently, the Data Quality Assurance Repository (Data quality assurance repository) contains details of the following:

- Guidelines for exchanges and workshops for both age and maturity.
- Exchange and workshop reports
- A very limited number of ageing and maturity manuals.
- Some relevant ICES expert group reports (such as WKPICS, TACADAR, WKFICON etc…)
- PGMED reports 2009–2012.
- And under the heading 'Others' e.g. Guidelines and Tools for Age Reading Comparisons, Eltink et al., October 2000 etc….

While the Repository houses some very important resources for colleagues engaged in ageing and maturity staging, it hasn't been widely accessible to people outside of the WGBIOP family and is therefore underutilised and considered not fit for purpose.

It was agreed that the most suitable avenue to disseminate WGBIOP-related information is the new ICES Library, which is currently in development. In order to expedite this process, contact was made with Ruth Anderson of the ICES Library, during the WGBIOP meeting in 2022 and so work has been ongoing with the ICES Library over 2022 and 2023 to transition from the Data Repository to create and curate a WGBIOP Collection within the ICES Library. A WGBIOP-related Collection has been created and titled: "Biological Parameters Calibration - Guidelines and Reports", which when made public will have its own DOI. It will be possible to 'Follow' this collection within the Library so that you receive notifications each time the collection is updated,

it will be searchable, and it will be possible to track the usage of the collection. WGBIOP Members will be alerted once the collection is 'live'.

Going forward the task of updating the collection will be undertaken by the relevant WGBIOP Subgroup at the annual WGBIOP meeting in October and will hopefully include links to published reports of exchanges and workshops from SmartDots in the future.

For the moment a twin-track approach will be taken with both the ICES Library collection and the Docs Repository remaining available. There is a need to update the guidelines for workshops and exchanges and also the guidelines for image quality for these calibration exercises. The updated documents will be formatted to conform with a recognised format which can be published by ICES e.g. user handbook or TIMES formats.

2.1.1.6 Stock Information Database – A final update

Contact was made with a member of the governance group for SID (Stock Information Database) to consider if a facility in SID could be used as a repository for workshop and validation studies so they could be readily available for assessment groups and other interested parties.

The response was that SID only stores high-level data directly linked to the stocks and it is not a "holder" of available data therefore does not have a facility for this. It was agreed that this information is important and should be made readily accessible to the ICES community, but SID is not the place for it so instead this information will be stored in the WGBIOP Library collection.

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 was to improve training and quality assurance of age reading, maturity staging, and other biological parameters.

It is important that the biological parameters used in stock assessment are of the highest quality. In order to support this aim, WGBIOP will gather all the information on quality assurance and accuracy estimates of biological parameters used at institute level in order 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 but methods, routines, and protocols for monitoring the quality of age and maturity on a national level need to be standardized. There is also 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 2023

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

Quality status on ageing and maturity tables had been produced in 2020 and were sent around to national laboratories during 2021 and 2022. The tables summarizing the implementation and handling of both age and maturity quality scores received from the national coordinators were published in Annex 4 of the WGBIOP 2022 report (ICES, 2023a) and can now also be found on

the GitHub repository (wg_WGBIOP). Quality assurance tables were returned by 27 national laboratories from 19 countries. In 2023, the answers regarding the implementation and handling of both age and maturity quality scores were revised, but it has not been considered necessary for them to be updated.

Moreover, in the future the quality status table can be used as a template for emerging biological parameters. Such biological parameters include for example egg staging or larvae identification that are calibrated within SmartDots utilizing the new egg and larvae modules. Best practice guidelines should be provided then.

2.2.1.1 Outline "best laboratory practice" guidelines in cooperation with the RCG

Quality scores (QS) for maturity and other biological parameters are already implemented and available under "MeasurementCertainty" within ICES vocabulary. QS codes are common for all biological parameters except for ageing. The codes for ageing (AQ) remain the same because an existing code cannot be changed.

To understand marine trophic webs, guidelines for stomach sampling with a view to defining new biological parameters are necessary. These guidelines have been developed by ISSG Stomach Sampling within the framework of the RCG Baltic and the RCG North Atlantic, North Sea and Eastern Arctic. The main objective of the ISSG Regionally Coordinated Stomach Sampling is to establish a regionally coordinated stomach sampling program – potentially covering on-board sampling, stomach analysis in laboratories, data storage and reporting – in European waters, starting with the North Sea, Skagerrak and Kattegat as a case study.

2.2.1.2 Update guidelines for age and maturity, prepare new ichthyoplankton guidelines in cooperation with WGSMART and continue the monitoring of them (ToR f)

There are two sets of guidelines. Those for setting up exchanges and workshops and those for laboratorys outlining best practice procedures.

Best practice guidelines can be found in Annex 5.

Guidelines for setting up events for age and maturity will be thouroghly revised under the new term of WGBIOP and then published in the WGBIOP collection in the ICES library.

WGBIOP has not developed specific guidelines for ichthyoplankton sampling as we do not currently have enough relevant expertise within the Group, and recommends that those guidelines should follow the manuals developed and provided by the working groups dealing with ichthyoplankton, i.e.,WGALES, WGMEGS, WGSINS.) (ICES, 2010, ICES, 2013, ICES 2019e).

The previous three tasks will be included within the new Quality Assurance ToR in the next three-year period.

2.2.1.3 SMSF modified/clarified. Getting it implemented in all countries.

A specific subgroup namely "maturity" has been created to deal with maturity issues, including this task.

The internationally agreed maturity scale SMSF (Table 1; ICES, 2018) became compulsory for reporting in 2020. However, few countries actually started using and reporting in it in 2020, while other countries continued to use their national maturity scale and converted it to the SMSF before

uploading data to ICES. Unfortunately, those conversions were not always correct, which implied extra effort in data manipulation for some stocks to align input data used in the stock assessment. As of 2023 not all countries have implemented the SMSF scale. In 2023 WGBIOP realized that despite workshops, several reports and discussions, there were still doubts on the use of the SMSF both at national and international level. In 2023 WGBIOP received specific recommendations from assessment and Survey WGs asking for more guidance and clarification for conversion between scales (see Annex 6). WGBIOP decided to clear up some of the more controversial (sub)stages, identifying clear key macroscopic and histological characteristics (Table 2) aiding for maturity assessment and advantageous for the conversion of previous international but also national scales.

Table 1: SMSF (WKMATCH 2012 maturity scale revised). Source: ICES, 2018.

State	Stage	Possible sub-stages
SI. Sexually immature	A. Immature	
SM. Sexually mature	B. Developing	Ba. Developing but functionally immature (first-time developer)
		Bb. Developing and functionally mature
	C. Spawning	Ca. Actively spawning
		Cb. Spawning
	D. Regressing/Regenerating	Da. Regressing
		Db. Regenerating
	E. Omitted spawning	
	F. Abnormal	

The use of substages (at least for the B stage), overlooked by some countries, is fundamental for an accurate estimation of maturity ogives and SSB and has an impact in stock assessment. The substage **Ba** identifies a sexually mature but functionally immature (virgin developing for the first time) fish which is **not going to contribute** to the current upcoming spawning season. Either it is uncertain if the fish will make it for the upcoming spawning season as it is a long time to the current upcoming spawning season (i.e. if maturity is assessed 8 months prior to the spawning season it is unsure if the first time developer will be ready to spawn in 8 months time), or the time between assessing the maturity stage and the current upcoming spawning season is too short to fully develop the oocytes (i.e. if it takes 6 months to fully develop oocytes from previtellogenic to eggs and a Ba fish is found 3 months prior to the current upcoming spawning season, it will not have enough time to develop the oocytes). On the other hand, the substage **Bb** identifies a developing and functionally mature (first or repeat spawner!!) fish which, in most of the cases **is going to contribute** to the current spawning season. One should be aware that a fish at the onset of vitellogenesis it is not 100% sure that the fish will spawn in the current upcoming spawning season (i.e. Rideout & Tomkiewicz 2011). Various reasons can be the cause of a fish aborting vitellogenesis (Rideout & Tomkiewicz 2011), and can occur in fish with long and short oocyte development times. Distinguishing those two substages Ba and Bb is then a critical step for obtaining accurate maturity ogives and a correct estimation of the proportion of the stock that has reached sexual maturity and is going to reproduce during the current upcoming spawning season.

Fish in stages E (spawning omission) and F (abnormal) are not going to reproduce during the current upcoming spawning season.

For being a stage E, a fish must have been reproducing before (thus cannot come from substage Ba, as this fish is developing for the first time) (Rideout & Tomkiewicz 2011) and is still regenerating Db or early Bb at the time when it should already be in advanced oocyte development. This implies that this fish is not going to make it this upcoming spawning season. In order to assess a gonad in spawning omission the developing time (i.e. the time needed for that species for going through Ba/Bb to Ca/Cb) must be known. For example, if it is known that it takes 8 months (for example for North Sea plaice or winter spawning North Sea herring) for that species to develop in stage Bb to reach stage Ca/Cb and we find a gonad in stage Db or early Bb three months before the coming spawning season, we can state that this fish is not going to make it for the current spawning season thus we can record it as Stage E.

For this reason, WKASMSF (ICES, 2018) advised the use of the SMSF scale for northern temperate stocks only three months prior or during the spawning season. Most of the southern stocks spawn all year around so the developing time (from Ba/Bb to stage C) must be known or investigated.

Table 2: Macroscopical and histological key characteristic for identifying and discern the different substages of the SMSF scale.

SUBSTAGES	MACROSCOPIC key characteristic	HISTOLOGICAL key characteristic
A. Immature	No sign of development	Only oogonia and primary growth oocytes
Ba. Developing	No visible oocytes	Cortical Alveoli oocytes
Bb. Developing	Visible oocytes and grainy appearance	Vitellogenic oocytes
Ca. Actively spawning	Hydrated oocytes and running	Hydrated oocytes and ovulated eggs
Cb. Spawning capable	Hydrated oocytes	Hydrated oocytes
Da. Regressing	Ovaries contracted, flaccid and <u>some</u> mainly hydrated oocytes	Some Hydrated oocytes and Post Ovulatory Follicles (POFs)
Db. Regenerating	Same as Bb BUT grey cast and thicker wall!	POFs and previtellogenic oocytes

As a rule of thumb, when assessing maturity of a fish, we need to know the reproductive cycle of that specific stock including the spawning season. Also, the sampling time in relation to spawning time must be taken into consideration for the final assessment.

Other important guiding issues that may help the maturity stager when assessing a gonad is to look at stages present in the entire sample, e.g. if there are running or regressing individuals in the sample. Also, it is important to reflect on the questions whether that specific fish has spawned before and if it is going to make it for the current upcoming spawning season.

A general presentation on SMSF was prepared and shared among WGBIOP members via the SharePoint for in-house presentation.

The maturity subgroup will have a dedicated ToR in the next three-year term.

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 2023

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 2023, ToR c prepared various deliverables:

- Compiled responses to the issue lists of stocks that are proposed for a benchmark assessment in 2023 (Annex 6; Table 1)
- Compiled information on each stock to be benchmarked detailing existing age/maturity exchanges/workshops (Annex 6; Table 1).
- 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 6; Table 2)
- Generate a comprehensive summary concerning the Quality Indicator Table based on the stock-specific information gathered from Stock Coordinators over the current three-year period 2021–2023 (Annex 6; Table 3).
- 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 WG's for the upcoming (2024) benchmark stocks were collated mainly from SID and the issues concerning biological parameters 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 6; Table 1). Most of the stocks using age in the assessment, which are going to have a benchmark in 2024 had an age determination exchange recently. This information was shared with the ToR A subgroup dealing with new upcoming workshops and exchanges.

The goal was to inform the WG's 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. Previously we were adding this information as a comment to the Stock Rolling Issue Lists on SID. But as we weren't sure people read that. For the future WGBIOP presentations in the assessment groups this point will be emphasised.

Responses from Stock Coordinators received as feedback on WGBIOP 2022 comments to issue lists were followed up (Annex 6; Table 2).

2.3.1.2   Quality Indicator Table

The primary objective in assessing the quality of biological parameters involved the formulation of various quality indicators during the initial three-year term of WGBIOP (2015–2017). In the following years, a Quality Indicator Table was created first in .xls format and afterward 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.

Before WGBIOP in 2021 and 2022, the link to this table was sent out to chairs of most of the ICES stock assessment Working Groups, who were asked to distribute it among the corresponding stock coordinators. WGBIOP didn't get responses for all stocks, therefore the table was sent out once more before WGBIOP 2023 in order to collect the information for the missing ones. But this time WGBIOP got the actual list of all Stock Coordinators, so it was possible to send the request out to all coordinators whose answers were missing.

In 2023 WGBIOP received responses for 195 out of a possible 270 ICES stocks (72% of the total). 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 comprehensive knowledge about input data for their stocks. It was suggested that some of the questions should be addressed to national data submitters. Not all stock coordinators who answered the questions were aware of calibration exercises carried out for their stocks. Further improving communication between WGBIOP and those involved in Stock Assessment would enhance the usefulness of this process and will be a focus for the next 3-year WGBIOP term.

The answers given are useful and give 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 are shown in Annex 6; Table 3.

The Quality Indicator (QI) Table exclusively encompasses ICES stocks. Although there was an intention to expand its scope to encompass Mediterranean stocks, efforts to gather pertinent information regarding potential Mediterranean stock assessors or coordinators proved unattainable.

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

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 structures (CS) and preparation methods, was analyzed for each species (Figure 1 & 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).
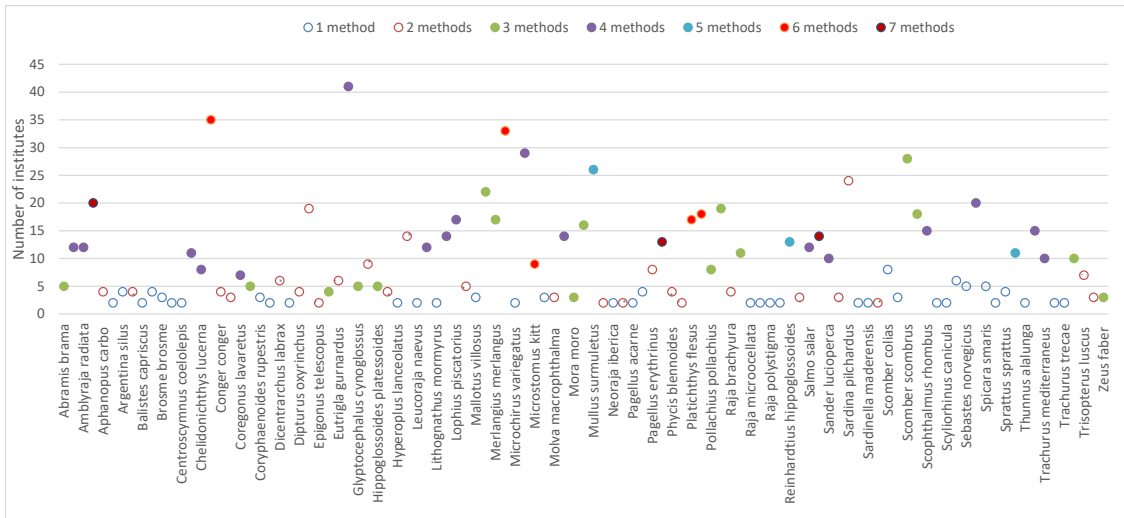
Figure 1: Number of ageing methods used by European countries, represented by the institutes, for the ageing data of each commercial species (Data extracted from WGBIOP 2019).

