WORKING GROUP ON BIOLOGICAL PARAMETERS (WGBIOP)

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Contents

i Executive summary

The ICES Working Group on Biological Parameters (WGBIOP) general aim is to review the status of current issues and developments associated with biological parameters, supporting the Data Collection Framework and end user (stock assessment) requirements.

WGBIOP continued the work of reviewing past exchanges and workshops for age and maturity organised under the remits of WGBIOP and in line with their above-mentioned aim. The focus was on the stocks to be benchmarked in the coming years and available issue lists used to identify any problems to be addressed. Steps for implementing the output from exchanges and workshops into the stock assessment models in the form of age error matrices (AEM's), which are now a standard output in the SmartDots reports, were outlined. SmartDots is an age reading platform that facilitates age readings based on otolith images. The most effective way to investigate this process would be during the benchmark process. The continued efforts to streamline the workflow of WGBIOP with the benchmark process has not developed any further since the group met in 2018 and will be addressed with the Advisory Committee (ACOM) and the Planning Group on Data Needs for Assessment and Advice (PGDATA) in 2020. Continued investigations into possible new life history parameters for modern assessment included the development of a deliverable stomach sampling and contents analysis action plan.

The need for age validation studies was again highly stressed by the repeated low levels of poor agreement between age readers of some stocks with lack of resources identified as the main obstacle. During the scientific session on 'Age and Maturity Validation Studies' several experiment/studies were presented and discussed, mostly in light of their applicability and in 2020 a list of prioritised stocks to be validated will be finalised. WGBIOP also developed a workplan for the ICES Handbook on maturity staging of marine species.

With respect to standardisation of quality assurance procedures at a regional level, the guidelines for age and maturity workshops and exchanges underwent a major review in line with SmartDots development. Suggestions for an improved calculation of modal age were presented and an updated ICES code for otolith reading quality grading was adopted by the group. Efforts will continue to streamline the data and work flow across the Regional Coordination Groups (RCGs), the Working Group on SmartDots Governance (WGSMART) and other relevant groups.

ii Expert group information

Expert group name	Working Group on Biological Parameters (WGBIOP)
Expert group cycle	Multiannual Fixed Term
Year cycle started	2018
Reporting year in cycle	2/3
Chairs	Cindy Van Damme, The Netherlands
	Julie Coad Davies, Denmark
	Pierluigi Carbonara, Italy
Meeting venue(s) and dates	1-5 October 2018, Ghent, Belgium (32 participants)
	7-10 October 2019, Lisbon, Portugal (40 participants)

1 List of Outcomes and Achievements of WGBIOP in this delivery period

1.1 ToR a. Plan studies, workshops and exchange schemes on stock related biological variables and review their outcomes.

- Drafted resolutions for workshops and exchanges to be approved for 2020 and onwards;
- Reported on and reviewed results from workshops and exchanges, which occurred in the past and current year;
- Annual update of a series of files: the interactive table of historic workshops and exchanges by species.

1.2 ToR b. Improve training and quality assurance of age reading and maturity staging

- Updating the "material, techniques and preparation methods by species and area for fish ageing" table (https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx#others) and updating the table "Quality Status of Age Reading at Institutes";
- Reviewing the "material, techniques and preparation methods by species and area for fish maturity" table, updating the table "Quality Status of Maturity Staging at Institutes" and updating maturity stager contact details;
- Updating the guidelines for age reading and maturity staging workshops and exchanges (https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx#others) taking into consideration what has been reported by the WGBIOP 2018 participants and the results derived from the exchanges and workshops carried out in 2017 and 2018.

1.3 ToR c. Evaluate the quality of biological parameters: Issues and guidelines

- Annually the issue lists put forward for benchmark assessments are evaluated and, where necessary, action is undertaken by WGBIOP. Beside the work of the subgroup also focused on scrutinizing results from previous age and maturity calibration exercises in order to detect gaps in the quality assurance of biological parameters in stocks for which a benchmark is planned for 2021;
- All Working Groups' chairs dealing with stocks of upcoming benchmarks have been contacted with responses to issues on biological parameters, and to inform them about previous, ongoing and planned exchanges and workshop on ageing and maturity;
- The Quality Indicator Table (WGBIOP, 2017) that covers the entire workflow from the data collection to the stock assessment model runs has been reviewed and revised.

1.4 ToR d. Data availability, documentation and methods to improve identified biological parameter estimates, as input to assessments

- WGBIOP outlined steps towards implementing Age Error Matrices (AEM) from age reading exchanges (available as a standard output from the current SmartDots platform and historic exchanges) into stock assessment by; i) Summarising information on which Stock assessment models are being used by stock, ii) Discussing with the developers/users of the different models in use to what extent their models are capable of accommodating AEM, and iii) Promoting the development of the tools necessary to do so in practice. This output is currently not being used in stock assessment, even though this can significantly improve stock assessment results;
- Validation of age readings is urgently needed for many stocks owing to the low agreement between readers obtained during calibration exchanges;
- Age and maturity information sheets are proposed to improve the level of knowledge, within age and maturity workshops and exchanges, of the stock assessment's requirements.
- WGBIOP recommends a Workshop on Operational Implementation of Stomach Sampling (WKOISS) to ensure knowledge sharing and coordination following the work done by the Workshop on Better Coordinated Stomach Sampling (WKBECOSS) and the Workshop on sampling, processing and analysing the stomach contents (WKSTOCON);
- WGBIOP supports evaluation and adoption of the FishPi[2] and STREAM project's stomach sampling protocol by WKOISS and the "Intersession Sub-group on Stomach Sampling" of the Regional Coordination Groups (RCGs);
- Links with end users of biological parameters have been developed through: i) a joint web session with the WG on Integrated, Physical-biological and Ecosystem Models (WGIPEM) that provided information on their models' data needs; ii) a meeting to obtain the life history parameter estimates used in WKLIFE's stock simulation operating models;
- Fish condition can be calculated from comprehensive single fish data available from a Regional database (RDB's) and the ICES DATRAS database.

1.5 ToR e. Address requests related to biological parameters and indicators

- Each technical and statistical recommendation addressed to WGBIOP 2019 was addressed and actions planned. Some of these recommendations have been communicated to the subgroup on ToR a, and considered in the list of age and maturity exchanges and workshops for 2020;
- Completed and updated the summary table of the input data used in each species stock assessment (e.g. length age, age plus group, maturity ogive) produced by WGBIOP 2018.

1.6 ToR f. Update and further develop tools for the exchanges and workshops

During the meeting the following tasks were carried out. Presentations that were given and a quarterly newsletters were reviewed and summarised below.

- A new version of the SmartDots software was released in September 2019 and details of the improvements are highlighted in the SmartDots newsletter and summarised below:
  - Two extra (optional) properties have been added to the annotation panel: Nucleus & Edge. The available options for both properties are: Opaque, Translucent and NA (not applicable);
  - An extra AQ-code "AQ3_QA" is added to the readability scale. "AQ3_QA" means that rings cannot be counted, the calcified structure is considered unreadable. Age is assigned for Quality Assurance purposes only;
  - There is a new toggle button added in the age-reading window. Clicking on this button toggles the line visibility;
  - A new button with options has been added to the age-reading window. With this button the user can measure distances on the otolith image;
  - A fixed reading line/guideline cannot be approved as a valid annotation or have a quality code assigned to it any longer;
  - An overview of users progress and a finish button have been added to the event overview page;
  - A help button linking to the user manuals has been added to the app login page;
  - Newly updated manuals will be available following the WGSMART meeting in October;
  - Reminder about responsibility as a national age/maturity coordinator; Please make sure your readers expertise's are updated in SmartDots;
  - If a WGBIOP exchange or workshop is to be run by someone else at your institute, it is your responsibility as coordinator to propose the event in SmartDots and delegate the event to the responsible person.
- The number of exchanges in SmartDots was reviewed for 2018 and 2019 and are presented in Annex 5
- Each of the presentations that were presented in the meeting were reviewed to see if there were any comments/reflections suggestions on the use of SmartDots and is presented in Annex 5.
- Issuing of the SmartDots newsletter on a quarterly basis by the WGSMART steering group provides a very useful document highlighting changes and updates

1.7 Other achievements

- WGBIOP expanded its cooperation with other ICES groups in 2019. During the meeting, a WebEx was held with the Scallop Assessment Working Group (WGSCALLOP) and a subgroup of WGBIOP members. The work of WGBIOP was presented, focussing on quality assurance aspects of biological parameters as input to stock assessment and the SmartDots tool. WGBIOP has supported WGSCALLOP intersessionally in the setup of an age reading workshop for Scallop, which will take place on the SmartDots platform in 2020;
- Continuous intersessional work with the Working Group on SmartDots Governance (WGSMART) on the further development of the platform as a quality assurance tool for age reading and maturity staging in the ICES and GFCM areas;

- Intersessional work with the Regional Coordination Groups (RCGs) subgroups on End-user needs and Fisheries Overviews.

2 Progress report on ToRs and work plan

2.1 ToR a. Plan studies, workshops and exchange schemes on stock-related biological variables and review their outcomes

2.1.1 Progress during WGBIOP 2019

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

- During the meeting, the interactive table of workshops and exchanges "Wk, Ex, SG History Master Table" was updated for the current year (http://ices.dk/community/Pages/PGCCDBS-doc-repository.aspx);
- It was decided to merge the table "Species – Stock Quality Status" with the "Wk, Ex, SG History Master Table" so that all relevant information is kept in the "Wk, Ex, SG History Master Table". This table now also includes information on when stocks are subject for benchmark review (if information is available) and information about available validations for age and maturity for the different stocks and links to validation reports when applicable;
- The subgroup also reported results from workshops and exchanges, which took place in 2018 and 2019, and the summaries are available in Annex 3.a;
- WGBIOP reviews the suggestions for exchanges and workshops in relation to the needs of the data-end-users, and has paid special attention to those stocks, which have been included in the benchmark schedule for the coming years. The proper channel to include an exchange/workshop in the ICES planning process is for WGBIOP to include a proposal in its annual report. This proposal then goes to PGDATA and ACOM/SCICOM for consideration. Exchanges and workshops are therefore usually planned more than a year before they are supposed to take place;
- Drafted resolutions for workshops and exchanges endorsed by WGBIOP and to be approved from 2020 and beyond which can be seen in Annex 3.b.