Of these 108 species presenting two or more different preparation methods, for 37 species, there were between two and four calcified structures including 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.
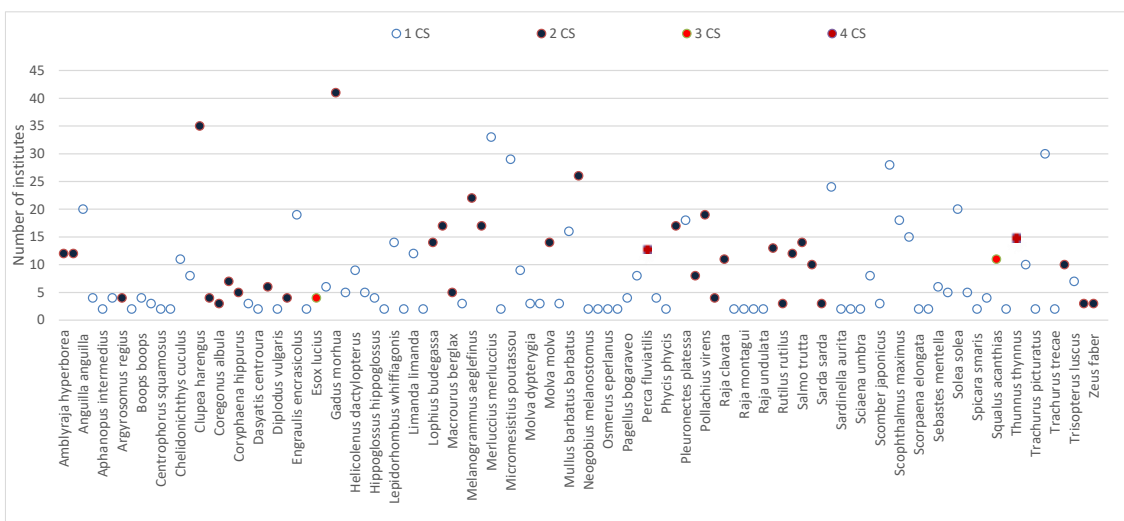
Figure 2: Number of calcified structure (CS) used by European countries, for the ageing data of each commercial species, represented by the institutes (Data extracted from WGBIOP 2019).

To complete this analysis, it would be important to extract the Accuracy results (PA, CV) of all events in the SmartDots tools in order to carry out a multivariate analysis of the parameters that

explain the differences in reading accuracy between species. The criteria by species/by stock could be as follows:

- ✓ Individuals number
- ✓ Readers number
- ✓ Age range
- ✓ Length range
- ✓ First reading (exchanges) versus 2nd reading (workshops)
- ✓ Number of Ageing scheme used to identify the last growth ring
- ✓ Number of ageing methods used by European countries
- ✓ Number of institutes participating to the European Ageing data
- ✓ Number of institutes participating to the SmartDots event
- ✓ Number of ageing methods used in the SmartDots event

This multivariate analysis could help to identify the main sources of error between readers/species.

Considering the importance of the topic and the time needed to address it, it was decided to forward this issue to the 2024 meeting.

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 2023

2.4.1.1 Document available cases in which life-history parameter estimates were used as additional information to improve the understanding of the ICES/GFCM stock health.

The health of the ecosystem has an impact on how well fisheries resources can thrive and recover. In times of global climate change, the emphasis of fisheries management is changing to also consider such factors. There are some biological parameters which may be helpful in assessing the impact of these ecosystem effects.

Possible biological parameters that are continuously collected and readily available include:

a.   Body condition (condition factor)
b.   L50 (the length at which 50% of the population are mature)
c.   A50 (the age at which 50% of the population is mature)
d.   Sex ratio
e.   Growth from indirect calculations
f.   Length structure
g.   Energy reserves (hepatosomatic index, gonadosomatic index)

Possible biological parameters that could be used comprise at least:

- Growth from tagging
- Stable isotope signatures
- Trophic level; position in food-web

- Stomach contents and stomach fullness index
- Level of parasite infestation
- Spawning time interval
- Historical weight (at age)

The lists above are not exhaustive. The first six parameters are likely "low-hanging fruits" for stock assessors (SA) to include in their routine diagnostics used to assess stock status since time series data should be available for many stocks.

To facilitate communication between WGBIOP and stock assessment WGs, a questionnaire will be developed and circulated among stock assessors of different ICES assessment WGs. It will contain questions about the availability and potential use of other biological parameters from the time series; one central question will be "What is your opinion on the use of other biological parameters, either to be included in your model or as supplementary indicators of stock status?"

In this task, we propose to identify and present case studies from stocks with different traits, where additional biological parameters were used to inform the assessment and advice, e.g., the influence of condition factor on M in, e.g., red mullet, or in cod (Björnsson et al. 2022).

2.4.1.2   Overview of Quality Assurance for Stomach Sampling.

WGBIOP has successfully initiated the Workshop on Better Coordinated Stomach Sampling (WGBECOSS) in the past (ICES, 2020). In the meantime, each RCG has established Intersessional Study Groups (ISSGs) on stomachs. The North Sea RCG ISSG stomach has made considerable progress here. Another workshop (Workshop on Operational Implementation of Stomach Sampling – WKIOSS) was postponed in 2020 and 2021 due to Covid-related issues. Given a lack of a chair, the meeting was finally cancelled in 2022.

Stomach sampling analysis efforts are currently well-coordinated within the RCG ISSG stomach sampling. There are good pathways for communicating with survey groups and experts collecting stomach samples at sea while analysing them in laboratories is still a challenge for many national labs. As such it is suggested that this task, i.e. stomach sampling, will not be included in the new ToRs for WGBIOP.

2.4.1.3   Facilitate closer links between data providers and end users, including WGQUALITY, benchmark groups and developers.

During this WGBIOP meeting, a list of WGBIOP members who are also members of assessment working groups was compiled. "Bridging persons" to be identified by WGBIOP will request the opportunity to present relevant WGBIOP issues to Stock Assessment Working Groups with the intention of improving links and understanding between end users of the biological data and data providers and facilitating clearer communication routes between the two.

Examples of what these presentations could include:

- examples where Age Error Matrices have been successfully incorporated in stock assessments (e.g. in SS3 used for Central Baltic herring)
- results of case studies presenting how life-history parameter estimates were used as additional information to improve the understanding of stock health and encourage the presentation of biological parameters as supplementary diagnostics in addition to the standard graphs.
- information on the results of relevant otolith exchanges.

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

2.5.1 Progress during WGBIOP 2023

Details of recent or recommendations received, and responses agreed can be seen in Annex 7.

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 for different category stocks in 2022. The flows were shown included the Stock Information Database (SID), Intercatch and/or the Regional Database FishFrame (RDBES), DATRAS, the Acoustic trawl surveys and Eggs and Larvae databases. Also the input of data from SmartDots events was shown in the diagrams. This can be either raw data (as agreed during WKAMEMSA) or an error matrix as produced at each exchange and workshop. In the Transparent Assessment Framework (TAF) codes are stored to carry out the assessment and forecasts for each stock.

A suggested deliverable for 2023 was to create an overview of which institute provide which biological parameter data in the various databases. However, this would produce a very large confusing table. At the same time overviews of data in the various databases can be downloaded from the ICES website. On the ICES data portal website it is possible to find all ICES databases. Clicking on one of the databases in the righthand menu brings you to the database side. For the fisheries independent databases, queries can be done by anyone, and data downloaded after accepting the ICES data policy. Fisheries dependent data are only available in anonymized form, after official request. ICES has also created a data portal for easy querying and viewing data on a map ICES DataPortal.

The chairs of ICES groups WGQUALITY, DIG and DSTSG along with the RCG chairs of NANSEA, BALTIC and MED&BS were contacted in 2023 to determine if there is a need for a connection between ICES databases, and if so, cooperate with WGBIOP to develop a work plan to create the connections between databases. In addition, the chairs were made aware of where SmartDots data fits into the dataflow and that it is providing biological parameter quality assurance data from exchanges, workshops and training events.

In general, first replies were that a good overview of databases connections was lacking. However, receiving in depth answers showed that WGRDBESGOV and the ICES Data Centre are working on extensive descriptions of the databases and dataflows (see responses below). Also, there is currently no need for database connections.

The responses from the chairs have been summarised below:

RCG NANSEA (Rita Vasconcelos & Josephine Egekvist) and RCG Baltic (Maciej Adamowicz) – WGBIOP's contact was discussed and the chairs recommended that WGBIOP looks in the direction of WGRDBESGOV and the reports of this WG to see the type of work that they have already developed and are planning on developing. WGRDBESGOV also deals with the governance of the development of the new RD including the mapping of data flows, work processes and of transitioning between databases. The chairs appreciated the update regarding SmartDots and look forward to further information from the WGBIOP report.

DIG (Sjur Ringheim Lid) – The chair was welcoming of the initiative and commented that the idea behind the different databases i.e. RDBES and DATRAS are that they serve a specific task and that the process of going from data to advice is where the connection is being done. Due to the input data being potentially different for every stock, and the processing required, making too many "early" connections may not be the best way to move forward. The chair also contacted Neil Holdsworth, the Head of Data at ICES for comment.

Neil further commented to discuss the initiative with Carlos Pinto, and that ICES are working on a series of data schematics which should describe each data flow and their dependencies from/to other data flows (Discover research from ICES Data Flow Schematics) and that the SmartDots schematic will be discussed at WGSMART immediately following WBIOP. In addition, Neil referred WGBIOP to the WKDSG, 2021 report, section 3 which illustrates different ways of looking at the flow of information and connections.

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 http://ices.dk/data/tools/Pages/smartdots.aspx 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 (WGSMART) feedback from the users (mostly members of WGBIOP) are received, reviewed and prioritized to continuously improve and develop the platform. The development of the reporting module was also part of our focus.

2.6.1 Progress during WGBIOP 2023

During WGBIOP 2023 the subgroup has focused on:

1) Compiling comments and feedback from WGBIOP exchanges and workshops and list requirements for the coming years
2) Evaluation and finalization of the SmartDots image quality guidelines
3) Providing feedback to WGSMART and evaluating training needs
4) Running a SmartDots session at WGBIOP 2023
    a. New modules: maturity, ichthyoplankton, eggs and larvae
    b. Updates to the reporting module
    c. Data license
    d. Image quality guidelines
    e. QS scores updates
    f. Training material updates
    g. Country coordinator roles and responsibilities
    h. Reference collection needs
    i. Future integration of deep learning / AI methods within SmartDots
5) WGSMART and WGBIOP next lifecycle

2.6.1.1 Compile feedback from WGBIOP exchanges and workshops

For the period September 2022 – September 2023, 23 age reading events, 2 larvae events and 2 maturity events took place in SmartDots (see https://smartdots.ices.dk/ViewListEvents) with 7 published.

Table 3 provides a list of issues being dealt with by WGSMART since WGBIOP 2022. These can be found on the WGSMART GitHub https://github.com/ices-eg/SmartDots/issues. Feedback is received by WGSMART from the SmartDots feedback page, directly by email, from online training and/or testing by WGSMART members and converted to issues to be addressed by WGSMART.

Feedback related to the fecundity module in the web application have been put on hold and will be addressed when the community using this tool has further requests.

Table 3. General feedback compiled from the SmartDots feedback page, directly by email, from online training and/or testing by WGSMART members.

Issue No.	Feedback	Comment
#277	Send automatic mail with link to the guidelines when a coordinator sets up an event	This will happen once the Guidelines for workshop and exchanges are in the ICES FigShare Library
#265	Changing scale on images in a public event – it is possible to do this.?	Will be addressed by removing functionalities on read-only images
#299	Optimize preloading of images in SmartDots software	The image guidelines address optimal image sizes
#309	Fixed column width in Files table	Investigate the possibilities of keeping the user parameters like the width of the columns of the Files table in the API
#316	Progress label in SmartDots software	Needs to be addressed so that the number of annotation/samples makes sense in all modules
#304	Finalise Age Reading Report in TAF	Done. The newest report script runs from the SmartDots web page for all to access
#271	Measurement in mm not pixels	Measurements will always be stored in pixel in the database, but if a scale has been set the measurement will be shown as mm in the SmartDots software.
#270	Option to delete single dots	Done (lavate16ize16ton specific issue)
#269	Automatic open next image when done with the previous	Done (16lavate16ize16ton specific issue)
#303	Approve and Unapprove (bug in maturity module)	Done (maturity specific issue)
#231	Version number of SmartDots	Is now clearly visible
#218	Size of rings – new dot type for absorbed vertebrae	Added to V4.0. Freshwater dot now called "Freshwater/Absorbed".
#306	Create only one SmartDots Manual for the software	Done. Called "How to annotate" manual.
#300	Add scale setting to maturity event	Done
#320	Data license required	In progress

Issue No.	Feedback	Comment
#298	Research on best file size, type, quality, ... integrate results in manual	Points added to the WGSMART Guidelines for Image Quality in SmartDots exchanges
#97 Linked to #301	Reference collection	Input required from WGBIOP on what is needed in a Reference collection/Training set module
#313	WGSMART Guidelines for Image Quality in SmartDots exchanges	https://www.ices.dk/data/tools/Pages/smartdots.aspx Will be updated and published as an ICES handbook ultimo 2023
#284	Setting up event (coordinator to receive Guidelines for Exchanges and Workshops by mail)	Will be done by 2023 Q4 meeting
#294	Area information #294	Done. Detailed map with ICES areas has been added to help menu in software
#310	Planning of training sessions for the new modules.	Age and Maturity 15-16 May 2023 Eggs and Larvae 9 November 2023
#279	SmartDots Dataflow	Requested from ICES Data Centre. Will be completed ultimo 2023
#256	who will add ichthyoplankton expertise?	Cooperation and sharing of responsibilities between WGALES, WGBIOP and WGSMART still needs clarification
#321	Is the guest token necessary? This is confusing people	Will be done by 2023 Q4 meeting
#322	Thumbnails of images in SmartDots larvae events do not load	Will be done by 2023 Q4 meeting
#323	From automated mails for larvae and eggs events the link to the Web event needs to be removed	Will be done by 2023 Q4 meeting
#324	Scale sync between the software and the web application	To be discussed at WGSMART Q4 meeting
#325	Make sure web application pages look the same for age/maturity/eggs/larvae	To be discussed at WGSMART Q4 meeting
#326	add "show the emails of the stagers" on the maturity web application (below the box with stagers in the event). (same as for age reading).	To be discussed at WGSMART Q4 meeting
#327	Remove button "annotate fish" from the maturity view event page (when you click on an image).	To be discussed at WGSMART Q4 meeting

Issue No.	Feedback	Comment
#328	Add to the maturity web application the link "Anonymized names to Smartuser". Same as is already done for age.	To be discussed at WGSMART Q4 meeting
#329	Shortcut keys in software	To be discussed at WGSMART Q4 meeting
#330	Add filter editor option to the files panel of the age reading module	To be discussed at WGSMART Q4 meeting
#331	age: oblige readers to approve an annotation before being able to finish an event?	To be discussed at WGSMART Q4 meeting
#332	Need to decide on Approval of annotations and how this works in the report	To be discussed at WGSMART Q4 meeting
#333	Growth graph – viewing all annotations from a reader in one graph as a visual check for inconsistencies	To be discussed at WGSMART Q4 meeting

2.6.1.2 Evaluation and finalization of the SmartDots image quality guidelines

Following feedback from age and maturity exchanges ran during the last years and recommendations made to WGBIOP and WGSMART for a training seminar and image taking guidelines, the need for image quality guidelines aimed at standardizing and improving the quality of the materials used in SmartDots exchanges was reiterated.

WGBIOP 2022 issued an official recommendation as followed:

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

These guidelines were drafted and developed throughout 2023 in collaboration with users and coordinators for all three SmartDots modules (age readers, maturity stagers and eggs/larvae/plankton experts), as well as with members of relevant working groups such as WGALES. An advanced draft was published on the official [ICES SmartDots webpage](#), with its conversion to an official ICES handbook pending final evaluation during WGBIOP 2023.

The document contains general instructions for optimized SmartDots events (file size, etc) and is otherwise divided into three larger sections corresponding to each SmartDots module (age, maturity, egg/larvae/plankton identification). Within each section, general quality guidelines are given for the specific needs of that module: clean sample preparation, even lighting to prevent flares, correct focus plane on the structures to be interpreted, etc. In addition, specific guidelines are presented with numerous examples of both target image quality and undesirable image issues to be avoided.

After multiple rounds of feedback and additions to the guidelines, the draft presented to WGBIOP 2023 has been unanimously well received and the conversion to an official ICES handbook encouraged. Version 1.0 of these image quality guidelines should be available online sometimes before the end of 2023. Moving forward, feedback and necessary changes (such as the addition of new guidelines corresponding to the development of new modules) will be curated, reviewed, and addressed by WGSMART and WGBIOP, with a corresponding version update on the ICES library when needed.

2.6.1.3   Providing feedback to WGSMART and evaluating training needs.

For the 2023 ICES Training Course "**A practical course in the use of the SmartDots platform for age reading and maturity staging**" which took place online from 15–16 May, feedback from participants was requested by an online questionnaire. Replies from eight of the 23 participants were obtained. The questions to which participants were asked to rate, and the average ratings (5 or 10 is highest, i.e., most positive) of the replies, are listed in the table below:

How did this training contribute to your knowledge of how to use the SmartDots web application?	8.9 / 10
Learning objectives were clear	8.9 / 10
Course content was organized and well planned	8.8 / 10
Course workload was appropriate	8.9 / 10
Was the length of the training course appropriate?	4.6 / 5
Was the level of instruction appropriate?	4.8 / 5
How would you rate the quality of the teaching?	4.6 / 5
I received useful feedback throughout the course	9.5 / 10

The participants listed the following aspects which they found <u>most</u> useful or valuable:

- How to set up an event and working with the reports of events
- Ageing, annotations
- The hands-on homework and the availability of the teaching team
- The breakout rooms for more individual attention from instructors
- The course content was well-organized and comprehensive; the modules were presented in a logical sequence. The materials were engaging and interactive.
- The instructors responded quickly to questions, gave informative feedback and provided constructive feedback and support.
- The platform's interface is user-friendly and easy to navigate for accessing course material, tracking progress, and communicating with instructors and other participants.

The participants listed the following aspects which they found <u>less</u> useful or valuable:

- The maturity aspect

Comments regarding administration and preparations for the course for the future:

- Important to ensure that participants receive emails (at correct email address) in time to prepare for the course

- Informing the participants beforehand about familiarizing with the sharing platform used (in this case Webex)
- Providing the course schedule in UTC as well as CET time
- Gathering information from participants beforehand about previous experience with SmartDots (registration form)
- To assess if silence of participants during the course is because they have no issues or because they do not want to state them in front of all, a short one-to-one meeting in a breakout room with each participant early on in the course is suggested.

Comments on how to improve this course:

- Having one day for maturity and one day for age.
- Provide a Comprehensive Tutorial

Comments on how participants would plan to use gained knowledge in their existing job/position:

- Ageing, measuring, interpreting
- Transferring knowledge to colleagues and students
- To organize SmartDots events, exchanges etc.
- Setting up internal events in SmartDots.
- Using SmartDots events as a repository for annotated images to 1) refer back to when age readers have not been ageing for some time 2) train new/inexperienced age readers.
- Use the information gained on Downloading data to view details on specific otoliths.

Additional comments:

"It was lovely to be amongst international colleagues in the ageing world"

"Hosts made it comfortable to ask questions and have open dialogue."

"I would like to see participants encouraged to be more vocal and express clearly if they are following what is being explained or whether they would like some aspect explained again."

"It would be nice if participants were all invited to come on for 1 minute each to state name, agency, what species they work on"

"It was a great training, and I feel thankful for people 's effort and time"

Topics for other training courses that participants found interesting:

- Daily increment, annulus interpretation
- Guidelines for ICES benchmarks
- Otolith Reading
- Biological data statistics
- 'Very simple statistics' to understand and interpret the tables and graphs in the SmartDots report
- Using the measuring aspect of SmartDots; interpreting the Report_DotsDistancesSmartDots table; getting a scale onto an image
- Any new SmartDots features

The SmartDots training course "**A practical course in the use of the SmartDots platform for egg and larvae identification and staging**" was held online on 9 November 2023 with 56 participants joining.

Feedback from participants was requested by an online questionnaire. Replies from 11 participants were obtained. The questions to which participants were asked to rate, and the average ratings of the replies, are listed in the table below (5 or 10 is highest, i.e., most positive):

How did this training contribute to your knowledge of how to use the SmartDots web application?	9.1 / 10
Learning objectives were clear	8.9 / 10
Course content was organized and well planned	8.4 / 10
Was the length of the training course appropriate?	4.3 / 5
Was the level of instruction appropriate?	4.9 / 5
How would you rate the quality of the teaching?	4.8 / 5
I received useful feedback throughout the course	9.1 / 10

The participants listed the following aspects which they found <u>most</u> useful or valuable:

- Straightforward explanation of how the SmartDots software works
- How to use the SmartDots platform including creating events and uploading data
- The combination of presentations and practical "try for yourself" exercises
- The possibility to ask questions in real time

The participants listed the following aspects which they found <u>less</u> useful or valuable:

- The course did not help regarding the actual identification of eggs and larvae
- The course was too long; both methodologies (eggs and larvae) could rather be grouped into one session

Comments regarding administration and preparations for the course for the future:

- In the beginning of the course, time was needed for participants to get adjusted to SmartDots
- Access to SmartDots with some introductory information before the start of the course, e.g., sharing the existing videos about topics, could be beneficial
- Allowing participants to try converting data to the correct template before the course would let people acquaint themselves with this and have questions ready for the course
- The duration of the course could possibly be shortened
- A possibility to use your test event for some days after the course is asked for, for participants to try again for themselves

Comments on how participants would plan to use gained knowledge in their existing job/position:

- Quality control of fish egg/larvae identification (within the institute)
- Keeping knowledge on identification updated; gaining more knowledge
- For internal training

- Interest of being included in test groups and calibrations in the future
- Awareness of challenges when implementing events in SmartDots
- Identifying possible other areas where the SmartDots platform could be applied
- Easily sharing doubts regarding identification with colleagues

Additional comments:

"*A good and really helpful course*"

"*A useful but challenging part was learning how to have the data in the necessary format for uploading*"

"*I would like more focus on the identification status in coordination with SmartDots*"

"*During this online course I sometimes lagged behind, and it was difficult to focus on the new stuff while catching up – perhaps it would be different if the course was given i.r.l.*"

Topics for other training courses that participants found interesting:

- Larvae identification
- Early life stages of fish
- Maturity
- Age reading; fish growth
- Using graphical tools (at ICES)
- Science communication

2.6.1.4 Running a SmartDots session at WGBIOP 2023

During WGBIOP 2023 a SmartDots session was held where the latest modules updates and discussion were presented. The session focused on deliverables following from WGBIOP 2022 as well as points of discussion for the new lifecycle of both WGBIOP and WGSMART.

a)   New modules for maturity, ichthyoplankton, eggs and larvae

The new modules have been successfully developed and implemented after a joint request to ICES from the EU/UK was received following WGBIOP 2022. One module for maturity staging, one for egg identification and one for larvae identification. The Technical Service report can be found on the ICES FigShare repository at https://rb.gy/7mmud.

The newly developed modules were split up over two releases:

- 2023/01: update age-reading module & new maturity module
- 2023/05: new modules for larvae and eggs

There was an optimization of the SmartDots software user interface. The bottom toolbar was removed and so has the save button. All annotations are now saved automatically. The help menu was expanded with extra links to the manuals and video tutorials. Improved sorting and filtering tools were added.

For the maturity module, a new image browsing panel was added. This panel was added because there was a need to link multiple images to one single fish.

The new egg and larvae modules use the same code base. Depending on the event type the user interface of the SmartDots software changes. The parameters to be determined in the larvae and egg modules are defined by the event coordinator in the SmartDots web application.

Once a reader has finished an event he/she has access to the annotations of the other readers.

Besides the development of the SmartDots software, the SmartDots web application and the SmartDots Web API were also expanded for the new modules.

Both the existing age module and the newly developed maturity module were presented to users during an online 2-day training session organized 15–16 May, covering both practical use of the modules and comprehension of the event setup, coordination and reporting functions. The module for ichthyoplankton, eggs and larvae identification will be presented during an online training held on 9 November 9.

b)   Updates to reporting modules

Age and maturity multimode reporting modules pushed to GitHub master branch and added as a default within SmartDots. At this stage, the main issues identified at WGBIOP in 2022 have been completed and corrections implemented. Furthermore, some feedback and bug fixing have been addressed throughout the year for the reports from both age and maturity modules. The event report templates (full and summary) are available after a request from the event coordinators of calibration exchanges and workshops 23la link at the "View event" SmartDots webpage. The event coordinators will receive the report templates by email in a .zip file which includes all the tables available in separate .csv files.

The multimodal approach now also considers readers experience to determine reader ranks, with a smaller reader number linked to a higher reader expertise. The reader expertise (i.e reader number) is determined based on the number of years of experience and also the number of structures read by year, this information is filled by each national coordinator and must be updated at the time of the workshop. The reader ranking template file is available for download at the "Edit event" webpage on SmartDots.

In the case of a maturity event, the true maturity stage can be based on histology validated staging. For this type of event, it is important that the samples with histology are correctly identified and that the event organizer also stages all the samples.

c)   Data license

Since last year's WGBIOP, a new feature has been developed within the SmartDots platform, enabling event coordinators to copy events and/or samples from another event. This functionality allows event organizers to reuse samples that were previously utilized by other organizers, eliminating the need to start each event from scratch.

This raised the awareness to a long-standing issue within the SmartDots platform that had remained unresolved—the data licensing for uploaded images and samples. Note that this license will apply to events and samples once they are published, while unpublished events will remain within the privacy of the participants of that event.

In WGBIOP 2023 it was proposed that SmartDots adopts an open license (Creative Commons CC BY 4.0 license). While this would be optimal on paper it showed to be problematic during discussions with WGBIOP. There were some concerns about the ownership and authorisation to share images and associated metadata. People were in favour of sharing images and metadata but raised some concerns:

- Who should be cited when a report is published? ICES or the institute?
- SmartDots is often used for publications, so its data should not be shared before a publication is made.

- Should reports be published in the ICES library? This would facilitate referencing as the report gets a DOI and can be quoted in a consistent way.
- Only published events should have the possibility to be copied. In case an event coordinator wants to copy from a non-published event, they will have to contact the coordinator of the event directly.

The main question that remains is whether these issues and possible solutions would still qualify SmartDots as under a CC 4.0 license, or if a more specific one is needed. This will be further discussed at WGSMART 2023.

d) Image quality guidelines

The image quality guidelines draft developed by WGSMART following recommendation from WGBIOP 2022 were presented to WGBIOP for final approval during the SmartDots session on the Thursday (26.10) morning. Additional feedback and comments from WGBIOP members that may not have contributed to the manuscript beforehand will be collected for one final edit of the guidelines draft between WGBIOP 2023 and the end of WGALES the following week. The document will then be submitted to ICES for approval and publication as an official ICES handbook before the end of 2023. Details on the guidelines and their content can be found in the dedicated report section above.

e) QS scores update

The development of the new maturity and ichthyoplankton modules requires that the existing AQ scores be expanded to include other biological parameters. Discussions between the relevant experts under WGBIOP, WGSMART and the ICES Reference Management Group resulted in an agreement that a new vocabulary be written for maturity staging and egg and larvae identification quality scores. This was necessary as it was not possible to change the existing quality score as the code exists in the original form in databases other than SmartDots and this would be poor data management.

The new and original AQ scores can be found here https://vocab.ices.dk/?code-typeguid=e08ec685-61f6-4ccb-9e93-594047b05797 and have been integrated into the SmartDots platform. It is envisioned that these can be used in the future for other biological data.

f) Training material update

The SmartDots user manuals were updated. There are 2 manuals available now:

- "How to annotate?" for the end-users
- "How to run events?" for the event coordinators.

The user manual "How to annotate?" exists out of a generic part and more specific parts for the different modules.

The manuals are published here: https://ices-library.figshare.com/search?q=%3Atitle%3A%20smartdots&sortBy=publication_date&sortType=desc&groups=37194

The SmartDots YouTube channel (https://www.youtube.com/@icessmartdots2352/videos) was updated with 4 new videos covering guided tutorials for:

- The updated age module

- How to annotate maturity stages in the new maturity module

- How to annotate larvae in the new dedicated module

- How to annotate eggs in the new dedicated module

Links to the manuals and YouTube videos are integrated into the Help menu of the SmartDots software and on the SmartDots home page (https://www.ices.dk/data/tools/Pages/smartdots.aspx).

g)   Country coordinator role and responsibilities

The roles and responsibilities of the country co-ordinators for age and maturity were outlined for the group. The most important points being:

- Users expertise be kept up-to-date in the SmartDots database as this is used for reader ranking and the calculation of modal age (and related statistics) in SmartDots events. The information required is both general and stock specific. If coordinators update the database when participation is required in events then this database will be built up overtime.

- Training of users in national laboratories to use the SmartDots platform and provide feedback. All training material is easily accessible both within the software and from the ICES SmartDots landing page.

- Check the training material before consulting WGSMART for help

- Ensure that all national members participating in exchanges and workshop have access to the SmartDots platform using ICES user accounts, are added as users in the SmartDots database and have the software downloaded before attending the workshop or joining the exchange.

h)   Reference collection needs

WGBIOP members were asked if a reference set/training module is deemed as necessary in SmartDots. The consensus from the group is that this would be an extremely useful addition to the platform and would further improve SmartDots as a quality assurance tool for biological parameters. It will require that existing agreed age collections are identified and made available. Guidelines for compilation and use will be required. Additionally, a list of features and user requirements will be needed. These points will fall under the remit of WGBIOP in the coming term 2024–2026. A recommendation will be made to WGSMART to develop this module.

i)   Future integration of AI methods within SmartDots

During WGBIOP 2023 a scientific session was held (Tuesday 24.10) in which 6 lecturers from various institutes presented different on-going initiatives in developing deep learning approaches to estimate fish age from images.

The session ended in an open discussion with focus on the need for a dedicated resolution in the next lifecycle for both WGSMART and WGBIOP. Of particular interest was the potential integration of AI into SmartDots, as the platform provides a large number of annotated images for a wide variety of species and stocks. ILVO is currently experimenting with different approaches

that could be fed to SmartDots as an additional, unbiased "AI annotation set", but future work could be directly using event as training material.

WGSMART should be preparing and actively participating in any AI approach intending to use SmartDots, in collaboration with WGBIOP (see next section of next lifecycle).

2.7 Other achievements

Scientific presentations on artificial intelligence (AI) and machine learning.

A series of scientific presentations on AI and machine learning was delivered, these included work on: Aging of Atlantic cod using machine-learning algorithms: progress and perspectives from two different approaches (by Come Denechaud, IMR), AI applied for age reading of plaice (by Daniel Benden, WMR), Automation and Explainability in Otolith Age Reading (by Lukas Snoeck, ILVO), Artificial Intelligence in Maturity Staging – a proposal for the use of AI (by Ewout Blom, WMR), An AI-driven Interactive Platform for Otolith Analysis and Collaboration (by Arjay Cayetano, Thuenen Institute) and Exploring Herring Age with AI (by Abdullah Muhammad, DTU Aqua). Useful plenary discussions were held regarding how WGBIOP could support this work going forward, for example by helping to ensure that those working in this field are joined up, and by supplying quality controlled and accessible training sets of data. This will form the focus of a new ToR for the Group for the next three-year period.