2.1.2 Workplan for 2019-2020

- For 2020, 11 age calibration exchanges and two maturity staging exchange exercises are planned;
- There are two workshops planned for 2020 and two for 2021, dealing with emergent biological parameters such as larvae and stomach contents;
- One age calibration exchange is proposed for 2021.

To see the full list of exchanges and workshops for 2020-2021, please see Annex 3.b.

2.1.3 Deliverables for 2020

- For 2019, 2020 and beyond all proposed exchanges have been approved and coordinators agreed upon. Several of these exchanges have a reporting deadline on the first week of October 2020, to ensure the results are available for the benchmark data compilation workshops. Exchanges for species that are not up for benchmark should be finished by

the end of 2020. Coordinators will be contacted six months after WGBIOP to ensure that exchanges are progressing as scheduled;

- WGBIOP will receive reports on the progress and the outcomes of these exchanges before its 2020/2021 meetings. All exchange results will be compiled ahead of the meeting and presented at the meeting where the group will critically assess any recommendation for further work at this time;
- WGBIOP will also track the progress of proposed workshops, facilitating the agreement of chairs, dates and locations for workshops to convene. Results will be presented to the WGBIOP meetings in 2020/2021 for consideration.

2.2 ToR b. Improve training and quality assurance of age reading and maturity staging

2.2.1 Progress during WGBIOP 2019

At this meeting ToR b has focused on:

a) Updating the "material, techniques and preparation methods by species and area for fish ageing" table (https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx#others) and updating the "Quality Status of Age Reading at Institutes" table;
b) Reviewing the "material, techniques and preparation methods by species and area for fish maturity" table, updating the table "Quality Status of maturity at Institutes" and updating maturity stager contact details;
c) Updating the guidelines for age reading and maturity staging workshops and exchanges taking into consideration what has been reported by the WGBIOP 2018 (ICES, 2018a) participants and the results derived from the exchanges and workshops carried out in 2017 and 2018 (https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx#others)

a) Age

For age reading a lot of work has been already done in the previous years of WGBIOP. Interactive tables containing information on quality assurance, procedures in national labs and an overview of materials, techniques and methods applied in national labs have been created. The subgroup requested all national laboratories to update the information in the tables and in SmartDots. The yearly update of the table was done. It was decided during the meeting that it would be more interesting to have all information gathered on the SmartDots webpage. Therefore, a list will be compiled intersessionally to indicate what material and methods age related information should go into SmartDots.

b) Maturity

The group revised the table prepared in WGBIOP 2018 (ICES, 2018a) under the name "Material_techniques_and_preparation_methods_by_species_and_areas_for_fish_maturity", which was structured in WGBIOP 2018 (ICES, 2018a) to include data for age reading and maturity staging. Numerous problems in the table format and mistakes in the data already filled in were identified during the revision of it. A number of them are presented below:

1. Too complicated as it requests information for both maturity and ageing. Very long and complicated table, not user-friendly;
2. There were cases of inconsistency of the information provided in the table, for example between the scientific name of the fish species and the common name;

3. New species are added, thus the table needs to be updated continuously;
4. There are cases that instead of choosing from the drop-down menu, the information was typed in and there is inconsistency between the choices and the information added;
5. Frequently there are comments in the same cell along with the value of the cell, which prevents the table from being unambiguous;
6. The maturity scaling is probably outdated and many different scales are being used even for the same species. Thus it is needed to update the list with the most recent publications of maturity scaling, preferable those produced by WKs and WGs;
7. Follow the principles of the Workshop for Advancing Sexual Maturity Staging in Fish (WKASMSF) (ICES, 2018c).

In order to simplify the tables the following conclusions/recommendations were noted:

1. Table should be split in two separate tables, one for maturity and one for age (an age table already exists);
2. Tables should be kept as simple as possible;
3. Decide on which data/information is important to be integrated into SmartDots;
4. Investigate the possibility to integrate this table into SmartDots, so the table should be unambiguous for later transfer to SmartDots.

In a first attempt to simplify the table, the most important information that is likely to be integrated in SmartDots is presented in Table 2.1.

Table 2.1. Suggestion for information to be included in SmartDots

Institute	**FRI-HAOD**
Countries	Greece
Collaboration	
Latin name	*Alepocephalus bairdii*
English name	Baird's slickhead
FAO	21.1.B
Year	2011
Quarter	Q1
Sampling	Research Survey
Gonad	O
Condition	Frozen
Maturity	Y
Scale	WKMSREGH 2011
Conversion to WKMATCH 2012 revised	Y
Histology (Y/N)	N
Method	
Purpose	Maturity Ogive
Comments	

A skype meeting was set-up to address maturity issues that came up during ToR b subgroup discussions. The connection was poor and only two points were discussed:

1. Definition of the maturity stage Ba in the new WKMATCH maturity scale revised seems to cause confusion within some institutes and whether this stage is to be included or excluded in the SSB calculation. Inclusion or exclusion of this stage from the calculation depends on the sampling time in relation to the gonad maturation time and spawning periods. The importance of maturity stagers to be well acquainted with the biology of the stocks they are sampling was stressed. Furthermore, the overlap from stage Bb (developing) to Ca (actively spawning) was clarified and a fish should be staged in Ca when hydrated eggs (even if just a single hydrated egg) is present in the ovary.
2. The format of the CRR handbook was discussed and it was decided that the editors come up with a template to send to contributors in order to streamline contributions at an early stage. The need to identify a Coordinator among the authors of each chapter was stressed. A first deadline to the contributors of each chapter was set for April 2020. The advanced draft of the CRR will be presented at the next WGBIOP 2020. The final draft of the CRR will be submitted by October 2022.

An intersessional subgroup on maturity related issues will work to complete and fully update the "materials, techniques and preparation methods…" table. Once the updated table is agreed upon all national maturity coordinators will be requested to complete the table with their 2018 and 2019 data. The existing data will be transferred into the updated table by the subgroup. The subgroup will also work to have the appropriate information considered for integration into the SmartDots database.

c) Guidelines for Age and Maturity Exchanges and Workshops

A complete review and update of the guidelines for ageing was done during the workshop. (https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx#others). The age reading guidelines were scrutinized thoroughly, simplified and updated with the recommendations that were put forward during past workshops and exchanges.

The main changes are:

- Exchanges/workshops should be held by stock so that an AEM (age error matrix) per stock can be handed over to the stock assessors;
- A list of variables, to be considered when organizing an exchange/workshop was compiled and described in the manual;
- Reports of the exchanges/workshops should be uploaded to the SmartDots webpage
- The text has been simplified.

The maturity guidelines (https://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx#others) were also updated taking in consideration the recommendations accepted during workshops in 2019.

The main changes are:

- The use of SmartDots for maturity staging not only during exchanges but also during the workshops on maturity;
- On the basis of the oral communications presented during the scientific section on the validation methods for maturity at WGBIOP 2019, the list of validation methods to be used during the workshop has been updated (cfr. whole mounts and GSI-HIS);
- It is stressed that during the exchanges the maturity readers must declare their level of expertise (basic or advanced);
- In the protocol for regular sampling for histology at sea, an example of Table 2.2 to be used during the examination of the histological section has been added. It has been considered useful for a comparison among the histological section estimation of the different readers.

Table 2.2. Readers cell examination overview and result to be included in the protocol for regular sampling for histology at sea

	Type of cells - Oogenesis									
	OG	**PG**	**CA**	**Vt1**	**Vt2**	**Vt3**	**HYD**	**POFs**	**AT**	**Result**
Fish1	x	x								A
Fish2						x	x	x		C
Fish3			x	x	x					Bb

2.2.2 Workplan for 2019-2020

- Compile a list of data, based on the data in the table "material, techniques and preparation methods by species and area for fish ageing" which should go into the SmartDots database;
- Compiling a list of data, based on the data in the table "material, techniques and preparation methods by species and area for maturity staging" which should go into the SmartDots database;
- Based on the updated information provided by the national laboratories a full review of the national procedures for ageing and maturity staging quality assurance will be carried out and best practice guidelines compiled on a regional level;
- In cooperation with subgroups working on ToRs a and c, a prioritised list of validation studies by stock will be proposed and workshops organised where feasible.

2.2.3 Deliverables for 2020

- Up-to-date guidelines for organising ageing and maturity staging workshops and exchanges;
- Incorporation of the most important method related information for ageing and maturity staging into the SmartDots database;
- Based on the review of national procedures for ageing and maturity staging quality assurance, regional best practice guidelines will be complied;
- A list of prioritised validation studies by stock.

2.3 ToR c. Evaluate the quality of biological parameters: Issues and guidelines

2.3.1 Progress during WGBIOP 2019

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 2019, ToR c prepared various deliverables:

- Compiled responses to the issue lists of stocks that are proposed for a benchmark assessment in 2021 (Annex 4.a)
- Compiled information on each stock to be benchmarked detailing existing age/maturity exchanges/workshops (Annex 4.a);
- Emailed 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.

The issues put forward by the assessment WGs for the up-coming benchmark stocks were collated and the issues were discussed, with any necessary responses from WGBIOP recorded in a table (Annex 4.a) and reported to the stock coordinators.

The subgroup scrutinized results from previous age and maturity calibration exercises for stocks for which a benchmark is planned in 2021. 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.