Age reading error in assessment

Ulrika Beier (WMR) gave a presentation on how age reading error matrices (AEM) can be used in assessment, using plaice as an example.

Reference collection discussion

Daniel Ricard (Fisheries and Oceans Canada) was invited to present on how they are working with reference collections. Discussions on how WGBIOP should proceed followed.

3 Next meeting

The next full WGBIOP meeting will be held in the w/c October 7, 2024, in Mazara del Vallo, Sicily, Italy. This will be a hybrid meeting, but we encourage participation in person, the meeting in 2025 will be online only.

References

Björnsson, B., J. Sólmundsson, and P.J. Woods. 2022. Natural Mortality in Exploited Fish Stocks: Annual Variation Estimated with Data from Trawl Surveys. Edited by Sam Subbey. ICES Journal of Marine Science 79 (5): 1569–82. https://doi.org/10.1093/icesjms/fsac063

Dolder, Paul J., Cóilín Minto, Jean-Marc Guarini, and Jan Jaap Poos. 2020. Highly Resolved Spatiotemporal Simulations for Exploring Mixed Fishery Dynamics. Ecological Modelling 424: 109000. https://doi.org/10.1016/j.ecolmodel.2020.109000

Eltink, A.T.G.W. 2000. Age reading comparisons. (MS Excel workbook version 1.0 October 2000) Internet: http://www.efan.no

Eltink, A. T. G. W.; Newton, A. W.; Morgado, C.; Santamaria, M. T. G.; Modin, J. (*2000).* Guidelines and tools for age reading comparisons. ICES External Publications Database. Report. https://hdl.handle.net/10779/ices.21493215.v1.

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. http://www.fao.org/3/ca2740en/ca2740en.pdf.

Horbowy, J., Hommik, K., 2022. Analysis of Fmsy in light of life-history traits – effects on its proxies and length-based indicators. Fish Fish. 1–17. https://doi.org/10.1111/faf.12640.

ICES. 2010. International herring larvae survey (2010) Survey Manual for the International Herring Larvae surveys, south o] 62°N, January 2010 version. International Council for the Exploration of the Sea, Copenhagen, Denmark

ICES. 2013. SISP 2 – Manual for the Midwater Ring Net sampling during IBTS Q1. Version 2. Series of ICES Survey Protocols. 18 pp. https://doi.org/10.17895/ices.pub.3434

ICES. 2018a. Report of the Working Group on Atlantic Fish Larvae and Eggs Surveys (WGALES). 22-26 October. Lyngby, Denmark. ICES CM 2018/EOSG:04. 56 pp. https://doi.org/10.17895/ices.pub.8155

ICES. 2018b. Working Group on Biological Parameters (WGBIOP), 1–5 October 2018. Ghent, Belgium. ICES CM 2018/EOSG:07. 186pp.

ICES. 2018c. Report of the Workshop on Mackerel biological parameter Quality Indicators (WKMACQI), 15–17 May 201. IJmuiden, The Netherlands. ICES CM 2018/EOSG 34. 42 pp.

ICES. 2018d. Report of the Working Group on Commercial Catches (WGCATCH), 6-10 November 2017, Kavala, Greece. ICES CM 2017/SSGIEOM:09. 132 pp.

ICES. 2019a. Workshop on sampling, processing and analysing the stomach contents (WKSTCON). Palma de Mallorca, Spain 24-27 April 2018. 46 pp

ICES. 2019c. Working Group on Biological Parameters (WGBIOP). ICES Scientific Reports. 1:85. 93 pp. http://doi.org/10.17895/ices.pub.5682

ICES. 2019d. Working Group on optimizations of biological parameters (3 edition) SLU Aqua (Lysekil) 27-31 May 2019 ICES Scientific Reports. 1:78. 219 pp. http://doi.org/10.17895/ices.pub.5

ICES. 2019e. SISP 5 – WGMEGS Manual for the AEPM and DEPM estimation of fecundity in mackerel and horse mackerel. Version 12. Series of ICES Survey Protocols. 84 pp. https://doi.org/10.17895/ices.pub.5139

ICES. 2020a. Working Group on Biological Parameters (WGBIOP). ICES Scientific Reports. ICES Scientific Reports. 2:117. 150 pp. http://doi.org/10.17895/ices.pub.7651

ICES. 2020b. Working group on smartdots governance (WGSMART; outputs from 2019 meeting) ICES Scientific Reports. 2:12. 11 pp. http://doi.org/10.17895/ices.pub.5963

ICES. 2020c. Workshop on Better Coordinated Stomach Sampling (WKBECOSS). ICES Scientific Reports. 2:26. 73 pp. http://doi.org/10.17895/ices.pub.5991

ICES. 2020d. ICES Workshop on age validation studies of small pelagic species (WKVALPEL). ICES Scientific Reports. 2:15. 76 pp. http://doi.org/10.17895/ices.pub.5966

ICES. 2020e. ICES Workshop on unavoidable survey effort reduction (WKUSER). ICES Scientific Reports. 2:72. 92pp. http://doi.org/10.17895/ices.pub.7453

ICES (2022). Fourth Workshop on Optimization of Biological Sampling (WKBIOPTIM4; Outputs from 2021 meeting). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.21103000.v1

ICES. 2021d. Working Group on Biological Parameters (WGBIOP). ICES Scientific Reports. 3:112. 370 pp. https://doi.org/10.17895/ices.pub.9629

ICES. 2022a. Workshop on Mackerel, Horse Mackerel and Hake Eggs Identification and Staging (WKMACHIS). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.19960985.v1

ICES. 2022b. 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

ICES. 2022c. Workshop 2 on Age Reading of North Sea plaice (Pleuronectes platessa) (WKARP2). ICES Scientific Reports. 4:64. 189 pp. http://doi.org/10.17895/ices.pub.20473083.

ICES. 2022d. Workshop on Adult Egg Production Methods Parameters estimation in Mackerel and Horse Mackerel (WKAEPM) ICES Scientific Reports. 4:28. 43 pp. http://doi.org/10.17895/ices.pub.19430855

ICES. 2022e. Workshop on unavoidable survey effort reduction (WKUSER2) Marine Institute, Galway, Ireland, 13–17 September 2022

ICES. 2022f. Working Group on Offshore Wind Development and Fisheries (WGOWDF).ICES Scientific Reports. 4:98. 18 pp.

ICES. 2022g. Workshop 2 on the identification of clupeid larvae (WKIDCLUP2). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.20054435.v1

ICES. 2023. Working Group on the Governance of Quality Management of Data and Advice (WGQuality). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.22347691.v1

ICES. 2023a. Working Group on Biological Parameters (WGBIOP; outputs from 2022 meeting). ICES Scientific Reports. 5:76. 365 pp. https://doi.org/10.17895/ices.pub.23617833

Kader, G. D., and M. Perry. 2007. Variability for Categorical Variables. Journal of Statistics Education **15**

Rideout, R.M. and J. Tomkiewicz. 2011. Skipped Spawning in Fishes: More Common than You MightThink. Marine and Coastal Fisheries 3(1). 176 – 189**. https://doi.org/10.1080/19425120.2011.556943**

Regional Coordination Group North Atlantic, North Sea & Eastern Arctic and Regional Coordination Group Baltic. 2022. Part I Report, 100 pgs. Part II Decisions and Recommendations, 13 pgs. Part III, Intersessional Subgroup (ISSG) 2021-2022 Reports, 159 pgs. (https://datacollection.jrc.ec.europa.eu/docs/rcg)

Regular, Paul M., Gregory J. Robertson, Keith P. Lewis, Jonathan Babyn, Brian Healey, and Fran Mowbray. 2020, SimSurvey: An R Package for Comparing the Design and Analysis of Surveys by Simulating Spatially Correlated Populations. PloS One 15 (5): e0232822 https://doi.org/10.1371/journal.pone.0232822.

Thorson J. T. 202). Predicting recruitment density dependence and intrinsic growth rate for all fishes worldwide using a data-integrated life-history model. Fish and Fisheries, 21: 237–251.

Vitale, F., Worsøe Clausen, L., and Ní Chonchúir, G. (Eds.) 2019. Handbook of fish age estimation protocols and validation methods. ICES Cooperative Research Report. No. 346. 180 pp. http://doi.org/10.17895/ices.pub.5221

https://vlab.ncep.noaa.gov/documents/259399/3406930/SS3.30.10_User_Manual.pdf

Wischnewski J., Bernreuther M., Kempf A. Admissible dissimilarity value (ADV) as a measure of subsampling reliability: case study North Sea cod (Gadus morhua). Environ Monit Assess. 2020 Nov 12;192(12):756. Doi: 10.1007/s10661-020-08668-6.

Annex 1: List of participants

Name	Institute	Country (of institute)	Email
Wim Allegaert	Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)	Belgium	wim.allegaert@ilvo.vlaanderen.be
Gualterio Basilone	Consiglio Nazionale delle Ricerche (CNR)	Italy	lavatei.basilone@cnr.it
Ulrika Beier	Wageningen Marine Research (WUR)	Netherlands	ulrika.beier@wur.nl
Karen Bekaert	Flanders Research Institute for Agriculture, Fisheries and Food (ILVO)	Belgium	karen.bekaert@ilvo.vlaanderen.be
Florian Berg	Institute of Marine Research (IMR)	Norway	florian.berg@hi.no
Dheeraj Busawon	Fisheries and Oceans (DFO)	Canada	lavate.Busawon@dfo-mpo.gc.ca
Ângela Canha	Regional Directorate for Fisheries in the Azores (DRP/RAA)	Portugal	angela.ml.canha@azores.gov.pt
Pierluigi Carbonara	COISPA Tecnologia & Ricerca	Italy	carbonara@coispa.it
Julie Coad Davies	DTU Aqua, National Institute for Aquatic Resources	Denmark	joco@aqua.dtu.dk
Côme Denechaud	Institute of Marine Research (IMR)	Norway	come.denechaud@hi.no
Laurent Dubroca	Ifremer	France	laurent.dubroca@ifremer.fr
Romain Elleboode	Ifremer	France	romain.elleboode@ifremer.fr
Inês Farias	Portuguese Institute for Sea and Atmosphere (IPMA)	Portugal	ifarias@ipma.pt
Rosalia Ferreri	National Research Council (CNR)	Italy	rosalia.ferreri@cnr.it
Guðrún Finnbogadóttir	Marine and Freshwater Research Institute (MFRI)	Iceland	gunna@hafogvatn.is
Maria Cristina Follesa (chair)	University of Cagliari	Italy	follesac@unica.it
Mandy Gault	Marine Directorate of the Scottish Government	United Kingdom	mandy.gault@gov.scot
Ruadhán Gillespie-Mules	Marine Directorate of the Scottish Government	United Kingdom	ruadhan.gillespie-mules@gov.scot
Patricia Gonçalves	Portuguese Institute for Sea and Atmosphere (IPMA)	Portugal	patricia@ipma.pt
Yvette Heimbrand	Swedish University of Agricultural Sciences (SLU Aqua)	Sweden	Yvette.heimbrand@slu.se
Annelie Hilvarsson (chair)	Swedish University of Agricultural Sciences (SLU Aqua)	Sweden	annelie.hilvarsson@slu.se
Maria Korta	AZTI	Spain	mkorta@azti.es
Uwe Krumme	Thünen-Institute of Baltic Sea Fisheries	Germany	uwe.krumme@thuenen.de
Kirsteen Mackenzie	Ifremer	France	kirsteen.mackenzie@ifremer.fr
Kélig Mahé	Ifremer	France	kelig.mahe@ifremer.fr

Name	Institute	Country (of institute)	Email
Zuzanna Mirny	National Marine Fisheries Research Institute	Poland	zuzanna.mirny@mir.gdynia.pl
Larissa Modica	Instituto Español de Oceanografía (IEO)	Spain	larissa.modica@ieo.csic.es
Gráinne Ní Chonchúir	Marine Institute	Ireland	grainne.nichonchuir@marine.ie
Konstantina Ofridopoulou	Fisheries Research Institute (FRI)	Greece	ofridopoulouk@inale.gr
Vaso Papantoniou	Fisheries Research Institute (FRI)	Greece	vaso.papantoniou@yahoo.gr
Carlos Pinto	ICES	Denmark	carlos@ices.dk
Annie Pursiainen	Luke	Finland	annie.pursiainen@luke.fi
Tiit Raid	Estonian Marine Institute	Estonia	tiit.raid@ut.ee
Jari Raitaniemi	Luke	Finland	jari.raitaniemi@luke.fi
Louise Scherffenberg Lundgaard	DTU Aqua	Denmark	lslu@aqua.dtu.dk
Joanne Smith	Cefas	United Kingdom	joanne.smith@cefas.co.uk
Szymon Smoliński	National Marine Fisheries Research Institute	Poland	ssmolinski@mir.gdynia.pl
Sally Songer (chair)	Cefas	United Kingdom	sally.songer@cefas.gov.uk
Pedro Torres Cutillas	Instituto Español de Oceanografía (IEO)	Spain	pedro.torres@ieo.csic.es
Cindy van Damme	Wageningen Marine Research (WUR)	Netherlands	cindy.vandamme@wur.nl
Valerio Visconti	Cefas	United Kingdom	valerio.visconti@cefas.gov.uk
Francesca Vitale	Swedish University of Agricultural Sciences (SLU Aqua)	Sweden	francesca.vitale@slu.se
Dace Zīlniece	Institute of Food Safety, Animal Health and Environment (BIOR)	Latvia	dace.zilniece@bior.lv

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	Due to COVID restrictions the meeting 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 15th December 2023 to DSTSG	Hybrid

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	Plan and prioritise validation studies, workshops and exchange schemes on stock-related biological variables, and review the results.	Reviewing and prioritisation 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 prioritised 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.	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 standardisation and inplementation in

ToR	Description	Background	Science Plan Codes	Duration	Expected Deliverables
		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 prioritised.			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 timeseries 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	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.

ToR	Description	Background	Science Plan Codes	Duration	Expected Deliverables
		other biological parameter quality information into assessments.			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 this 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.

ToR	Description	Background	Science Plan Codes	Duration	Expected Deliverables
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:   ToR a: exchanges and workshops

Exchanges and workshops completed in 2022 (Q4) and 2023

2022 exchange for the central Baltic herring stock her.27.25-2932 (event ID 449)

The exchange for her.27.25-2932 took place on SmartDots following a request from WGBFAS and in preparation for the 2023 benchmark of the stock. Fifteen readers from 9 countries took part, including 12 readers who provide age data for assessment, reading 163 otolith images. The analysis was carried out by ICES SD and results showed a general high agreement between readers. Age Error Matrices (AEM's) were provided and included in the assessment model. Report is available https://smartdots.ices.dk/ViewEvent?key=449..

2023 European anchovy (*Engraulis encrasicolus*) otolith exchange (event ID 455)

Based on the results of a large-scale otolith exchange held in 2018, the Workshop on Age estimation of European anchovy (*Engraulis encrasicolus*) WKARA 3, 23 – 25 November 2021 (online meeting), identified the need for an otolith exchange which was proposed to WGBIOP 2022. This otolith exchange took place during the first half of 2023. A total of 27 readers from 8 countries (Portugal, Spain, Italy, Greece, Tunisia, France, Croatia and Germany) participated in the exchange. A total of 437 otolith images from Atlantic and Mediterranean areas were analyzed (Atlantic: 27.8.a, 27.8.b, 27.8.c, 27.9.a; Mediterranean: GSA01, GSA06, GSA07, GSA09, GSA11.1, GSA12, GSA13, GSA14, GSA17, GSA18, GSA19, GSA20, GSA22). SmartDots results show an overall agreement of 57% for all readers, increasing to 61% for advanced readers and an overall CV of 52% for all readers and 45% for advanced readers. Overall agreement was low (57%) and has decreased compared to the last 2018 exchange (64%). The first analysis indicates differences in the identification of true annuli, checks and the edge nature. New readers and new laboratories participated in the exchange. Given the large number of areas involved in the exchange, a more detailed data analysis will be carried out in 2024 to prepare the exchange report. We´ll communicate to WGBIOP 2024 if a workshop is recommended for 2025. Coordinator: Carmen Hernández (IEO-CISC, Spain), Gualtiero Basilone (CNR-IAS, Italy) and Ilaria Costantini (CNR-IRBIM, Italy).

2023 WKARA3 – Workshop 3 on age estimation of European anchovy (*Engraulis encrasicolus*)

Three new validation studies were presented (two already published in ISI Journal)

Two new Workshops/Exercises conducted at the national level were presented (in both cases the readers appeared in agreement with the proposed WKARA2 age reading protocol adopted in 2016). The results of Exchanges 2018 and 2014 showed a small decrease in the overall level of agreement and a decrease of CV. While among the considered variables a PCA showed those which explained a higher % of variance were: (1) the distances of the winter rings from the core;(2) the number of false rings before the 1° winter. Moreover, no differences between otolith sampling areas were detected by PCA (Strait of Sicily and Bay of Biscay).

2023 Boarfish (*Capros aper*) otolith exchange (event ID 509)

The aim of the boarfish otolith ageing exercise was to age samples less than 10cm, compile otolith images in SmartDots for future training and shed light on the possibility of adjusting the plus

group designation. The results found that boarfish within the length range of 5.5 cm – 9.5 cm were between the ages of 1 and 3 years old and that SmartDots was a suitable storage bank for otolith images; however, it couldn't provide helpful information to support or oppose changes to the plus group. The results also found that boarfish otoliths are difficult to age. The mean percentage agreement, CV and relative bias for the readers were calculated at 64%, 26% and 0.67 respectively. Since the conclusion of the exercise, there haven't been any updates.

2023 Baltic Plaice - SD22 (ID 698)

The 2023 exchange for ple.27.21-23 took place on SmartDots, aiming to standardise age reading methods across labs, test for reader agreement and investigate any existing issues with identification of the first translucent zone in otoliths from ICES SD22. Images of whole, sectioned and sectioned and stained otoliths (from the same fish), were read by 12 readers (9 who provide age data for assessment). Results will be presented to WGBFAS in April 2023 and report made available on https://www.ices.dk/data/tools/Pages/smartdots.aspx

2023 Workshop on age reading and maturity stages of elasmobranch species (WKARMSE)

Regarding the age reading, the first bias results showed that, for each ray species, the weighted average percentage agreement based on modal ages for all readers was around 48 % (from 44% to 52% according to the species), with the weighted average CV of 40 % (from 30% to 49% according to the species) and APE around 30 % (from 21% to 37% according to the species). The lowest bias between readers was observed in Raja clavata, which was the species with the highest number of specimens and also the most studied species. Finally, the bias between readers increased with the age of the observed individuals and this trend was the same for all skate species. The bias was comparable between whole and cut vertebrae for the same species, however, staining preparation method seemed to decrease the bias between readers for one ray species. Regarding the maturity, the distinction between sexes was very good both for basic and advanced stagers with a PA respectively of 97.7% and 98.4%. No major issues seem to arise. Concerning the maturity staging, advanced stagers always obtained better results than basic stagers, which was in line with the expectations. Especially for advanced stagers, the percentage agreement was very good, being 98% for females and 87 % for males, while for all stagers it was 81 % for females and 82 % for males. The main mis-staging seems to occur in stage D, especially in the male specimens. For females, stage D also seems the most difficult stage to stage correctly, but to a lesser extent than for males.

2023 Workshop on Age reading of Norwegian Spring Spawning Herring (*Clupea harengus*) (WKARNSSH)

The assessment working group (WGWIDE) for Norwegian spring-spawning (NSS) herring requested an age reading exchange to calibrate age reading. Prior to this workshop two exchanges with NSS herring otoliths (SmartDots event 447) and scales (SmartDots event 448) of the same individuals were conducted. In total, 254 individuals were aged by 9 scale readings (6 advanced, 3 basic) and 18 otolith readings (10 advanced, 8 basic). Modal ages of otoliths and scales were compared directly as well as individual readings combined. The modal age of the independent exchanges resulted in 77.95% percentage agreement (PA) and an average percentage error (APE) of 3.71%. The comparison of all individual readings resulted in a PA of 76% and APE of 6%. The PA of all readers decreased from above 75% to below 50% at age 9 and older, where the otolith age is typically younger than the scale age. More details can be found in the workshop report.

Megrim 7.b-k, 8.abd otolith exchange (event ID 355).

This exchange is based on a collection of otoliths and their images, and it is currently in its final stages, with the collection arriving at the final institution to be read. This exchange is 15 months behind schedule overall, mainly due to the difficulty of the shipping and receipt of the physical collection in the UK. Once the exchange has been completed, the report will be made as soon as possible. Coordinator: Jorge Landa (Spain).

Exchanges planned for 2024

- Western Baltic spring spawning (WBSS) herring otolith exchange. (Coordinators:Florian Berg Steffie Haase, and Julie Davies)

- Red mullet *Mullus barbatus* and striped red mullet *Mullus surmuletus* otolith exchange in GFCM e ICES areas (Coordinators: Pierluigi Carbonara and Andrea Massaro)

- North Sea, Skagerrak and Kattegat, eastern English Channel Witch Flounder (*Glyptocephalus cynoglossus)* otolith exchange. (Coordinator: Louise S Lundgaard)

- Irish Sea and northern and central Bay of Biscay Common sole (*Solea solea*) (sol.27.7a and sol.27.8ab)   otolith exchange (Coordinator: Kirsteen MacKenzie)

- North Sea Common sole (*Solea solea*) otolith exchange (Sol.4) (Coordinators: Karen Bekaert and Ralf van Hal)

- North Sea, eastern English Channel and Skagerrak cod otolith exchange (Cod 27.46a7d20) with emphasis on younger ages (Coordinator: Ralf van Hal)

Workshops planned for 2024 and onwards.

WKARCM2 Workshop on Age reading of Chub Mackerel (*Scomber colias*) [WKARCM2], chaired by Andreia Silva, Portugal, and Carmen Hernández, Spain, will be held in Lisbon, Portugal, 7-11 October 2024 to:

a) Review information on age determination, otolith exchanges and validation techniques on this species

b) Estimate (relative) accuracy and precision of chub mackerel age determination in the main fishing areas.

c) Identify causes of age determination error and provide specific guidelines for the improvement of precision and reduction of bias between readers and laboratories.

d) Elaborate an age reading protocol.

e) Create a reference collection of otoliths and a data base of images of otoliths.

f) Address the generic ToR's adopted for workshops on age calibration (see 'WGBIOP Guidelines for Workshops on Age Calibration').

WKARCM2 will report by XX Month 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 is 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 the purpose of 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 ICES area, mainly in Iberia Peninsula, where a couple of decades years ago it was considered as a by-catch. Catches, mainly from the purse-seine fleet, are not limited, and no formal assessment and fishing management advice has been requested in ICES area so far, the species being assessed as a single stock in FAO/CECAF region. There is, however, concern on the stock status and exploitation levels, particularly in European waters, and a great uncertainty and lack of information concerning stock identity, dynamics and connectivity, and its biology. Though 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 potentially be used for advice. Preliminary analysis of the species available data have suggested geographical differences for most of its life history parameters, and also in growth pattern, 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 the workshop is to identify the current ageing problems between readers and standardize the age reading procedures in order to improve the accuracy and precision in the age reading of this species.

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 on, 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 for ICES, GFCM and FAO/CECAF Member States

Secretariat facilities None

Financial No financial resources needed

Linkages to advisory committees ACOM

Linkages to other committees or groups WGBIOP, WKCOLIAS, SCICOM

Linkages to other organizations RCGs, EU DG-MARE, EU Data Collection Framework

2024/WK/DSTSG The **Workshop on Maturity staging of Lemon sole (WKMSLEM)** chaired by Ingeborg de Boois, Netherlands, and Ewout Blom, the Netherlands will meet 24-26 June 2024, in Oostende, Belgium

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Agree on a common maturity scale description for lemon sole (*Microstomus kitt*) across laboratories following the SMSF scale //vocab.ices.dk/?CodeID=201768	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.	3.1	Year 1	Common maturity scale definition for lemon sole.
b	Calibrate staging of lemon sole using fresh fish	See ToR a	3.1	Year 1	Overview of commonality and differences in staging from fresh fish
c	Calibrate staging of lemon sole using SmartDots, following the pattern of trial-discussion-retrial	See ToR a	3.1	Year 1	Overview of commonality and differences in staging from pictures
d	Validate macroscopic maturity determination	Validation of the macroscopic maturity stage with histological analysis, mainly for	3.1	Year 1	Evidence-based decision on the more difficult stages after and prior

	with histological analysis	stages that are normally incorrectly classified (as the 'resting' stage)			to the spawning period
e	Propose optimal sampling strategy to estimate accurate maturity ogives	The ecology of the species, existing surveys, commercial sampling capacity should lead to the optimal sampling strategy to estimate accurate maturity ogives	3.1	Year 1	Overview of crucial elements in sampling strategies

WKEMSLEM will report by XX Month 2024 for the attention of WGBIOP, DSTSG, ACOM and SCICOM

Supporting information

Priority	High. Laboratories involved in the collection of maturity data for the various assessment WG's 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 for to be used during the workshop. Additional sampling will be carried out during 2023. Guidelines on how to prepare the Workshop, as well 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 biological sampling of lemon sole.
Secretariat facilities	None
Financial	None

Linkages to ACOM and groups under ACOM	WGNSSK, the assessment group for lemon sole
Linkages to other committees or groups	WGBIOP, and WGBEAM, IBTSWG the survey groups where lemon sole maturity is assessed
Linkages to other organizations	None

2023/WK/EOSG/03 **The Workshop on Adult Egg Production Methods Parameters estimation in Mackerel and Horse Mackerel (WKAEPM)** chaired by Maria Korta*, Spain, will meet in San Sebastian, 11-15 November 2024 to:

a) Inter-calibration of egg production methods (Annual and Daily Egg Production Methods), including historical re-evaluation of histological samples for maturity, fecundity, batch fecundity Estimation and atresia and post-ovulatory follicle classification. **ICES Science plan** 3.1, 3.3, 5.1

b) Comparison of egg production indices based on harmonized maturity, fecundity, atresia and POF estimates with currently used egg production estimates. **ICES Science plan** 3.1, 3.3, 5.1

c) Review existing, previously utilized and newly developed methods and calculations for realised fecundity estimation as well as batch fecundity and spawning fraction estimation, and document changes in procedures and their consequences in a protocol to be stored on the WGMEGS GitHub. **ICES Science plan** 3.1, 3.3, 5.1

d) Review available documentation on adult parameters estimation, both textual and figures, to redefine the standard protocols and update the survey manual. **ICES Science plan** 3.1, 3.3, 5.1

WKAEPM will report by 31st January 2025 for the attention of EOSG, WGMEGS, WGALES, WGBIOP, ACOM and SCICOM

Supporting Information

Priority	Data quality, used to provide fisheries advice through WGWIDE, will be impaired if this workshop is not conducted.
Scientific justification	Adult reproductive parameters estimation is fundamental for conversion of egg production into spawning stock biomass of western and southern mackerel and horse mackerel stock components. Both (batch) fecundity and atresia estimation as well as spawning fraction estimation are carried out using histological and image analysis methods, and the analysis and interpretation of these materials requires standardization across participating institutes. The standardization in this aspect is carried out in workshops since 2001 which have been extremely helpful for agreed practices among institutes and is recommended that experiences gathered during these workshops be extended during a workshop in 2024. It is expected that the workshop will refine the developed

	methodologies and clarify established calculations for these adult parameters estimation to obtain unbiased biomass output from the egg surveys.
	The workshop will update a TIMES manual with regards to any new findings in the fecundity, batch fecundity, atresia, and spawning fraction estimation from sampling, as well as the evaluation procedures and final calculations, for appropriate quality assurance purposes.
Resource requirements	None
Participants	Mainly scientists and technicians (approximately 20) involved in the surveys.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	ACOM
Linkages to other committees or groups	SCICOM, WGMEGS, WGBIOP, WGALES WGISDAA and WGWIDE
Linkages to other organizations	None.

2023/WK/EOSG/04 **Workshop on Mackerel, Horse Mackerel and Hake Eggs Identification and Staging (WKMACHIS)** chaired by Ewout Blom*, Netherlands, and Hannah Holah*, Scotland, will meet in Bremerhaven, Germany, 21-25 October 2024 to:

a) Carry out internationally comparative plankton sorting trials on typical MEGS survey samples to evaluate and standardize the effectiveness of plankton sampling procedures. This should follow the pattern of trial – analysis– identification of problem areas – retrial; **ICES Science plan** 3.1

b) Carry out comparative egg identification and staging trials for mackerel, horse mackerel and hake eggs following the methodology used in the previous egg staging workshops in order to quality assure the egg production estimates for the target species; **ICES Science plan** 3.1

e) Discuss sources of misidentification and -staging of fish eggs and prepare an uncertainty matrix of mackerel, horse mackerel and hake egg identification and staging; **ICES Science plan** 3.1

f) Review available documentation on species identification and staging of fish eggs, define standard protocols and update relevant descriptions and pictures in the survey manual; **ICES Science plan** 3.1

WKMACHIS will report by 19 December 2024 for the attention of EOSG, WGMEGS, WGBIOP, ACOM and SCICOM

Supporting Information

Priority	High priority to ensure the quality of data provided to WGWIDE for the production of advice.
Scientific justification	Sorting fish eggs from plankton samples, their staging and identification to species remains one of the key proficiencies in the execution of the mackerel and horse mackerel egg surveys. As this is carried out by a number of different operators in many different countries, and then the data combined, it is vital that the process be standardized. WGMEGS strongly feels that this is best done through the mechanism of a regular workshop to compare results between survey participants. In the context of the triennial egg surveys, it proved appropriate to hold a workshop prior to every survey to standardize approaches and methodologies in the run-up to the surveys. This will have the advantage of training new operators as well as harmonizing the approach of experienced operators. Egg staging workshops were held since 2000, and were very successful in achieving these aims. It is recommended that experiences gathered during these be used for setting up the procedures for the proposed workshop in 2024. The workshop will use the proven method of carrying out a set of sorting trials, analysing the results and identifying problems, and then repeating the trials on the basis of the new understanding. The workshop will also be tasked to update the descriptions and photographs given in the MEGS manual to assist in the plankton sample handling procedure.
Resource requirements	None
Participants	Mainly scientists and technicians (approximately 20) involved in the surveys.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	SCICOM, ACOM
Linkages to other committees or groups	WGMEGS, WGBIOP, WGALES and WGWIDE
Linkages to other organizations	None.

Annex 4: ToR a: Priority species and stocks in need of validation studies

Note that there are still species missing from the tables, adding uncertainty. We have therefore included three tables: Table 1, based on the new master table, Table 2, based on the previous master table and Table 3, for species where known age otolith samples are/soon will be available to improve the assessment that is currently not age-based.

New master table (updated for 2016–2023)

Priority list based on the new master table

Criteria for stock recommendations:

- Only species with age-based analytical assessment
- Percent agreement (PA) < 70 %
- Coefficient of variation (CV) > 15%
- Average percent error (APE) > 15% (note that APE is missing for some species)

Table 1. Priority list based on the new master table, ordered by species, year and PA.