In terms of further development of the process of evaluating the quality indicators of the biological parameters, the Quality Indicator Table that covers the entire workflow from the data collection to the stock assessment model runs has been reviewed and revised (Annex 5b). This table consists of a series of clarification questions classified according to the issue each of them deals with, and highlighting the biological parameter(s) it concerns. Seven issues have been considered in total; (e.g. Topic 3 "Methods and Definitions" includes the subtopics "age", "growth", "sex", etc. In sub-topic "age", three indicators -"Structure", "Preparation" and "Birthdate & Scheme"- are included). Six of them (1, 2, 3, 5, 6, and 7) are explained in detail in section 5.2.1 of WGBIOP 2017 (ICES, 2017), while a new one including two indicators regarding the source of reproduction information ("Length/age at maturity" and "Sex ratio")has been added from WKBIOPTIM-3 (ICES, 2019).

1. Sampling design & implementation
2. Stock identity
3. Methods and definitions
4. Data Collection
5. Validation
6. Calibration
7. Stock assessment

Apart from the content, subgroup C revised the structure of the Table in order to make it more straightforward and simpler to use. There is a short clarification/question for each item (indicator) and a grading scheme is proposed for most of them, including Y/N or up to 7 (0 to 6) answer possibilities appearing as a short list, with the aim of facilitating its completion and subsequent analysis (Annex 5.b). This table should be delivered to the chair of each ICES stock assessment working group and distributed among the corresponding stock coordinators. This would support the delivery of a qualitative evaluation of biological parameters coming from the corresponding stock coordinators and may be used in the benchmark planning process. A number of chairs have been contacted and feedback will be considered by WGBIOP.

2.3.2 Workplan for 2019-2020

- Continue the work with the issue lists on an annual basis and consider and feedback from stock assessment EGs;
- Implement and formalize a communication loop with the ICES secretariat, BSG, PGDATA and RCGs to establish and support an efficiently timed and coordinated delivery of age/maturity calibration events for stocks undergoing a benchmark.

2.3.3 Deliverables for 2020

- Annual review of the benchmark issue lists;
- Finalize the quality indicator table.

2.4 ToR d. Data availability, documentation and methods to improve identified biological parameter estimates, as input to assessments

2.4.1 Progress during WGBIOP 2019

a) Age

Data use: Results from 14 age calibration exchanges and ageing workshops were presented for: Atlantic Mackerel, Lemon sole, Megrim, Anchovy, Horse Mackerel, Jack Mackerel, Plaice, Turbot, Brill, Eel, and Whiting from various areas. All exchanges except one were carried out in SmartDots. While the statistics calculated from these exchanges (Percentage Agreement and Coefficient of Variation) are highly informative in terms of assessing the quality of the age estimates used in stock assessment, they also allow the calculation of an Age Error Matrix (AEM) (ICES 2014). One of the key outputs from SmartDots is a standardized AEM. While historic calibrations and exchanges did not provide AEM's directly, they can easily be calculated from each exchange, and may thus provide the basis for creating a time series of ageing precision, given several exchanges have taken place.

However, despite the fact that AEM's are available for many stocks directly from SmartDots, or with a little effort from historic exchanges, this information has to WGBIOPs knowledge only been implemented in one stock: Eastern Baltic cod (Stock assessment model: Stock Synthesis 3; Benchmark 2019, ICES 2019) and one sensitivity analysis (WKMACQI, 2018, ICES 2018b). Consequently, a wealth of information on ageing precision is being created within WGBIOP, which is not being put to any use in stock assessments. The main hindrance to accomplish this is that there currently are no procedures in place to use or implement the AEM in stock assessments (ICES 2014).

Requirements for implementation of AEM: There are three major requirements for a successful implementation of AEM's in stock assessments:

1. Age-based stock assessment model;
2. Stock assessment model that can implement AEM's;
3. AEM's that are derived exclusively from the readings of age readers contributing data to the stock assessment.

Implementation potential: It is currently unclear which Stock assessment models are capable of accommodating AEM. One of the most frequently used models is SAM, that, to the group's best knowledge, has the flexibility to implement AEM's – but which is not yet done. A model, which can accommodate AEM's already, is Stock Synthesis, the use of which is currently expanding. A WGBIOP priority for 2019-2020 should therefore be to gather information on:

i. Which Stock assessment models are being used;
ii. Which models are capable of accommodating AEM;
iii. Promote the development of the tools necessary to do so in practice.

Communication: The major hindrance for implementing AEM's in stock assessment is a two-directional communication process. Age readers are often don't know how their age readings are used in stock assessment, and coordinators of exchanges and workshops are not necessarily aware how exchanges may improve assessment. Moreover, the effort invested into otolith exchanges of a stock is used most efficiently when the results are considered in the stock assessment. Hence, prioritisation of exchanges may be done by stocks that consider AEM's. Stocks without age-based assessments and stocks where the assessor has a strong reason for not including AEM's could get a lower priority. It is therefore essential and of urgent need to improve the

communication between the age reading community and the respective stock assessors and developers of stock assessment models.

A two-stage process is proposed:

- *Stock assessors*: To provide a stock "age information sheet" with information on *i*) Who the stock assessor is, *ii*) what age-information is used in the stock assessment? *iii*) What +group is being used/has been used, *iv*) Where the working group sees the main problems related to age data? *v*) Which areas are most important to cover with exchanges? *vi*) What format the AEM should have to be included in the stock assessment? (This approach of providing an information sheet is further developed in the section below for maturity.);
- *Exchange coordinator/WGBIOP*: Stock assessors may not be aware of the existence of AEM data. This information can only be provided by participants of the respective exchanges and workshops. It is therefore desirable for exchange coordinators or WGBIOP members with sufficient insight in the respective stock to participate in the Stock assessment Working Groups and give a formal presentation of the exchange results, highlighting the main problems emerging from them.

Responsibility for communication: The responsibility for this communication needs to be formally assigned to the stock coordinator/assessor and the coordinator of the corresponding age reading exchange.

Overview over stock assessment models in use: An overview of Stock assessment models in use was extracted from the ICES Stock Information Database. This compilation (Table 2.3) shows that there is considerable potential for implementing AEM's in stock assessments. For the model Stock Synthesis (SS3), implementation of AEM is already feasible to date (seven stocks), while SAM may be adapted to do so, but this is presumably not done yet (27 stocks). For these 34 stocks, exchanges should have a higher priority. A further 54 stocks are being assessed using Age-based models with unknown options for AEM implementation. Here, even if AEM's are not directly implemented in model fitting they could help to generate inputs for sensitivity analysis. Trend-based assessments (61 stocks) cannot accommodate an AEM, since they do not make direct use of age data; for these latter 61 stocks, exchanges should have a lower priority.

Table 2.3. List of stocks using Assessment models that could accommodate AEM now/in the near future

Model type	Model	AEM implementation status	Nr Assessments
Age-based	Stock Synthesis (SS3)	Implemented	7
	SAM	Implementation possible	27
	Age-based model	Unknown	24
	SMS	Unknown	4
	XSA	Unknown	17
	ASAP	Unknown	3
	Gadget	Unknown	6
Trend-based	SPiCT	not possible	2
	surplus production	not possible	3
	Trends	not possible	56
Other	Analytical model	Unknown	5
	CBBM	Unknown	1

The stocks currently assessed using the **SS3** model are; bss.27.4bc7ad-h, bss.27.8ab, hke.27.3a46-8abd, hom.27.2a4a5b6a7a-ce-k8, mon.27.8c9a, pil.27.8c9a and pra.27.3a4a. Those assessed using the **SAM** model are; cod.21.1, cod.27.1-2, cod.27.21, cod.27.22-24, cod.27.47d20, cod.27.5b1, had.27.1-2, had.27.5b, her.27.1-24a514a, her.27.20-24, her.27.30, her.27.3031, her.27.3a47d, her.27.6a7bc, her.27.nirs, mac.27.nea, nop.27.3a4, ple.27.21-23, ple.27.24-32, pok.27.1-2, pok.27.3a46, pok.27.5b, sol.27.20-24, tur.27.4 whb.27.1-91214, whg.27.47d and wit.27.3a47d.

Validation of age readings: The between-reader Agreement of many exchanges presented was considerably below the 80% recommended as lowest acceptable limit for safe use of age data in stock assessment (Campana, 2001; ICES, 2013). Given the observed age reading agreement, the need for age validation studies was repeatedly highlighted. Uncertainties generally arise from the correct identification of the first annulus, the structure type of the edge and the occurrence of multiple sub-annual growth bands that are confused with true annuli. At WGBIOP the results of validation studies based on different methods (chemical tagging, length frequency analysis coupled with back-calculation methods, chemical profiling) were presented. Several approaches are cost-efficient and could presumably be adopted for the validation of ageing of many stocks. These actions should take into account the biological characteristic of the species and the availability of data. Indeed different age validation methods can be applied depending of the life span, survival to capture, cost of the analysis etc. In October 2019, a meeting on the suitability/applicability of age validation methods for small pelagic species was held (ICES Workshop on Age Validation Studies of Small Pelagic Species, WKVALPEL). The results from this meeting will be used in the next WGBIOP meeting (2020) in the prioritisation of stocks/species which require age validation.

a) Maturity

Incorporating stock assessment maturity information into maturity exchanges and workshops

In stock assessment models, maturity ogives enter into the calculations to obtain the spawning-stock biomass (SSB) through the proportion of mature individuals at length or age.

Maturity ogives are estimated based on data collected during scientific surveys and/or on board commercial vessels. The maturity data are a direct output of maturity staging, which is undertaken by visual observation of the individual's gonads, according to macroscopic maturity scales that have been developed and applied for specific species/stocks/institutes. Some maturity scales have been validated by histology, others not (cf. Annex 3 in WGBIOP 2018 and, e.g. the presentation at this meeting of Carbonara and Follesa "Methods of ELASMOBRANCHES maturity data collection: maturity stages estimation and their histological validation").

A correct assignment of maturity phases, and thus an unbiased individual classification as immature or mature, is of critical importance to investigate maturity within the context of fisheries stock assessment. For the purposes of maturity ogive accurate estimation, a given number of recommendations exist in terms of sampling requirements in order to reduce the risk of maturity phase misclassification, as for instance the sampling timing in relation to the species spawning time, the spatial coverage of sampling in regard to the stock distribution, the length range of the fish sampled, the freshness of the fish samples, the origin of the samples (surveys vs. market), the knowledge on the species reproductive strategy and biology, the routine training of the observers (for review, see WKMOG 2008, ICES, 2008a).

Alternative methods to the simple visual observation of the gonads are also suggested for maturity staging, e.g. the work presented at this meeting by Carine Sauger ("Quantitative Histology for maturity staging of the plaice (*Pleuronectes platessa*)") describing quantitative histology based on stereological methods to objectively determine sexual maturity phase.

Macroscopic maturity scales should be consistent, objective and universal. Nevertheless, maturity staging has an obvious degree of subjectivity, and thus, as with age determination, is subject to precision and bias issues, with subsequent implications for maturity ogive estimation. The common procedure, up to now, has not been to quantify maturity staging uncertainty (as is done for age estimation) by a maturity staging error matrix (MSEM), as considered, e.g. in WKMACQI 2018 (ICES, 2018b). These error matrices give the probabilities that a sampled fish of "true maturity" phase m is assigned to one of the observed maturity phases. Compared to age, "true maturity" can be more easily validated by means of histological examination of the gonad, but it is nevertheless time and money consuming, and therefore not carried out very often during regular maturity assessment (WKMACQI 2018, ICES, 2018b). This error matrix can be applied as a conversion factor to correct the macroscopic maturity ogive. The differences in the proportion of mature individuals per age/length class between the macroscopic observations and the histological analysis can be used to calculate a relative bias per age/length and a corrected maturity ogive for each age/length class can be obtained applying this relative bias for each age/length (Dominguez *et al.*, 2017).

Calibration exchanges and workshops with people involved in the acquisition of these data regularly take place, and during these exchanges and workshops the issues related to sampling problems and to uncertainty in maturity staging are comprehensively discussed and potential solutions presented (see, e.g. WGBIOP 2018 for the list of events in 2017-2018 and the main issues discussed). However, these issues rarely are reported to stock assessors or to the assessment EGs, impairing the understanding by those involved in stock assessment of the uncertainties in biological data. On the other hand, people involved in data collection, and in particular those participating in calibration exchanges and workshops, seldom are aware of which and how data are used in assessment models, in which format data ought to be provided for assessment, and how

uncertainty in the biological data can affect the assessment model outcomes. This close collaboration between the two parts and the bidirectional flow of information is undoubtedly mutually beneficial and should be encouraged.

Consequently, when organizing a maturity calibration exchange and/or workshop for a given species/stock, it is be recommended that a certain number of key pieces of information from the stock assessment process be provided to the coordinators, to disseminate to the participants, namely:

1. The contact of the stock assessor/coordinator, in order to get feedback of specific issues that have been raised during previous assessments related to maturity data;
2. The maturity ogive currently used in the assessment, among the three types of maturity ogives commonly used: a) knife-edge: it assumes that all fish mature at the same length/age, i.e. the proportion of mature specimens at age (or length) changes abruptly from zero to one (indicate at which age); b) fixed: time-invariant maturity ogive, which does not change over time, so, the same proportion of mature individuals at age (or length) is applied every year (indicate reference; c) variable: time-variable maturity ogive, as previous studies have indicated that for a given species/stock the onset of fish maturation varies depending on the cohort, conditioned by exogenous, biological and/or anthropogenic factors (the reference of the maturity ogive currently in use, and last update, is recommended to be provided, cf. Annex 7 in WGBIOP 2018, ICES, 2018a);
3. The maturity data source: originating from sampling (survey or market samples) or based on literature information, if individuals are sampled fresh or frozen, the spatial coverage of the samples in relation to the stock distribution, the timing of the year data are collected for the purpose (monthly, quarterly, annually, within or not the main spawning season), the periodicity at which the maturity ogive is estimated (monthly, quarterly, annually, triennially);
4. Which assessment model is used, and if it requires a maturity ogive per length or per age. In case maturity ogives at age are used, it is important to collaborate with those involved in age reading in order to be aware of issues related to age data quality.
5. If the model uses a sex-combined or a sex-separated maturity ogive, a key issue for species with length/age dependent sex ratios, and/or growth/maturation patterns distinct between males and females;
6. Which maturity phases are considered for assessment purposes to discriminate immature from mature fish, and more specifically to identify which individuals from the population will take part in the spawning in the current year (depending on the species/stock reproductive strategy and its reproductive dynamics, information that should be also provided) (cf. WKASMSF 2018, ICES, 2018c for detailed WKMATCH 2012 ICES, 2012a maturity scale revised, and the recommendations for its use in maturity ogive estimation). For instance, fish that are not virgin but skip spawning (stage E of the WKMATCH 2012, ICES 2012a maturity scale revised) are classified as immature as they will not take part in spawning; fish with developing gonads but with a reproductive cycle longer than a year, and in their first year of development, will also not take part in the spawning in the current year (stage Ba of the WKMATCH 2012, ICES, 2012a maturity scale revised).
7. Is the maturity ogive estimated macroscopically or microscopically (maturity phases validated histologically)?
8. How is the maturity ogive modelled and how is uncertainty estimated (see methods in WKMOG, 2008, ICES, 2008a). Two methods are mainly used: Generalized linear models (GLM), with binomial errors (logistic function), and Age-Length-Sex-Maturity Key (ALSMK), the former typically resulting in an estimate of maturity-at-length, the latter producing an estimate of maturity-at-age. One of the additional possible outputs of the GLM is also the estimation of a L_{50}, i.e. the length at which 50% of the individuals are

mature. The precision estimate is commonly obtained either directly from the model, or by bootstrap (resampling of fish individuals or of sampling stations) (WKMOG, 2008, ICES, 2008a);

9. Does/can the stock assessment model use the maturity ogive uncertainty and/or maturity staging error-matrices?

Example:

SPECIES MATURITY Information sheet	
Species Common Name	Sardine
Species Scientific Name	*Sardina pilchardus*
Stock Key Description	Sardine (*Sardina pilchardus*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)
Ecoregion(s)	Bay of Biscay and the Iberian Coast Ecoregion
Stock Key Label	pil.27.8c9a
Assessment Expert Group	ICES WGHANSA - Working Group on Southern Horse Mackerel, Anchovy, and Sardine
Stock coordinator (2019)	Isabel Riveiro (IEO, Spain)
Stock assessor (2019)	
Assessment model:	
Length-, age- based	Age- and length-structured model (SS3)
Sampling for maturity:	
Origin samples	Surveys (DEPM), fresh samples
Sampling period	Close to peak spawning
Periodicity	Triennial
Maturity ogive currently in use (reference, last update)	Time-variable (ICES 2017; 2017)
Maturity ogive by sex	Sex-combined
Reproductive strategy/dynamics	Indeterminate batch spawner Annual cycle, autumn-winter spawner
Immature/mature classification (WKMATCH 2012 maturity scale revised)	Immature: A, Mature: B, C and D
Maturity ogive macro- or microscopic	Microscopic (since 2012)
Maturity ogive estimation method:	Model of proportion of mature fish per length class (GLM with logit function); then raised to age with ALK, weighed by stock abundance at age

SPECIES MATURITY Information sheet	
Maturity uncertainty estimation:	
Maturity staging	No
Maturity ogive	Yes (CV)
Maturity uncertainty currently incorporated in the model? If yes, which? If not, possible?	No ??

This information should be taken from existing databases and we propose that WGBIOP work with ICES to develop a suitable method to automatically generate the maturity information sheet.

c) Stomach Sampling

Currently, there are limited national collection programmes for stomach data across ICES, and no common EU stomach sampling ongoing (WKBECOSS, 2019). However, there is new work developing related to fish stomach sampling plans and stomach contents analysis. This includes the Regional Coordination Groups forming an intersessional study group on stomach sampling (RCG ISSG), the Fish Pi2_WP4 and the ICES Stomach Database_. WGBIOP provides an important forum to link current work on stomach sampling and modelling within the ICES and GFCM communities.

Work to develop a stomach sampling action plan has a clear deadline as end users and data providers need to have a plan that is fit for modelling data needs, in place by mid2021 to feed into the next DCF programme for 2022-2027.

WGBIOP 2018 (ICES, 2018a) developed and proposed the Workshop on Better Coordinated Stomach Sampling (WKBECOSS) that met on 3–6 September 2019. WGBIOP 2019 studied an advanced draft of the WKBECOSS report; it included a recommendation for "*the sampling protocol for predator stomachs proposed by the FishPi2 project to be considered by WGBIOP*". We support the evaluation and adoption of this protocol through the RCG ISSG on Stomach Sampling and a new workshop (WKOISS). WGBIOP recommends this Workshop on Operational Implementation of Stomach Sampling (WKOISS) to follow up the work of WKBECOSS and ensure continued knowledge sharing and coordination between different institutes and regions. To coordinate with work in the Mediterranean region, WKOISS' content and timing will take into the account the work of the STREAM project (STrengthening REgional cooperation in the Area of fisheries biological data collection in the Mediterranean and Black Sea, MARE/2016/22) and the proposed GFCM workshop on stomach contents analysis (WKSTCON2) in early 2020.

d) Links with Data Users – WGIPEM

A joint web session was held between WGBIOP members and the Working Group on Integrated, Physical-biological and Eco-system Models (WGIPEM) during the WGIPEM 2019 meeting. Following this session, WGIPEM provided a summary of data used and information that is missing for integrated, physical-biological and ecosystem models. [Contact: Marie Maar (mam@bios.au.dk)]

The summary is provided below and was made available for discussion at WGBIOP. It was not expected that WGBIOP replies or acts on all the questions, some of them are also for WGIPEM to use. The aim is to provide an idea of the data needs for the modelling work and discuss how we can exchange data, develop ideas and get new variables included in the monitoring.