Species	English name	Stock code	Assessment	Year	PA	CV	APE
Sardina pilchardus	Sardine	pil.27.8abd	WGHANSA	2017	64.9	57.9	37.1
Sardina pilchardus	Sardine	pil.27.8c9a	WGHANSA	2017	64.9	57.9	37.1
Scophthalmus maximus (formerly Psetta maxima)	Turbot	tur.27.4	WGNSSK	2018	53	50	32
Pleuronectes platessa	Plaice	ple.27.7h-k	WGCSE	2019	56	26	18
Pleuronectes platessa	Plaice	ple.27.420	WGNSSK	2020	69	56	28
Pleuronectes platessa	Plaice	ple.27.420	WGNSSK	2020	69	55	31
Sprattus sprattus	Sprat	spr.27.22–32	WGBFAS	2020	59	32	23
Micromesistius poutassou	Blue whiting	whb.27.1-91214	WGWIDE	2020	66	26	17
Sebastes mentella	Beaked redfish	reb.2127.dp	NWWG	2021	38	23	17
Trachurus trachurus	Horse mackerel	hom.27.2a4a5b6a7a-ce-k8	WGWIDE	2022	46	44	32
Trachurus trachurus	Horse mackerel	hom.27.9a	WGHANSA	2022	46	44	32
Engraulis encrasicolus	Anchovy	ane.27.8	WGHANSA	2023	57	52	37
Engraulis encrasicolus	Anchovy	ane.27.9a	WGHANSA	2023	57	52	37

Species	English name	Stock code	Assessment	Year	PA	CV	APE
Engraulis encrasicolus	Anchovy	ane.27.8	WGHANSA	2023	61	45	34
Engraulis encrasicolus	Anchovy	ane.27.9a	WGHANSA	2023	61	45	34

Previous master table

Criteria for stock recommendations:

- Only species with age-based analytical assessment
- Percent agreement (PA) < 70 %
- Coefficient of variation (CV) > 15% (note that CV is missing for some species)
- Average percent error (APE) > 15% (note that APE is missing for some species)

Table 2. Priority list based on previous master table, ordered by year and PA.

Species	English name	Stock code	Assess-ment	Year	PA	CV	APE
Merluccius merluccius	Hake	hke.27.8c9a	WGBIE		30.7 blind, 49.7 interpre-tation		
Trachurus picturatus	Blue jack mackerel	jaa.27.10a2	WGHANSA	2015	55.0	54	35
Molva dypterygia	Blue ling	bli.27.5b67	WGDEEP	2018	34	17	13
Aphanopus carbo	Black scabbard fish	bsf.27.nea	WGDEEP	2018	38.0	23	17
Pagellus bogaraveo	Blackspot (Red) seabream	sbr.27.10	WGDEEP	2018	39.0	26	19
Pagellus bogaraveo	Blackspot (Red) seabream	sbr.27.6-8	WGDEEP	2018	39.0	26	19
Pagellus bogaraveo	Blackspot (Red) seabream	sbr.27.9	WGDEEP	2018	39.0	26	19
Brosme brosme	Tusk	usk.27.1-2	WGDEEP	2018	44.0	15	11
Sebastes norvegicus (previously S. marinus)	Golden redfish	reg.27.1-2	NWWG	2020	47	47.0	24
Sebastes norvegicus (previously S. marinus)	Golden redfish	reg.27.561214	NWWG	2020	47	47.0	24
Molva molva	Ling	lin.27.3a4a6-91214	WGDEEP	2018	48.0	18	13
Molva molva	Ling	lin.27.5a	WGDEEP	2018	48.0	18	13
Molva molva	Ling	lin.27.5b	WGDEEP	2018	48.0	18	13

Species	English name	Stock code	Assess-ment	Year	PA	CV	APE
Trachurus mediterra-neus	Mediterranean horse mackerel	No stock code		2018	54.0	55	-
Phycis spp.	Greater forkbeard	Former stock code "gfb-comb"			55.0	29	20
Scomber colias	Chub mackerel	No stock code	WKARCM2	2022	62.0	41	25
Scomber scombrus	Mackerel	mac.27.nea	WGWIDE	2019, 2021	64.7	34.3	

Other species to recommend:

One species where age information is available but not used in assessment is the European eel (*Anguilla Anguilla*). There are and will be, however, more known-age eel otoliths available for an exchange with an age up to 40 years. These samples will be available (from Sweden) for an age exchange in 2025. It is not clear how well this has been communicated to WGEEL, but it would be useful if we also recommend an exchange / SmartDots event with "known age" eel otoliths from WGBIOP. The PA and CV were poor in previous exchanges.

Table 3. Priority species lacking age-based assessment.

Species	English name	Stock code	Assessment	Year	PA	CV	APE
Anguilla Anguilla	European eel	ele.2737.nea	WKAREA3	2019	40	30	

Annex 5:   ToR b: Best Practice Guidelines for Age Reading/Maturity Staging and Quality status tables

THE 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 6: ToR c: Additional information

Annex 6. Table 1. Benchmarked ICES stocks and WGBIOP comments and actions.

This table is available on github ([wg_WGBIOP](#)*)*

Annex 6. Table 2. Replies from stock coordinators in 2021.

Species/stock	biological parameters	replied to WGBIOP	advice taken on-board/ considered	replies	follow-up WGBIOP
her.27.25-2932	age	yes	yes	Mikaela: How should we interpret this? Do we need to make any actions? Also, considering that Julie will come to the herring benchmark data meeting next week and present the results of the recent exchange, it would be relevant to put the results from the two exchanges in relation to each other, no? Max: From an operational perspective, the best would be to provide us with an aggregated matrix of ageing precision by age and year (whenever available) to be used in the assessment model.	Julie will provide you with all the information, as she is the co-ordinator of the latest exchange. For sure, she can provide you with an Age Error Matrix, which was obtained from the last exchange, so you can try to use this in the assessment. You can also compare the results from both exchanges to get the idea if the age reading precision have improved or not.
her.27.28	age	no			
spr.27.22-32	age	no			
bss.27.4bc7ad-h	age	no			
bss.27.8ab	age	no			
cod.21.1	age	yes	yes	The last age validation workshop was in 2018 and we are working on a new exchange with the same countries involved (Iceland and Germany). The report is attached. It is also a part of the NWWG 2019 report as a WD.	

Species/stock	biological parameters	replied to WGBIOP	advice taken on-board/ considered	replies	follow-up WGBIOP
	maturity	yes	yes	I'm not aware of a workshop on sexual maturity staging. We follow the stage differentiation by Tomkiewicz et al. (attached) where we in the period 2007-2010 had samples analysed histology by Tomkiewicz to verify that we could use this staging for cod in Greenland. Unfortunately, there is no report on that work.	I attached the Report of the Workshop on sexual maturity staging of cod, whiting, haddock, saithe and hake (WKMSGAD), which I mentioned. Just in case you'd like to look at it. It's rather general, not addressing the Greenland cod. If you think that your stock would benefit from a maturity exchange, please let me know. WGBIOP can support such exercise, but it's welcome if you have a candidate to coordinate such exchange (preferably someone who knows the stock's biology). Of course there is not enough time to finalize an exchange before the coming benchmark, but it can be something to be considered in the future.
ghl.27.1-2	age	yes	yes	The age reading in the exchange is according to plan supposed to be finished tomorrow. We plan is to extract preliminary results from the exchange next week and bring to the benchmark data workshop that is planned to start later this month (27/11-2/12). Further plan is to have final report in SmartDots latest in January, so that it will be available before the benchmark in February.	
ghl.27.561214	age	no			
reg.27.561214	age	no			
pol.27.67	age	no			
pol.27.89a	age	yes	yes	This stock is a Data Limited Stock, at ICES category 5.2, and we are trying to go for a analytical assessment, so all the updated biological information is really helpful to understand the population dynamics.	If there is a need for an age or maturity exchange for your stock, please let me know. WGBIOP can support that, but it's welcome if you have a candidate to coordinate such exchange. Of course there is not enough time to finalize an exchange before the coming benchmark, but it can be something to be considered in the future.

Species/stock	biological parameters	replied to WGBIOP	advice taken on-board/ considered	replies	follow-up WGBIOP
ane.27.8	age	yes	yes	We still don't have dates for the benchmark, but we appreciate very much your e-mail and the provided information. Do you know (approximately) when the reports will be ready?	Unfortunately, I don't know when the reports from the exchanges will be published. The best way to get that information is to ask respective coordinators (see the email addresses below). I looked for some more information about anchovy exchanges and workshops and this is what I found: - Attached, you'll find: - a short description of results from European anchovy Otolith Exchange 2019. I copied it from WGBIOP report 2019. - a report from the latest anchovy exchange available. - WKAGESP Anchovy small exchange 2020 (smartdots id 267) was coordinated by Pierluigi Carbonara (carbonara@coispa.it). It was completed some time ago, so even if the report is not ready, you can try to ask the coordinator about the results. - I noticed mistake concerning the latest anchovy exchange (smartdots id 455). It will start on 1st of December, so we will have to wait for the report a bit. This exchange is coordinated by Carmen Hernandez (carmen.hernandez@ieo.e - There was also a workshop on anchovy age reading - WKARA3, chaired by Gualtiero Basilone. It met online 23–25 November 2021. The information is on ICES website (https://www.ices.dk/community/groups/Pages/WKARA3.aspx), but there is no report attached.
rjc.27.3a47d	age	no			
	maturity	no			
rjh.27.4c7d	age	no			
	maturity				
rjm.27.3a47d	maturity	no			

Annex 6. Table 3. A. Quality Indicators table by stock–WGBIOP 2023 answers.

This table is available on github

Annex 6. Table 3.B. Summary of answers to Quality Indicators table by questions –including WGBIOP 2023 answers.

1. Sampling Design_All_Survey Desing

Were possible weaknesses of the survey design critically assessed?		
0. Quality of biological data not evaluated	96	54.24%
1. Preliminary analysis of quality of biological data	39	22.03%
2. Detailed analysis of the quality of biological data	42	23.73%
Grand Total	**177**	**100.00%**
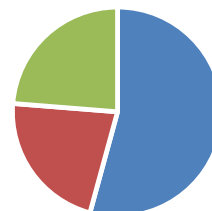
- 0. Quality of biological data not evaluated
- 1. Preliminary analysis of quality of biological data
- 2. Detailed analysis of the quality of biological data

2. 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)*		
Y	43	24.16%
N	53	29.78%
N/A	82	46.07%
Grand Total	**178**	**100.00%**
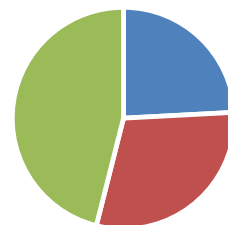
- Y
- N
- N/A

3. 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)*		
Y	96	52.46%
N	38	20.77%
N/A	49	26.78%
Grand Total	**183**	**100.00%**
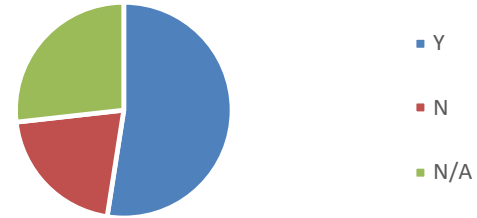
4. Stock Identity_All_Mixing Ratio

Is there any evidence for mixing? What methods are used to identify stock components? How reliable are spatio-temporal patterns in mixing resolved?		
0. No evidence	82	45.56%
1. No mixing	21	11.67%
2. Mixing exists: not accounted for	47	26.11%
3. Mixing exists: accounted for, not validated	12	6.67%
4. Mixing exists: markers study as a baseline	5	2.78%
5. Mixing exists: markers study and poor spatio-temporal coverage of mixing	2	1.11%
6. Mixing exists: markers study and good spatio-temporal coverage of mixing	11	6.11%
Grand Total	**180**	**100.00%**

5. Methods and Definitions_Age_Structure

Documentation of different structures used by country and stock		
0. No overview table	71	65.74%
1. Overview table available	28	25.93%
2. Overview table complete and up-to-date	9	8.33%
Grand Total	**108**	**100.00%**
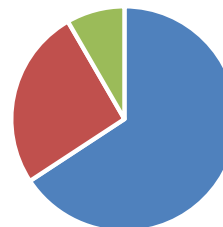
- 0. No overview table
- 1. Overview table available
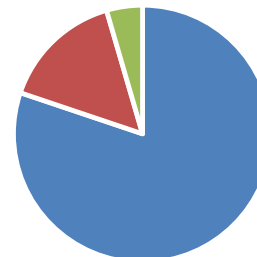- 2. Overview table complete and up-to-date

6. Methods and Definitions_Age_Preparation

Documentation of different preparation techniques used by country and stock		
0. No overview table	57	52.29%
1. Overview table available	42	38.53%
2. Overview table complete and up-to-date	10	9.17%
Grand Total	**109**	**100.00%**
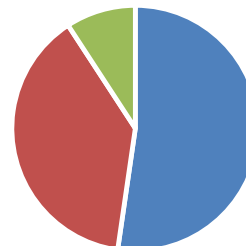
- 0. No overview table
- 1. Overview table available
- 2. Overview table complete and up-to-date

7. Methods and Definitions_Age_Birthdate & "Scheme

Documentation of different structures used by country and stock		
0. No overview table	89	80.18%
1. Overview table available	17	15.32%
2. Overview table complete and up-to-date	5	4.50%
Grand Total	**11 1**	**100.00%**
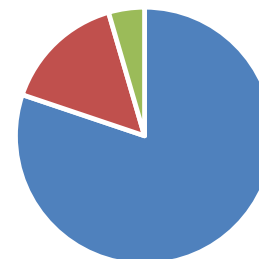
- 0. No overview table
- 1. Overview table available
- 2. Overview table complete and up-to-date

8. 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?		
1. Assumed	20	21.98%
2. Extrapolated	14	15.38%
3. Estimated indirectly	12	13.19%
4. Estimated directly	45	49.45%
Grand Total	**91**	**100.00%**
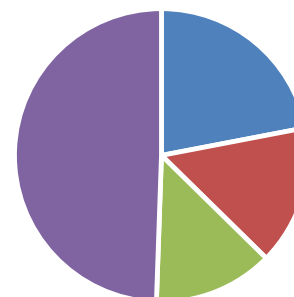
- 1. Assumed
- 2. Extrapolated
- 3. Estimated indirectly
- 4. Estimated directly

9. Methods and Definitions_Maturity_Structure

Documentation of different structures used by country and stock		
0. No overview table	89	80.18%
1. Overview table available	17	15.32%
2. Overview table complete and up-to-date	5	4.50%
Grand Total	11 1	100.00%

- 0. No overview table
- 1. Overview table available
- 2. Overview table complete and up-to-date
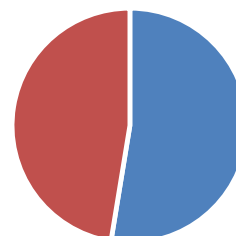
10. Methods and Definitions_Maturity_Preparation

Documentation of different preparation techniques used by country and stock		
0. No overview table	78	72.90%
1. Overview table available	23	21.50%
2. Overview table complete and up-to-date	6	5.61%
Grand Total	10 7	100.00%
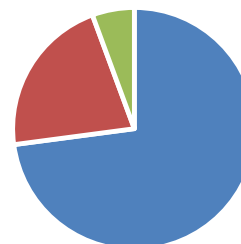
- 0. No overview table
- 1. Overview table available
- 2. Overview table complete and up-to-date

11. Methods and Definitions_Maturity_Scaling

Do differences between countries exist*(ed)*? Have different national maturity scales been successfully merged into one international standard?		
0. No chronicle (standard scale) available	58	55.77%
1. Differences between labs are known but ingnored	15	14.42%
2. Chronicle (standard scale) clearly documented and considered in data compilation	31	29.81%
Grand Total	**104**	**100.00 %**
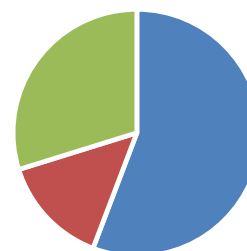
- 0. No chronicle (standard scale) available
- 1. Differences between labs are known but ingnored
- 2. Chronicle (standard scale) clearly documented and considered in data compilation