The initial response from WGBIOP is that the need for information on spawning behaviour is strongly related to WGBIOP's current work and expertise. We should focus on how current knowledge can be made available and accessible, for example through the planned ICES Comprehensive Research Report – the "Handbook on maturity staging of fish species in the ICES area". Highlighting the importance of non-commercial but highly abundant fish species to the models is also a useful point, as abundance can be taken into account as an additional factor when deciding priorities for maturity staging and validation work.

The needs for biological parameters for fish early-life stages and the vertical distribution, diel migration and swimming speed of zooplankton and fishes are related to data from egg and larval surveys and pelagic acoustic surveys. WGBIOP does not manage survey data, so this information is more likely to be within the remit of ICES WG's coordinating these surveys (WGMEGS, WGACEGG, WGALES). Overall, the points raised by WGIPEM can help to guide future planning of WGBIOP.

WGIPEM data questions

1. What type of biological parameters do you use in your models?

- **Low trophic models:** growth rates, mortality rates, grazing, nutrient uptake rates, particle remineralisation, sinking, sediment exchange rates;
- **Fish early-life stage models:** growth and mortality rates, movement, duration of the egg and pelagic larval stages, prey preference;
- **High trophic level models and E2E:** growth and mortality rates, food consumption, length, weight, gape size, swimming speed, temperature tolerance, reproductive strategy, environmental cues for seasonal migration.

2. Where do you find this information?

- Literature reviews;
- Field data (own data or databases, like ICES, FAO, Copernicus, satellite data);
- Laboratory experiments;
- Other models (e.g. ECOSIM).

3. What type of biological parameters you miss information of in your models?

- Life-history parameters for non-commercial but highly abundant fish species;
- Biological parameters for fish early-life stages (e.g. growth, mortality, feeding rates, settlement, diel migration, swimming speed);
- Feeding related parameters: consumption rates, diet preferences (size preference, nutrition), food assimilation rates;
- Spawning behaviour (seasonality, inter-annual changes, homing effects, spawning season duration);
- Vertical distribution, diel migration and swimming speed of zooplankton and fishes;
- Information on the uncertainty of measured parameters is required for model sensitivity analyses and estimates of the model uncertainty.

4. Potential changes in biological processes?

Potentially, yes, particularly due to external stressors (pollutants, extreme temperatures, etc.). Changes due to the organism adaptation to various stressors are of interest as well.

5. How can we improve knowledge transfer?

- Data archives;
- Joint seminars and workshops;
- Meetings in the annual science conference.

6. Questions?

- There is a mismatch between parameters measured in field and utilized in the ecosystem models. Where can we find conversion factors between wet and dry biomass of marine organism, carbon content of phyto- and zooplankton organisms, etc.?
- What data are available to parameterize mortality rates at various trophic levels? How can we improve existing mortality parameterizations (both due to predation and starvation)?

e) Links with Data Users – WKLIFE

Data-limited stocks mostly lack stock assessments on which to condition operating models (the simulated stocks in a simulation framework), therefore, stocks are usually simulated based on a limited set of life-history parameters. [Information from Simon Fischer (simon.fischer@cefas.co.uk)]

The minimum data requirement to create age-structured operating models as used during WKLIFE VI-IX are:

- von Bertalanffy growth parameters: k, L_{inf}, t_0
- length-weight conversion parameters: a, b
- maturity data: length or age at 50% maturity L_{50} / a_{50}

Such values should ideally represent particular stock units and not be based on averages for species. A list of 29 stocks as used in WKLIFE is available at https://github.com/shfischer/wklife-VII/blob/a640418bbbb6dadf18ce7dcd721fc0b741dc7ef2/R/input/stock_list_full2.csv

The columns for maturity data are of most immediate and direct relevance to WGBIOP, this information is shown in the Table 2.4 below.

Further useful data to have, but can be approximated with life-history assumptions are:

- maximum age a_{max}
  - to be used as plus-group in an operating model, i.e. age above which no substantial individual growth occurs
  - in WKLIFE work usually approximated as the age at which the size in the von Bertalanffy growth curve reaches 95% of L_{inf} or age at which less than 5% survive in an equilibrium unfished stock
- length at first capture
  - usually defined as length at which abundance in catch length frequencies at or above 50% of mode (length class with maximum catch)
- natural mortality M
  - M values at age or functional relationship between age and M
  - In reality almost impossible to obtain for data-limited stocks because no data or stock assessment is available
- recruitment
  - functional relationship between SSB and recruits and model parameters or defined in terms of steepness h
  - important for the set-up of operating models but usually entirely unknown for data-limited stocks due to the lack of stock assessments / time series

Table 2.4. Maturity parameters used in WKLIFE simulations

Name	Common	Area	Stock	Sex	L_{50}	A_{50}	source.L_{50}	source.A_{50}
Clupea harengus	Herring	Celtic Seas	her-nis	F	23	NA	Thorpe *et al.,* 2015	
Pollachius pollachius	Pollack	North Sea	pol-nsea	C	47.1	NA	Alonso-Fernandez *et al.,* 2013	
Molva molva	Ling	Widely	lin-comb	C	74	7.2	Magnussen, 2007	
Sebastes norvegicus	Rose fish	Northern	smn-con	C	40.3	NA	Ni and Templeman, 1985	
Mullus surmuletus	Red mullet	Celtic Seas	mut-comb	F	16.9	NA	Mahe *et al*., 2013	
Scopthalmus maximus	Turbot	North Sea	tur-nsea	F	34.2	2.2	Van der Hammen *et al*., 2013	Van der Hammen *et al.,* 2013
Microstomus kitt	Lemon sole	North Sea	lem-nsea	C	27	NA	Thorpe *et al.,* 2015	
Lepidorhombus whiffiagonis	Megrim	North Sea	meg-4a6a	C	23	3	Jennings *et al.,* 1999	Jennings *et al*., 1999
Ammodytes spp.	Sandeels	North Sea	san-ns4	C	12	NA	Thorpe *et al.,* 2015	
Pleuronectes platessa	Plaice	Celtic Seas	ple-celt	F	22.9	NA	van Walraven *et al*., 2010	
Merlangius merlangus	Whiting	Celtic Seas	whg-7e-k	F	28	NA	Hehir, 2003	
Melanogrammus aeglefinus	Haddock	Celtic Seas	had-iris	C	NA	2		WGNSDS2007, 7a
Lophius piscatorius	White anglerfish	Celtic Seas	ang-78ab	C	73	NA	Alfonso-Diaz and Hislop, 2006	
Lophius piscatorius	White anglerfish	North Sea	ang-ivvi	C	61	NA	Thorpe *et al.,* 2015	

Name	Common	Area	Stock	Sex	L_{50}	A_{50}	source.L_{50}	source.A_{50}
Nephrops	Shellfish	Biscay-Iberia	nep-2829	M	28.4	NA	WKLIFE_V_2015	
Scyliorhinus canicula	Lesserspotted dogfish	Celtic Seas	syc27.67	F	57	7.9	Ivory *et al.*, 2005	Ivory *et al.*, 2005
Scyliorhinus canicula	Lesserspotted dogfish	Biscay-Iberia	syc27.8c	F	59.1	NA	Rodriguez-Cabello, 1998	
Mustelus asterias	Starry smoothhound	Widely	sdv.27.nea	F	81.9	NA	McCully-Phillips, 2015	
Raja clavata	Thornback ray	Celtic Seas	rjc.27.afg	F	71.8	6.13	Gallagher *et al.*, 2005	Gallagher *et al.*, 2005
Raja clavata	Thornback ray	North Sea	rjc.27.347d	F	77.1	NA	Walker, 1999	
Sardina pilchardus	Pilchard	Celtic Seas	sardina_pilchardus	C	14.3	NA	Silva *et al.*, 2013a	
Zeus faber	John Dory	Celtic Seas	zeus_faber	F	34.5	NA	Dunn, 2001	
Chelidonichtys lucerna	Tub gurnard	Celtic Seas	chelidonichtys_lucerna	F	40.1	NA	Baron, 1985b	
Spondyliosoma cantharus	Black seabream	Celtic Seas	spondyliosoma_cantharus	F	22	NA	Soletchnik, 1982	
Anarchias lupus	Wolffish	North Sea	anarchias_lupus	F	21.5	3.8	Gunnarsson *et al.,* 2006	Gunnarsson *et al.*, 2006
Scophthalmus rhombus	Brill	North Sea	scophthalmus_rhombus	F	31.3	1.6	Van der Hammen *et al.*, 2013	Van der Hammen *et al.,* 2013
Argentina silus	Greater argentine	Widely	arg-comb-ex5.	C	38	8.2	Magnussen, 2007	Magnussen, 2007
Engraulis encrasicolus	Anchovy	Biscay-Iberia	ane-pore	C	16.8	NA	Silva *et al.,* 2006	
Lophius budegassa	Black anglerfish	Celtic Seas	ang-78ab_2	F	54.8	9	Duarte *et al.,* 1998	Duarte *et al.,* 1998

The WKLIFE maturity reference list was circulated to WGBIOP members for comment and review. Results from the maturity table and reference review will be combined and assessed intersessionally.

f) Provide an overview of regional data on condition factor for selected stocks

- Fish condition can be calculated from comprehensive single fish data available at the RDB and DATRAS

In contemporary stock assessments, changes in condition factor are usually accounted for by the weight-at-age data so that fish condition as an additional factor is not required. However, there are examples for cod (*Gadus morhua*) addressing direct links between low condition and increased natural mortality (Dutil and Lambert, 2000; Casini *et al.,* 2016). Hence, for certain species and/or stocks additional biological data such as condition can be very useful to improve fish stock assessments and as indicators of stock health (ICES 2016, WGFICON).