12. Methods and Definitions_Maturity_Timing

Is the maturity staging conducted during the whole year or only during a specified period of the year?		
1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3=bad, Q4=moderate)	51	52.58%
2. Staging year-round	46	47.42%
Grand Total	**97**	**100.00 %**

- 1. Conducted in a restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3=bad, Q4=moderate)
- 2. Staging year-round

13. Methods and Definitions_Maturity_Ogive

If sufficient maturity data are available, then spatially and/or temporally varying ogives can be considered		
1. Careless use of a type of ogive	29	34.52%
2. Careful selection of a type of ogive	40	47.62%
3. Selection of type of ogive based on thorough analysis of all options	15	17.86%
Grand Total	**84**	**100.00 %**
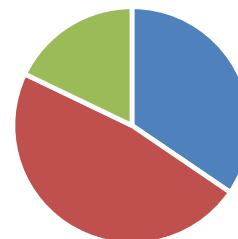
- 1. Careless use of a type of ogive
- 2. Careful selection of a type of ogive
- 3. Selection of type of ogive based on thorough analysis of all options

14. Methods and Definitions_Sex_Coding

Different countries use different coding for male and female in their national databases. This should be standardised before the data are submitted to ICES/GFCM, but there is a risk of errors.		
1. Potential errors in international database	18	23.68%
2. International database correct	58	76.32%
Grand Total	**76**	**100.00 %**
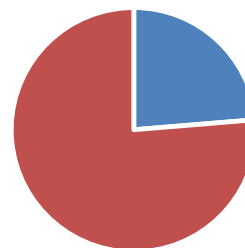
- 1. Potential errors in international database
- 2. International database correct

15. 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?		
0. Sex-specific issues not evaluated	59	59.00%
1. Preliminary analyses of sex-specific issues	22	22.00%
2. Detailed analysis of sex-specific issues	8	8.00%
3. Use of sex-specific issues in the assessment	1	1.00%
4. No sexual dimorphism occurs	10	10.00%
Grand Total	**100**	**100.00%**
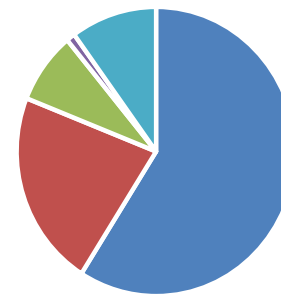
- 0. Sex-specific issues not evaluated
- 1. Preliminary analyses of sex-specific issues
- 2. Detailed analysis of sex-specific issues
- 3. Use of sex-specific issues in the assessment
- 4. No sexual dimorphism occurs

16. 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?		
1. Assumed	79	72.48%
2. Extrapolated	4	3.67%
3. Estimated	22	20.18%
4. Assessed (SMS key runs, ...)	4	3.67%
Grand Total	**109**	**100.00%**
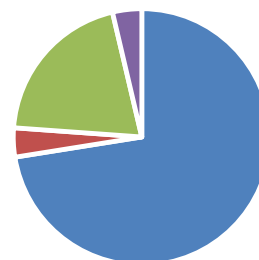
- 1. Assumed
- 2. Extrapolated
- 3. Estimated
- 4. Assessed (SMS key runs, ...)

17. Data Collection_Maturity_Length/age at Maturity

Was length/age at maturity estimated or extrapolated from neighbouring stocks?		
0. Not estimated	81	51.92%
1. Not estimated but extrapolated	6	3.85%
2. Estimated	69	44.23%
Grand Total	**156**	**100.00%**
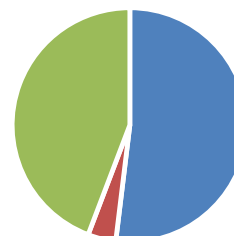
- 0. Not estimated
- 1. Not estimated but extrapolated
- 2. Estimated

18. Sex_Sex Ratio

| Was sex ratio estimated or extrapolated from neighbouring stocks?		
0. Not estimated	113	74.34%
1. Not estimated but extrapolated	0	0.00%
2. Estimated	39	25.66%
Grand Total	**152**	**100.00%**

- 0. Not estimated
- 1. Not estimated but extrapolated
- 2. Estimated
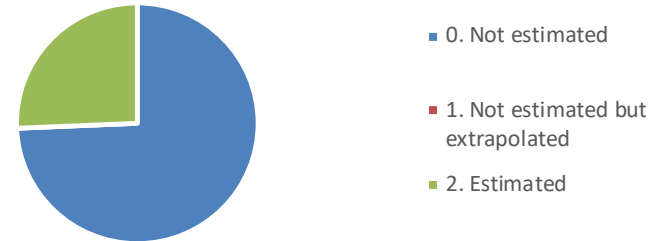
19. Validation_Age_Age Validation

Is there an age validation study available? (*What was the method of age validation?*)		
0. No validation study	59	59.60%
1. Only one method with major limitations	23	23.23%
2. Several complementary age validation methods showing similar results	17	17.17%
Grand Total	**99**	**100.00%**

- 0. No validation study
- 1. Only one method with major limitations
- 2. Several complementary age validation methods showing similar results
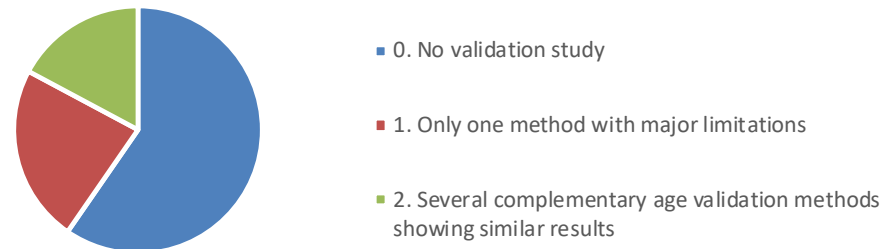
20. Validation_Age_Absolute Bias

Measure for accuracy in relation to true age (seldom available) *(Quantitative estimate; evaluation stock-specific)*		
Available in recent age reading exchange workshop report	3	10.71%
Not available	25	89.29%
Grand Total	**28**	**100.00%**
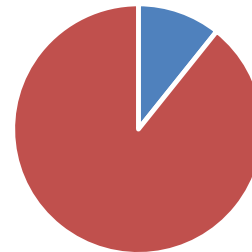
- Available in recent age reading exchange workshop report
- Not available

21. Validation_Age_Absolute Age Error Matrix

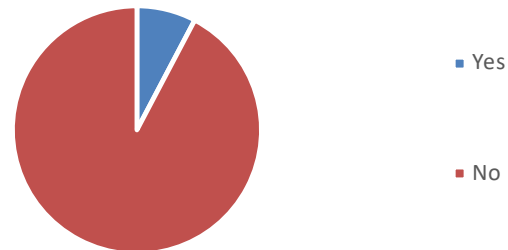| Probability distribution of repeated measurements relative to true age *(Quantitative estimate; evaluation stock-specific)*		
Available in recent age reading report	3	10.71%
Not available	25	89.29%
Grand Total	**28**	**100.00%**
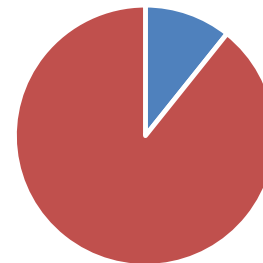
- Available in recent age reading report
- Not available

22. Validation_Maturity_Maturity Validation

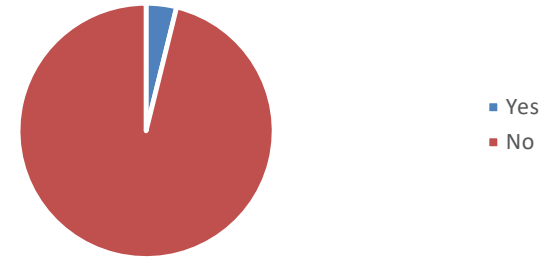| Were gonad stages compared with macroscopic and histological methods?		
0. No validation study	83	82.18%
1. Validation by histology available	9	8.91%
2. Validation maturity criteria based on histology available	9	8.91%
Grand Total	**101**	**100.00%**

- 0. No validation study
- 1. Validation by histology available
- 2. Validation maturity criteria based on histology available
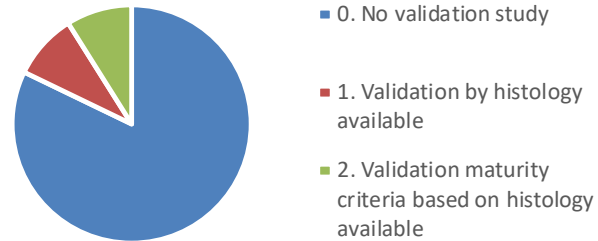
23. Validation_Maturity_Absolute Bias

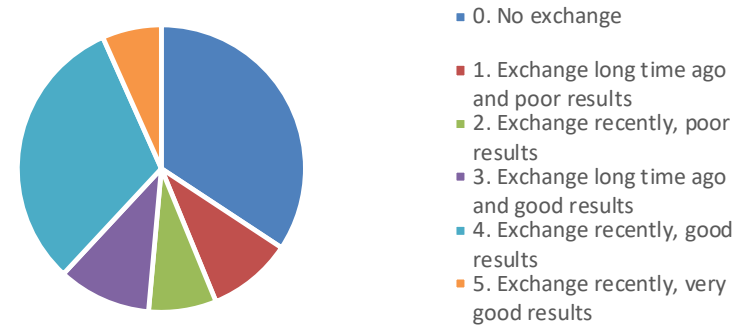| Measure for accuracy in relation to true maturity *(histological analysis) (Quantitative estimate; evaluation stock-specific)*		
Yes	2	7.69%
No	24	92.31%
Grand Total	**26**	**100.00%**

- Yes
- No

24. Validation_Maturity_Absolute Maturity Error Matrix

| Probability distribution of repeated measurements relative to true maturity *(Quantitative estimate; evaluation stock-specific)*		
Yes	1	3.85%
No	25	96.15%
Grand Total	**26**	**100.00%**

25. Calibration_Age_Exchange / Workshop

| When was the last exchange that included age readers from major data contributors?		
0. No exchange	36	34.29%
1. Exchange long time ago and poor results	10	9.52%
2. Exchange recently, poor results	8	7.62%
3. Exchange long time ago and good results	11	10.48%
4. Exchange recently, good results	33	31.43%
5. Exchange recently, very good results	7	6.67%
Grand Total	**105**	**100.00%**

26. Calibration_Age_Relative Bias

Measure for accuracy in relation to modal age (Quantitative estimate; evaluation stock-specific)		
Age_Relative Bias of the stocks lower than ± 0.1	21	53.85%
Not estimated	18	46.15%
Grand Total	**39**	**100.00%**
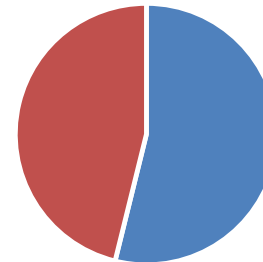
- Age_Relative Bias of the stocks lower than ± 0.1
- Not estimated

27. Calibration_Age_CV or APE

Measure for precision (Quantitative estimate; evaluation stock-specific)		
CV below 30%	20	42.55%
CV between 30% and 44%	7	14.89%
Available but not provided	5	10.64%
Not available	15	31.91%
Grand Total	**47**	**100.00%**
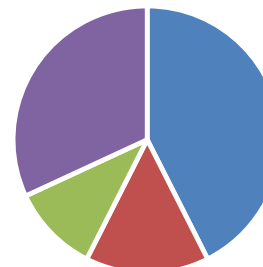
- CV below 30%
- CV between 30% and 44%
- Available but not provided
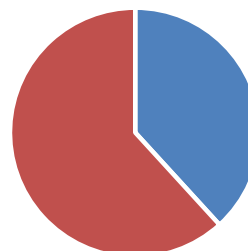- Not available

28. Calibration_Age_% Agreement

Percentage agreement between age readers *(Quantitative estimate; evaluation stock-specific)*		
Agreement over 70%	12	25.00%
Agreement between 35% and 70%	16	33.33%
Available but not provided	5	10.42%
Not available	15	31.25%
Grand Total	**48**	**100.00%**

29. Calibration_Age_Relative Age Error Matrix

| Probability distribution of repeated measurements relative to modal age *(Quantitative estimate; evaluation stock-specific)*		
Available	13	38.24%
Not available	21	61.76%
Grand Total	**34**	**100.00%**

30. Calibration_Maturity_Exchange/Workshop

When was the last exchange that included maturity readers from major data contributors?		
0. No exchange	74	79.57%
1. Exchange long time ago and poor results	3	3.23%
2. Exchange recently, poor results	1	1.08%
3. Exchange long time ago and good results	15	16.13%
Grand Total	**93**	**100.00%**
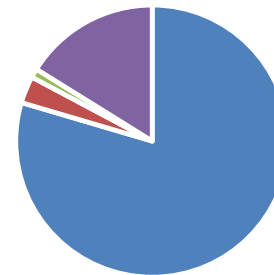
- 0. No exchange
- 1. Exchange long time ago and poor results
- 2. Exchange recently, poor results
- 3. Exchange long time ago and good results

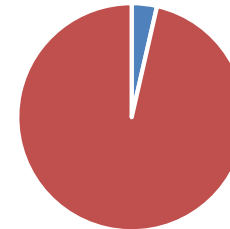**31. Calibration_Maturity_Relative Bias**

Measure for accuracy in relation to modal maturity *(Quantitative estimate; evaluation stock-specific)*		
Available	8	25.81%
Not available	23	74.19%
Grand Total	**31**	**100.00%**
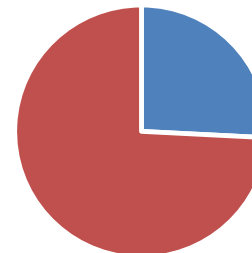
- Available
- Not available

32. Calibration_Maturity_CV or APE

Measure for precision *(Quantitative estimate; evaluation stock-specific)*		
Available	1	3.57%
Not available	27	96.43%
Grand Total	**28**	**100.00%**

- Available
- Not available

33. Calibration_Maturity_% Agreement

Percentage agreement between maturity readers *(Quantitative estimate; evaluation stock-specific)*		
Available	7	23.33%
Not available	23	76.67%
Grand Total	**30**	**100.00%**
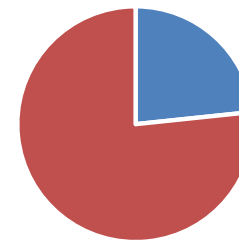
- Available
- Not available

34. Calibration_Maturity_Relative Maturity Error Matrix

Probability distribution of repeated measurements relative to modal maturity *(Quantitative estimate; evaluation stock-specific)*		
Available	0	0.00%
Not available	28	100.00%
Grand Total	**28**	**100.00%**

- Available
- Not available
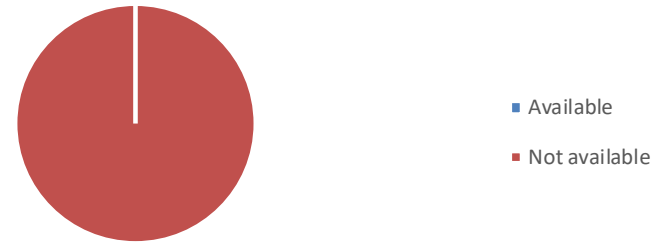
35. Stock Assessment_Age_Variance Structure

Is the stock assessment model age-structured?		
1. Age structure not used in assessment	43	40.19%
2. Age structure used in assessment	64	59.81%
Grand Total	**107**	**100.00%**