We assessed whether the required weight and length data would be available in ICES databases.

Presently, "condition factor" is not a parameter that is estimated on a routine basis for the data uploads to the Regional Data Base (RDB) or to DATRAS (trawl survey database) at ICES. This may be mainly because there are no fish stock assessments that by default require data on fish condition.

However, in case these data would be needed, both the RDB and DATRAS provide single fish data on weight and length that could be used to calculate individual fish condition. Alternatively, data calls could request condition factors to be additionally calculated. In the RDB single fish data are uploaded as part of the CA table.

DATRAS only provides single fish data from the internationally coordinated trawl surveys conducted during certain times of the year, following standardised processing schemes. For instance, for each stratum (e.g. a depth zone in an ICES subdivision), only 10 fish per 1 cm length class are sampled. Thus, overall sample sizes from the survey are much lower than the samples collected from the commercial fisheries that are available in the RDB. Moreover, one should note that nationally a much greater number of individual fish are usually processed each year as part of other, non-DCF-related research activities.

An overview of the data available at the RDB, hosted by ICES (https://www.rdb-fish-frame.org/default.aspx), was produced for selected fish stocks of the Baltic Sea region from the year 2018. Table 4.1.1.3 shows that for all selected stocks, thousands of individual measurements are available. The data usually cover the major fishing seasons and commercial fishing grounds and may, hence, be well suited to reflect spatio-temporal dynamics in condition factor changes.

For the two Baltic cod stocks, only data from the RDB category Lan_Sea_N_Weighted and Dis_Sea_N_Weighted are relevant because they comprise ungutted individuals needed to estimate condition. In Denmark the landings are usually only sampled in ports (gutted specimens) (Table 2.5), so that there is a data gap in ungutted weights from Danish landings.

For the two selected stocks of sprat and herring, some countries assign their measurements to the category Lan_Sea_N_Weighted or to Lan_Mkt_N_Weighted, depending on whether the samples originate from sea samples or are taken at the landing sites. Hence, data from both categories can be used.

In Baltic plaice and the major Baltic flounder stock, fishes are usually landed ungutted. Hence, all categories can be used. Apparently, from this data extraction, in Sweden no plaice and flounder were measured in 2018.

Table 2.5. Number of measured individual fish by selected fish stocks from the Baltic Sea region in the year 2018. Lan: Landings, Dis: Discards, Sea: sampled at sea. Mkt: sampled in the market. It is assumed that all individual weighed fish have a length measurement, too. Bold numbers: Sum of measured fish

cod2224	**Lan_Sea_N_Weighted**	**Dis_Sea_N_Weighted**	**Lan_Mkt_N_Weighted**	**Dis_Mkt_N_Weighted**
Denmark	1	356	1115	
Germany	2421	600		
Poland	72	9	54	
Sweden	1602	145	2250	
total sum	4096	1110	3419	

cod2532	**Lan_Sea_N_Weighted**	**Dis_Sea_N_Weighted**	**Lan_Mkt_N_Weighted**	**Dis_Mkt_N_Weighted**
Denmark		320	1381	
Germany	545	440		
Latvia	1774	874		
Lithuania	453		329	
Poland	652	267	111	6
Sweden	2399	434	4239	
total sum	5823	2335	6060	6

spr2232	**Lan_Sea_N_Weighted**	**Dis_Sea_N_Weighted**	**Lan_Mkt_N_Weighted**	**Dis_Mkt_N_Weighted**
Denmark	511		6469	
Estonia			6759	
Finland				
Germany	701			
Latvia	2784			
Poland	2040		232	
Sweden			3864	
total sum	6036		17 324	

her2529,32	Lan_Sea_N_Weighted	Dis_Sea_N_Weighted	Lan_Mkt_N_Weighted	Dis_Mkt_N_Weighted
Denmark	62		1574	
Estonia			9150	
Finland	47		1056	
Germany	2091			
Latvia	969			
Lithuania			1202	
Poland	1050		356	
Sweden			6458	
total sum	4219		19 796	

ple2232	Lan_Sea_N_Weighted	Dis_Sea_N_Weighted	Lan_Mkt_N_Weighted	Dis_Mkt_N_Weighted
Denmark		671	784	
Germany	2265	946		
Latvia				
Lithuania				
Poland			9	
Sweden				
total sum	2265	1617	793	

fle2425	Lan_Sea_N_Weighted	Dis_Sea_N_Weighted	Lan_Mkt_N_Weighted	Dis_Mkt_N_Weighted
Denmark	93	515		
Germany	1542	8		
Latvia				
Poland	143	69	92	
Sweden				
total sum	1778	592	92	

2.4.2 Workplan for 2019-2020

Optimization of age Exchange results: Formation of an inter-sessional subgroup with the task to review and summarize results from the various calibration Exchanges in order to get an overview of the need for further exchanges and prioritize potential age validation studies.

Implementation of AEM: A WGBIOP priority for 2019-2020 should be to work towards making AEM's from the Exchanges available – and used – in stock assessments. This requires a suite of initiatives: *i*) Summarize information on what Stock assessment models are being used by stock, *ii*) Discuss with the developers/users of the different models in use to what extent their models are capable of accommodating AEM, *iii*) Promote the development of the tools necessary to do so in practice, *iv*) Communication between Exchange coordinators and stock assessors of a given stock regarding optimization of the exchange setup and the subsequent use of the results.

Validation of age readings: In order to facilitate progress in the implementation of age validation studies, a checklist summarizing available approaches, data requirements, targeted structures and analytical methodologies would facilitate the prioritization of such studies. The ICES "*Handbook of fish age estimation protocols and validation methods*" (Vitale *et al*., 2019) and Campana (2001) contain highly useful overviews of available approaches, but are to some extent lacking information that would allow evaluation of which approaches could be suitable for a given stock where age reading problems have been detected. The outcomes of the ICES Workshop on Age Validation Studies of Small Pelagic Species (WKVALPEL) will be reviewed by WGBIOP intersessionally. In order to facilitate the initiation of more age validation studies in the future, WGBIOP 2020 should summarize available information into a comprehensive checklist, provide a prioritised regional list of species/stocks that require age validation, suggest methodological approaches to do so, and identify national labs that could lead the implementation of these age validation studies.

Incorporating stock assessment information into exchanges and workshops: To increase awareness of the stock assessment process and data requirements, review and update the proposed age and maturity information sheets for exchanges and workshops with coordinators and participants. Compare this information to existing exchange and workshop guidance and update the protocols if required. Work with ICES to automate the generation of the information sheets as far as possible.

Stomach sampling: WGBIOP should contact WGSAM chairs to ensure they are aware of the planned workshops relating to stomach sampling, these workshop's ToRs and their need for defined sampling levels. WGBIOP will review the work of WKOISS (Annex 3.b) and WKSTCON2 and link to the RCG Intersessional study group on Stomach Sampling. WGBIOP should observe further progress in developing a sampling action plan and initiate and co-ordinate further action as required.

Links with Data Users: WGBIOP should look at how current knowledge on spawning behaviour can be made available and accessible and continue discussions on the format and level of detail required for WGIPEM models. We will also review the maturity L50 and A50 values and references for the 29 stocks that WKLIFE uses in simulations, along with information from recent age and maturity workshops about these stocks and feed this information back to WKLIFE. More broadly, the information from end users can help to inform future work planning.

Provide an overview of regional data on condition factor for selected stocks: The example in this report demonstrates the information available for scientists studying condition factor. So meets the planned objective and no further action is proposed for 2019-2020.

2.4.3 Deliverables for 2020

Optimization of Exchange results: Formation of an intersessional subgroup with the task to review and summarize results from the various calibration exchanges

Implementation of AEM: Feedback from stock assessment model developers/users on the feasibility and interest in implementing AEM in their models

Validation of age readings: Checklist of validation approaches available, including data requirements and analytical methods. Development of a prioritized list of future age validation studies (with the ToR b subgroup).

Incorporating stock assessment information into exchanges and workshops: Example age and maturity information sheets for upcoming exchanges or workshops, along with a description or implementation to show how much of these can be generated automatically.

Stomach sampling: An overview of current work. Continued collaboration on the development of a deliverable sampling action plan that meets end users' requirements.

Links with Data Users: WGBIOP should look at how current knowledge on spawning behaviour can be made available and accessible and investigate the format and level of detail required for WGIPEM models. Provide a working document on the maturity values and references that WKLIFE uses in simulations, along with information on ageing or staging agreement if there have been age and maturity workshops for these stocks.

2.5 ToR e. Address requests related to biological parameters and indicators

2.5.1 Progress during WGBIOP 2019

During the WGBIOP meeting the subgroup working on ToR e, has focused on the:

i. Revision of each technical and statistical recommendation addressed to WGBIOP 2019. Some of these recommendations have been communicated to the subgroup on ToR a and considered on the list of age and maturity exchanges and workshops for 2020;
ii. Updated the summary table of biological input data used in stock assessment (e.g. length age, age plus group, maturity ogive) produced by WGBIOP 2018;
iii. WKMSYCat34 template and evaluate the possibility of producing a template table to be included on species stock advice sheet to easily identify the stocks from Category 3 and 4 that have all the requirements to be assessed as Category 1.

For (ii) the subgroup decided that instead of having an update table only available through the WGBIOP report, since some stock information is already available at the ICES Stock Information Database, all information should be available there. In spite of this, the subgroup proposed to add extra rows to the Stock Details table available http://sid.ices.dk/services/. The proposed table (Table 2.6) includes the summary of the input data used in each species stock assessment (e.g. age, age plus group, maturity ogive) and also the periodicity of age and maturity data collection for assessment. This data is useful for the planning of future age and maturity calibration exercises and workshops.