- 1. Age structure not used in assessment
- 2. Age structure used in assessment

36. Stock Assessment_Age_Error Matrix

Variance structure can directly be incorporated into stochastic stock assessment models		
1. Error matrix not used in assessment	92	95.83%
2. Error matrix used in assessment	4	4.17%
Grand Total	**96**	**100.00%**
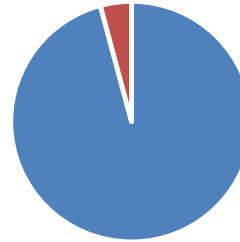
- 1. Error matrix not used in assessment
- 2. Error matrix used in assessment

37. Stock Assessment_Maturity_Variance Structure

| Is maturity function used in stock assessment model?		
1. No maturity information in assessment	36	33.03%
2. Knife-edge maturity at age or length in assessment	9	8.26%
3. Fixed maturity ogive at age or length in assessment	46	42.20%
4. Yearly maturity ogive at age or length in assessment	18	16.51%
Grand Total	**109**	**100.00%**
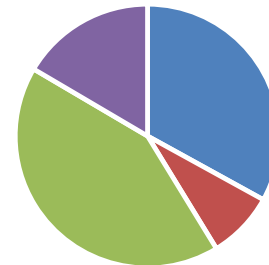
- 1. No maturity information in assessment
- 2. Knife-edge maturity at age or length in assessment
- 3. Fixed maturity ogive at age or length in assessment
- 4. Yearly maturity ogive at age or length in assessment

38. Stock Assessment_Maturity_Error Matrix

Variance structure can directly be incorporated into stochastic stock assessment models		
1. Error matrix not used in assessment	100	99.01%
2. Error matrix used in assessment	1	0.99%
Grand Total	**101**	**100.00%**
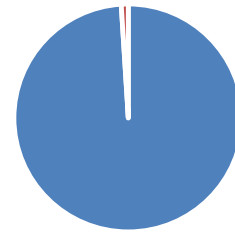
- 1. Error matrix not used in assessment
- 2. Error matrix used in assessment

**39. Stock Assessment_All_Sensitivity Analysis**

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)		
1. No alternative input data sets produced	78	77.23%
2. Two alternative data sets produced and sensitivity runs tested	2	1.98%
3. Numerous sensitivity runs with alternative data sets tested	21	20.79%
Grand Total	**101**	**100.00%**
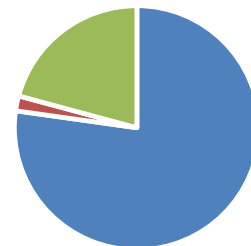
- 1. No alternative input data sets produced
- 2. Two alternative data sets produced and sensitivity runs tested
- 3. Numerous sensitivity runs with alternative data sets tested

40. 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?		
1. New parameters not used in assessment	88	85.44%
2. New parameters used in assessment	15	14.56%
Grand Total	**103**	**100.00%**
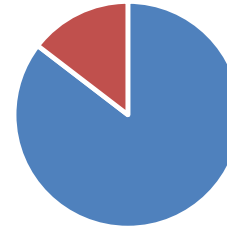
- 1. New parameters not used in assessment
- 2. New parameters used in assessment

Quality Indicator Table summary

Per the recommendation outlined in WGBIOP 2017, the biological parameters derived from shared stocks within the EU data collection framework (DCF) constitute an integral component of an intricate workflow. This comprehensive process spans from field sampling encompassing commercial catches and fisheries-independent surveys, to the subsequent analysis and estimation of biological parameters. The culmination of this workflow results in model outputs derived from stock assessment, which in turn, inform decision-makers' advice. The precise determination of factors such as age or maturity stage is significantly influenced not only by the immediate procedures but also by preceding steps, such as the statistical robustness of catch sampling schemes, the quality of scientific surveys, and subsequent methodologies, including enhancement processes. The ramifications of inaccurate estimates of biological parameters on fish stock assessment are frequently insufficiently assessed. Therefore, the Quality Indicator (QI) Table was generated as a scheme with the purpose of identifying the potential sources of error throughout that process.

The QI Table comprises a series of elucidative inquiries categorized based on the specific issues they address, emphasizing the biological parameter(s) under consideration. In total, seven distinct issues have been deliberated upon. For instance, Topic 3, "Methods and Definitions," encompasses subtopics like "age," "growth," "sex," among others. Under the sub-topic "age," three indicators, namely "Structure," "Preparation," and "Birthdate & Scheme," are included. Comprehensive explanations for six of these issues (1, 2, 3, 5, 6, and 7) are detailed in section 5.2.1 of WGBIOP 2017 (ICES, 2017), while a new issue, which incorporates two indicators concerning the source of reproductive information ("Length/age at maturity" and "Sex ratio"), has been added from WKBIOPTIM-3 (ICES, 2019). The primary issues (ICES, 2017) that initiated the need for the quality evaluation via this Table are briefly assessed according to the provided information as follows:

Annex 6. Table 3.C. Quality indicators by stock–WGBIOP 2023 answers. Summary of Results.

More information available on github (wg_WGBIOP)

Summary of Quality Indicators Table questionnaire
1. Sampling design & implementation
In relation to the assessment by STECF (or any) of the national catch sampling scheme (Q_2), over half of the participants were unaware, and more than half of the remaining group mentioned it lacks thoroughness. Concerning the survey structure (Q_1), the majority stated that it has not been appraised, and additionally, 20% highlighted that the survey doesn't cover the complete range of the stock (Q_3).
2. Stock Identity
The responses indicate a range of perceptions regarding the evidence for mixing (Q_4). A significant portion either acknowledged the presence of mixing or emphasized the absence of evidence or adequate methods to account for mixing in the identified stock components. This survey highlights a need for further validation, coverage, and accounting for mixing in the assessed scenarios. The ICES SIMWG (Stock Identification Methods WG) deals with methods for the identification of different stocks (for instance through genetics).
3. Methods and Definitions
About the "age" parameter, in most cases, there is not any calibration between the different labs within the country or the stock (Q_5-7), while growth parameters for half of the stocks are estimated directly (Q_8). About the "maturity" parameter, further than the lack of inter-calibration, there seem to be a lack of precision regarding the scale, the type of ogive and the timing of the sampling and although the database sex-coding is in most cases correct, other sex-specific information, such as dimorphism, isn't properly evaluated for at least 59% of the stocks (Q_9-15). Finally, the

Summary of Quality Indicators Table questionnaire
"natural mortality" parameter is for the majority of the stocks (72%) assumed (Q_16). This general lack of homogeneity can arise issues for shared stocks, since accounting of such differences could be important to assure the quality of data compiled from different countries.
4. Data collection
Subsequent parameters put into the survey indicated that estimates for length/age at maturity are lacking for half of the stocks, and that the sex ratio is not estimated for 74% of these stocks (Q_17-18).
5. Validation
Regarding validation on age and maturity data, for the majority of the stocks it is not available, while measure for accuracy or error matrices appear only for fewer than 20% of the corresponding validated stocks (Q_19-23). It should be noted that although age validation studies can be costly, validation of maturity staging can be achieved more easily through histology.
6. Calibration
Regarding the determination of the level of agreement between age readers or maturity stagers for a selection of hard structures or gonads, recent exchange with good results in relation to age was indicated only for 31% of the stocks while this wasn't the case for any of the stocks in relation to maturity staging (Q_24-34). This alone (even without taking into consideration CV, APE, percentage of agreement or error matrices), suggests that regularly organised stock-specific exchanges and workshops are a matter of essence.
7. Stock Assessment
Although the WKSABCAL (ICES, 2014) emphasized the importance of incorporating biological parameters as well as AEMs in stock assessment models, the survey showed that age and maturity is considered for only about 60% of stocks, while AEMs are ignored for the vast majority. Furthermore, alternative data sets are used to accommodate sensitivity analysis for less than 23% of the stocks (Q_35-39). Potentially useful new parameters are used for 15% of the stocks (Q_40).
8. General comments
It should be noted that in several cases the respondent wasn't fully aware of the desired extend regarding the requested information. This information may be shared between the assessor, the coordinator, or the data submitter regarding each stock. A general need of further improvement of the data quality was pointed out.

Annex 7:   ToR e – Recommendations and Responses

Recommendations 2023

Recommendations from WKARHOM4

ID 3 - To collect edge type data and ring measures for both sliced and whole otoliths in order to implement validation/corroboration studies.

To WGBIOP

Response from WGBIOP

The exchange suggested in ID 7 may be an opportunity to include these type of measurements/observations.

WGBIOP has made a list of species and stocks which are recommended for validation studies. The Trachurus species are on this list.

ID4 - To use the updated guidelines (age schemes and ageing criteria) (see section: Update age reading protocols for Trachurus species) and reference images for the ageing interpretation of Trachurus species (see section: Update otoliths reference collections) WGBIOP

To WGBIOP

Response from WGBIOP

If you can make the updated guidelines into a suitable document (with authors and year published) we can publish it in the WGBIOP collection in the ICES library and the guidelines can also be sent out to all national coordinators to distribute among the relevant readers.

ID5 - To only use calibrated images (with calibration bar, pretreatments of images could induce bias to different sized otoliths). This was not adhered to in the current exchange.

To WGBIOP and WGSMART

Response from WGSMART.

ID6 - Suggestions to improve the use of SmartDots as listed (both for readers and delegates) (see sub-section: SmartDots experience)

To WGBIOP and WGSMART

Response from WGSMART.

ID7 - A new full exchange in 2025 for the T. trachurus, T. mediterraneus, T. picturatus following the instructions provided in this report (see section: Recommendations for future Otolith Exchanges on Trachurus species).

To WGBIOP

Response from WGBIOP

WGBIOP endorse this but we need suggestions for coordinators for the exchange and we can then include this in the WGBIOP report.

Recommendations from WGNSSK

ID37 - We recommend an age reading exchange for cod (cod.27.46a7d20; especially the younger ages) and witch flounder (wit.27.3a47d) including readers of both commercial and survey otoliths. We recommend the investigation of changes in growth/maturity/length at age for both flatfish and roundfish.

To WGGRAFY and WGBIOP

Response from WGBIOP

WGBIOP has planned exchanges for both witch flounder (wit.27.3a.47d) and cod (cod.27.46a7d20) for 2024.

Recommendations from IBTSWG

ID46 - WGBIOP re-examine the new maturity scale, SMSF, because not all countries have implemented it. More guidance and clarity for mapping between scales is also required.

To WGBIOP

Response from WGBIOP

The SMSF scale has been revisited and some clarifications have been made for some stages (see section 2.2.1.4 in this report). This should make it easier for countries to translate their national scale into the SMSF scale. WGBIOP is happy to advise on any specific issues if further needed. However, the SMSF cannot be applied correctly without substages. To address all issues, a new maturity ToR has been created for the next three years. The SMSF scale is the only scale featured in the RDBES now.

Recommendations from WGBFAS

ID53 – WGBFAS asks WGBIOP to check how individual countries are applying the maturity scale in surveys and commercial samples to align input data used in the stock assessment.

To WGBIOP …

Response from WGBIOP

The SMSF scale has been revisited and some clarifications have been made for some stages (see section 2.2.1.4 in this report). This should make it easier for countries to translate their national scale into the SMSF scale. WGBIOP is happy to advise on any specific issues if further needed. However, the SMSF cannot be applied correctly without substages. To address all issues, a new maturity ToR has been created for the next three years. The SMSF scale is the only scale featured in the RDBES now.

Recommendations from WKBCOD

ID67 – Start sampling genetic information from North Atlantic cod on a regional basis. Since we assume the stocks are not mixing in Q1, it is especially important to sample from Q2-4. This could be conducted from both the Q3 and Q4 survey and from the commercial catches. The sampling should be coordinated throughout the entire area. This recommendation should be addressed to WGBIOP and to RCG NS&EA.

To WGBIOP and RCMs

Response from WGBIOP

WGBIOP is supportive of this but the RCGs and IBTSWG should coordinate and sampling should be done on the regional level. Funding is needed for the analysis, so consideration could be given to this in the new DCF workplan for 2025-27.

ID70 - There have been large changes in estimates of the proportion mature-at-age for all the Northern shelf cod sub-stocks. There are concerns that younger fish may contribute less to the reproductive potential of the stocks than their weight indicates, compared to older cod. Research is required about the fecundity versus weight and egg quality of these sub-stocks.

To WGBIOP

Response from WGBIOP

WGBIOP would be happy to be involved in planning a study on the fecundity of cod if funding were available. WGBIOP will investigate the possibility with the countries involved (who has the equipment needed etc) and with their representatives in WGBIOP.

Recommendations from WKBGREENCOD

ID72 - In recent years the cod catches on Dohrn Bank in the north-eastern area close to the Icelandic EEZ have visibly increased, and it is assumed, based on the modelling made during the benchmark, that a large proportion of these cod originate from another stock outside the Greenland EEZ. To better understand the dynamics occurring in this area it is recommended to have tagging and otolith chemistry studies based on samples from Greenland and Icelandic catches.

To WGBIOP and NWWG

Response from WGBIOP

WGBIOP endorse this study for countries in the area. While we have no funding or ability to do studies within WGBIOP, we are happy to advise if needed.

ID74 - Since the assignment of catch and biological data to either of the three cod stocks is based on genetic analysis, it is also recommended that sufficient number of samples from both fisheries dependent and fisheries independent catches area collected.

To WGBIOP and NWWG

Response from WGBIOP

WGBIOP endorse this study. Due to COVID and technical problems, the German research vessel Walther Herwig could not fish in the area during the last few years. The cruise leader has been contacted and replies that it is no problem to collect genetic samples during the survey coming

years if it takes place. Greenland run a survey covering shelf and slope areas in East and West Greenland and collected genetic samples necessary for the assessments of the different stocks.

Recommendations from WGCSE

ID 89 – Consider the possibility of otolith aging workshop on Anglerfish, anf.27.3a46 if feasible. This stock is intended to be benchmarked in 2023-2024.

To WGBIOP

Response from WGBIOP

WGBIOP contacted the chair of WGCSE, who decided that an exchange/workshop for age calibration is not currently needed.

Recommendation from WGWIDE

ID102 – WGWIDE recommends that the Working Group on Biological Parameters (WGBIOP) settup a comprehensive spatial and time varying data analysis on horse-mackerel otolith shape to study the stock structure along the Northeast Atlantic (NEA). Background: Currently, ICES considers horse mackerel in the Northeast Atlantic to consist of 3 separate stocks (western, North Sea and southern). A comprehensive genetic research project on stock identification of horse mackerel is being carried out, and initial results suggest that the boundaries of the stocks require revision. The initial results reveal potential changes in the perception of the stock distributions which could impact the reliability of the assessments for the three current stocks of horse mackerel in the Northeast Atlantic. In order to supplement these genetic analysis, other methods are also needed to allow a conclusive decision on population structure for fisheries assessment.
Otolith shape analyses can provide good and reliable results on species stock structure, with the advantage of being easy to perform and also allowing the analysis of a large number of structures, taking into account the temporal and spatial variation.
The next benchmark of horse mackerel is planned for 2024 and it is likely that the Stock Identification WG will subsequently review information on stock structure for this species or further workshops will be held to amend the current stock boundaries. Results from a comprehensive otolith shape analysis could give extra and important information concerning these species stocks boundaries around the NEA to feed into these processes.

To WGBIOP

Response from WGBIOP

WGBIOP supports this recommendation but currently no otolith shape data for horse mackerel is available. Seeing the state of the current available data it is unlikely that information will be available before the 2024 benchmark. If the benchmark results show it is necessary to include shape analysis for stock identification WGBIOP can support this analysis combined with the genetic results. The benchmark group should communicate with WGBIOP. Chairs to coordinate this can be found at WGBIOP 2024.