Table 2.6. Table with new rows to be included in the Stock Information Database (Stock Details Table).

	Example	Comment
Active Year	2019	
Stock Key Label	agn.27.nea	
Stock Key Description	Angel shark (Squatina squatina) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)	
Data Category	6.3	
Species Common Name	Angel shark	
Species Scientific Name	Squatina squatina	
Ecoregion(s)	Arctic Ocean Ecoregion, Azores Ecoregion, Bay of Biscay and the Iberian Coast Ecoregion, Barents Sea Ecoregion, Celtic Seas Ecoregion, Faroes Ecoregion, Greenland Sea Ecoregion, Iceland Sea Ecoregion, Greater North Sea Ecoregion, Norwegian Sea Ecoregion, Oceanic Northeast Atlantic Ecoregion	
Expert Group	WGEF - Working Group on Elasmobranch Fishes	
Meeting Dates (start -> end)	18/06/19 - > 27/06/19	
Advice Drafting Group	ADGEF - Elasmobranch Stocks Advice Drafting Group	
Professional Officer	Iñigo Martinez	
Professional Secretary	Jette Fredslund	
Year of Last Assessment	2015	
Year of Next Assessment	2019	
Assessment Frequency	4	
Assessment Type	no assessment	
Length based		New row
Age data available		New row
Age based		New row
Age plus group		New row
Age stratification (ALKs by month, quarter, semester or annually)		New row
Age-error matrix is considered in the assessment model		New row
Maturity Ogive (MO)		New row
MO period (e.g. fixed, annually updated…)		New row
MO reference		New row
Advice Type	No directed fisheries	
Use of Discards In Advice	not used	
Fisheries Guild	Elasmobranch	
Size Guild	Large sharks	
Trophic Guild	demersal piscivore	

In (iii) the subgroup evaluated the possibility of using the WKMSYCat34 template to produce a more complete table of information for stocks in categories 3 and 4. The idea being, to allow for an easier compilation of information to assist the decision making to upgrade them to category 1. Although, based on the identification of the type of information required and the application of this table, the subgroup concluded that this subject is not under the scope of this working group.

2.5.2 Workplan for 2019-2020

- Take up each recommendation addressed to WGBIOP and provide the appropriate action related to biological parameters and quality indicators (2019-2020);
- Further develop the table on biological parameter data used in assessments to be incorporated into the ICES Stock Information Database.

2.5.3 Deliverables for 2020

For the next year, the ToR e subgroup plans to produce the following deliverables:

- 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;
- Elaboration of a standard document on how to report the results from age and maturity exchanges/workshops (age and maturity error matrix) directly to assessment groups. This will be conducted intersessionally and presented and approved at the next WGBIOP meeting in 2020;
- The standard documentation produced under the intersessional subgroup work, should be also addressed to WGSMART to be included in the SmartDots report.

2.6 ToR f. Update and further develop tools for the exchanges and workshops

2.6.1 Progress during WGBIOP 2019

For the period June 2018 – October 2019, 21 events took place in SmartDots (see https://smartdots.ices.dk/ViewListEvents).

During WGBIOP 2019, of 15 different workshops and exchanges on age reading and age validation, the results were presented. In Annex 5.a an overview is given of which of them used the SmartDots, suggestions and remarks addressed to WGSMART, reason why not used and general comments coming from the workshops and exchanges.

A test run for a maturity workshop was carried out during the summer of 2019 and it will be possible to run maturity workshops and exchanges in SmartDots from January 2020 onwards.

During the WGBIOP 2019, all comments received by national age-coordinators, and the issues described on GitHub (https://github.com/ices-eg/SmartDots/issues were checked and compared. This should be carried out on an annual basis.

Remarks/suggestions coming from the presented age reading workshops and exchanges are:

- Some plots generated by SmartDots are difficult to interpret, owing to a high number of rings marked (ex: Average distance from centre to winter rings). => it is requested to have some more control over the graphical output e.g. axis limits. This has been addressed.
- Raw data from SmartDots was used in Eltink spreadsheet for better handling. Due to 0 age when otolith is unreadable (AQ3). And to get results by different stocks and by different group of readers. This has been addressed
- Difficulties due to different birthdays (1 July). SmartDots assigns age to number of winterrings. This has been addressed.

Summary Multistage approach:

When summarizing the output and reporting the results of the exchange events developed within the SmartDots framework, the modal age (the most common age decided by the age readers for every fish sample) is the most relevant measurement. It is a key statistic by itself, that indicates the most likely age of each sampled fish. But it is also fundamental for the estimation of some other relevant statistics to assess the performance of the techniques assessed in the exchange event, like the Percentage Agreement (PA), or input for stock assessments like the Age Error Matrix (AEM). During the WGBIOP meeting it was raised that on average, in the 34 exchange events analysed, the 18.9% of the fish samples presented more than one modal age (i.e. different ages got the same highest number of readers). As it is defined at this moment, the mode is taken as the lowest age of the multiple modal ages. Accordingly, this imply a wrong perception of the age by fish individual and introduction of bias in the calculation of the PA and AEM. A multistage approach to select the modal age was presented as a possible solution to solve partially this problem. This multistage approach was based in the different weight given to the age readers based in their experience. Two different weight scores scales were assigned, a weight score decreasing linearly and another decreasing with a negative exponential shape. It was found that the combination of the modes decided using this two weighting scores in together with the mode obtained with the current method, allows assigning a single modal age to each fish individual. It was indicated that this might still have an impact in the calculated PA and EAM, although the importance of that influence still needs to be assessed. The application of this multistage approach will require the development of a protocol to assign different "experience score" to the different readers participating in an event.

This issue will be further discussed in WGSMART

2.6.2 Workplan for 2019-2020

Feedback from WGBIOP to WGSMART

Proposed ideas for development for the SmartDots application and reporting:

- WGSMART to look at reviewing the newsletter to include screen shots of the improvements that have been developed;
- The newsletter to include hyperlink to the application;
- Can SmartDots automatically generate an email to remind age reader and maturity coordinators to update the details and age reader experience with confirmation of completed updates by coordinator back to ICES?
- When major changes are made to SmartDots, can an update mail go out to coordinators?
- Software update did not automatically happen, had to reload the software with updates;
- At the end of each exchange and when published can the coordinator of the exchange be reminded to update any issues to GitHub;

- SmartDots to have a brief overview of the exchange using a standard table to outline the information needed;

Official name of exchange	Species	Stock	Number of countries	Number of Institutes	Number of Readers	No of structures by preparation method

- Once the final report for an exchange or workshop a hyperlink to the exchange report should be available;
- The development of a full manual in co-operation with WGSMART. Currently, there is a short manual available, and on the website brief instructions for using the platform and creating an event. However, as there is a clear need to have good and transparent documentation, this needs to be updated and further developed based on platform developments and the comments of the different users;
- SmartDots@home: as the SmartDots age reading platform is an open source solution, the platform can also be used to manage internal age reading data. A custom web API and database must be developed to use the platform internally within an institute.

The use of the SmartDots age reading platform on a routine basis for exchanges and workshops will continuously provide feedback to WGBIOP allowing the group to outline a plan on future needs on an annual basis.

Currently, there are different databases and platforms, e.g. RDB/RDBES, TAF and SmartDots, which contain information of benefit to WGBIOP and the end-users. Example: information on species, area, sampling platform, country, numbers of ages, numbers of maturity by month/quarter, is available in the RDB/RDBES and could be compiled in an overview, eventually linked to information available in SmartDots. In the longer term, dashboards could be developed, linking the information from different sources, generating specific overviews 'on demand'.

During 2020, WGBIOP could start to identify and formulate their needs for specific overviews, in corporation with WGSMART, PGDATA and the RCGs.

2.6.3 Deliverables for 2020

WGSMART have proposed a training workshop that will train in the use of SmartDots. Date and Venue TBD. This should include both age readers, maturity readers, coordinators and end-users.

WGSMART have committed to update the manual and produce videos for use and guidelines.

2.7 A Handbook on maturity staging of marine species

During WGBIOP 2018, a previous version of Category 1 resolution (2018/1/EOSG02) for the ICES Cooperative Research Report (CRR) was granted conditional approval pending a former editor handing in two unrelated reports. Due to personal reasons, the Editor in question has opted to withdraw and the original resolution has been cancelled. The editorial team is now composed by Francesca Vitale (Sweden), Maria Cristina Follesa (Italy), and David Maxwell (UK).

The previous resolutions have been modified in order to highlight the broader purpose of the report: (i) available validation studies for each species will be included aiming at improving accuracy in maturity determination; (ii) the report will provide guidance on statistical methods for integrating the outputs from calibration exercises in stock assessment; and (iii) the handbook will not only focus on ICES areas, but also include Mediterranean, and (iv) will not be only restricted to fish.

The new resolutions will be submitted at the SCICOM September 2020 meeting.

At WGBIOP 2019, Editors have presented the final structure of the handbook and the final list of contributors in each chapter. The Handbook is composed of 11 chapters organised as following:

1. Introduction
2. Gadoids
3. Flatfish
4. Pelagic species
5. Shallow water species
6. Deepwater species
7. Crustaceans
8. Mollusca: Cephalopoda
9. Elasmobranches
10. Mollusca: Bivalvia and Gastropoda
11. Statistical handling of uncertainty in maturity estimations

The aim is to produce a preliminary draft of the CRR by April 2020 and an advanced draft during the next WGBIOP 2020. The Editors agreed to submit the final draft by 31 October 2022.

2.8 Regional Coordination Groups and WGBIOP

Each year a presentation of the RCGs and the annual Liaison meeting is given at WGBIOP summarising the progress in regional data collection within the ICES and GFCM areas. Topics relevant to WGBIOP include:

- Further development of the Regional Database (RDB) and the RDBES (Regional Database Estimation System) to improve accessibility and quality of regional fisheries and biological data (e.g. age, length, maturity);
- Regional overviews and data quality checks (e.g. age-length, length-weight and geographical sampling maps) carried out by the RCG Intersessional Subgroup (ISSG) on Fisheries & Sampling Overviews;
- End-user (ICES and GFCM) interaction on data requirements (e.g. age/maturity data and stomach sampling).

Prior to WGBIOP 2019 a meeting was held with some members of the ISSG on Fisheries and Sampling Overviews to discuss what output could be useful for WGBIOP to have on an annual basis and which could be used in their efforts to improve quality assurance of biological parameters on a regional level. A table was provided and presented at WGBIOP and feedback to the group will continue intersessionally.

WGBIOP discussed the idea for a future platform where it would be possible to access a combination of regional overview outputs and quality checks with report and data outputs from tools such as SmartDots and DATRAS. The group agreed that this would prevent the duplication of work done by groups aiming to improve data quality and support further regional cooperation.

Funding possibilities for validation studies was discussed again this year and the possibility to apply for project funding under the European Commission - European Maritime and Fisheries Fund (EMFF) under the guidance of the RCGs was identified as a possible source.

WGBIOP supports all recommendation from the RCGs

- RCG Med & BS: "To follow the agreed protocols from workshops for age reading."
- RCG Baltic: "To terminate the age readings for dab, flounder, brill and turbot from the commercial fishery in the Baltic sea (SD 22-32)"
- RCG NANSEA: "Develop an inventory list from the survey databases"

2.9 Scientific Session on Age and Maturity Validation Studies

The afternoon of 8 October, was dedicated to the validation methods for both ageing and maturity analysis. Age and maturity data are among the most important data input in stock assessment analytical models. However, bias in these data can lead to stock diagnosis failures. Poor quality ageing data have also contributed in certain cases to misleading evaluation of the population status. For these reasons, an increasing effort has been devoted during the last years to improving the quality of age data (ICES 2011, 2013), especially in the context of the European Union Data Collection Framework, which is implementing otolith exchange exercises, workshops and meetings concerning the ageing and maturity analysis of the most important species in the European fisheries (ICES 2018a). The accuracy of the age and maturity is low in some cases and partially due to the difficulties in applying the validation methods (direct, indirect and semidirect) to many commercial species and partially due to a lack of resources to carry out the studies. During this session, validation studies for both age and maturity, implemented in several contexts and regions were presented. The following section includes the abstracts of all studies and a summary table (Table 2.7).

Age validation of Western Baltic cod

Uwe Krumme, Thünen Institute of Baltic Sea Fisheries (OF), Rostock, Germany

Results of two German studies validating the age of Western Baltic cod, including an age reading guide, revealed a clear minimum separating age0 and age1 cohorts within length frequency samples from commercial pound nets every year. The first translucent zone (TZ, mean width: 2,0 mm) was consistently completed between September and December (McQueen et al. 2018; 2019). Recaptured cod from age 0-3 marked with tetracycline also consistently formed one TZ per year, being positively related to water temperature, thus confirming the TZ as a "summer ring" rather than a "winter ring". Age validation studies with other Baltic demersals are underway. Lessons learned are: resources, experience and patience is needed; animal testing permission issues to be systematically approached; easier are faster growing species/stocks available in shallower waters in high fishing pressure areas; consider shore-based tagging close to your institute; tag all sizes from the start; raise awareness of fishers/anglers to increase return rate; ensure return of whole fish.

Maturity overview

Maria Korta, AZTI Tecnalia, San Sebastian, Spain

More than 8 maturity staging calibration exercises have been carried out and several maturity manuals and protocols have been developed under the ICES scientific forum through several workshops since 2007: gadoids (WKMSCWHS 2007 ICES, 2008b and WKMSGAD 2013 ICES 2013b), mackerel and horse mackerel (WKMSMAC 2007 ICES 2008c; WKMSMAC 2015 ICES, 2015; WKMSMAC 2018, ICES, 2019c), demersal species (WKMSHM 2007, ICES, 2007a), pelagic species (WKSPMAT 2008 ICES, 2008c and WKMSHS 2011, ICES, 2011; WKMSHS 2017 and WKHERMAT 2010, ICES, 2010a), crustaceans (WKMSC; ICES, 2010b), elasmobranchs (WKMSEL

2010 ICES, 2010c; WKMSEL 2012 ICES 2013b; WKMSEL 2017), cephalopods (WKMCEPH 2010, ICES, 2010d), flatfish species (WKMSSPDF2010, ICES 2012b and WKMSTB 2012, ICES, 2012c), and redfish and Greenland halibut (WKMSREGH 2012, ICES, 2012c). These maturity workshops have been guided as well by other workshops dealing with maturity sampling (WKMAT 2007, ICES, 2007b), Universal maturity scale (WKMATCH 2012, ICES, 2012a), revision of the international maturity scale and conversion tables (WKASMSF, ICES, 2018c) and the impact of maturity staging errors in the assessment (WKMACQI 2018, ICES 2018b). In fact, sources of variance in maturity staging are diverse and not few, and that is why both intra and inter laboratories standardised calibration exercises, which should follow latest guidelines for maturity exchanges, are persistently recommended to perform. Moreover, the maturity validation should be indispensably achieved by means of available techniques, i.e., histology, whole mounts and GSI-HIS or their quantitative histology is, and developed reference illustrated handbooks for maturity staging. The use of the internationally agreed maturity scale along with key decision diagrams may help on improvement on the accuracy of maturity staging.

Multicriteria approach for validating first winter ring deposition in Eastern North Sea plaice (*Pleuronectes platessa*) otolith.

Francesca Vitale[1], Jan-Erik Johansson[1], Barbara Bland[1] and Pierluigi Carbonara[2]

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[2]COISPA Tecnologia e Ricerca, Stazione Sperimentale per lo Studio delle Risorse del Mare, Italy

A major difficulty in accurate age determination of plaice (*Pleuronectes platessa*) consists in how to interpret the first hyaline ring, sometimes read as a "settling ring" and sometimes read as a true annual ring. As the misinterpretation of this first ring leads to a bias in age-based stock assessment, validating this first ring is crucial. The sampling was carried out between May and December 2011 in shallow water (2-5 m) in the Swedish fjord “Gullmaren”, known to be a good settling ground. Adult specimens were also collected from the same areas in May 2011.

Here we applied a multicriteria approach based on edge analysis and morphometric measurements, useful in ring deposition validation studies when classic methods (e.g. mark and recapture, captivity rearing, radiochemical dating, bomb radiocarbon etc.) are difficult to implement.

The marginal analysis of the otolith from adults (age>0) and juveniles (age 0) show the same pattern with a prevalence of the opaque edge in summer/ early autumn and transparent (hyaline) edge in late autumn. However, a peak of juvenile specimens with hyaline edge, at a distance from the nucleus of about 400 μm, was observed in June. Moreover, morphometric measurements of the radius in otolith with hyaline edge observed in specimens caught in October / November did not show significant differences (Wilcoxon – Mann–Whitney test; $p>0.05$) from the first ring displayed by adult specimens. Nonetheless, in the adults in which narrow and indistinct checks could be seen, the measurements showed distances (around 400 μm) corresponding to juveniles observed in June of a length around 30 mm. These results suggest that a false ring deposition before the first winter ring does occur in juveniles.

Taken together both approaches present preliminary evidence indicating that the first ring displayed on the otolith of this plaice stock is unlikely to be the first winter ring, hence, not be counted as annual rings. These checks could be laid down in response to environmental stress; the young fish being subjected to greater fluctuations in food supply, temperature and predation pressure than adults in deeper water. This study represents a first step towards age validation of this stock and may possibly contribute to the disclosure of local populations.

Use of otolith microchemistry for age estimation: Theoretical background – methods - ongoing work- first validation results

K. Hüssy[1], Y. Heimbrand[2], K. Limburg[3], M. Krüger-Johnson[1], C. M. Albertsen[1], T. B. Thomsen[4], S. S. Hansen[4], M. Casini[2], M. Mion[2], A. Hilvarsson[2], K. Radtke[5], J. Horbowy[5]

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4 Geological Survey of Denmark and Greenland, Copenhagen., Denmark

5 National Marine Fisheries Research Institute, Gdynia, Poland

The objective of this presentation was to give an introduction to an innovative approach to age validation based on the chemical composition of otoliths along a transect from hatch to death, and to provide the first validation results linking chemical patterns with daily growth increment analysis. In order to obtain objective estimates of signal identifications, a statistical approach to data smoothing and maxima/minima signal detection was used. The incorporation of the elements phosphorus (P), magnesium (Mg), and zinc (Zn) is under physiological control and exhibit seasonal patterns that align well with patterns of daily increment width in Baltic cod smaller than 25 cm. Elements subject to environmental control, in particular strontium (Sr), barium (Ba) and manganese (Mn) performed significantly worse. P, Mg and Zn are therefore considered useful candidates for age validation. Further validation of this method on larger/older Baltic cod is ongoing, using tagged individuals from the BalticSea2020 funded Tagging Baltic Cod (TABACOD) project.

Holistic approach for age validation in otolith reading for red mullet (*Mullus barbatus*) and horse mackarel (*Trachurus trachurus*).

P. Carbonara and L. Casciaro, COISPA Tecnologia & Ricerca, Stazione Sperimentale per lo Studio delle Risorse del Mare, Bari Italy

The growth of *Mullus barbatus* and *Trachurus trachurus* has been widely studied using different methods, but very few previous study has focused on age validation for these two important fishing resources. The main uncertainty in estimating the age of the red mullet and horse mackerel by otolith reading is linked to the number of false-growth increments laid down before the annulus.

The capture of red mullets in the early life stage allowed us to estimate their size at the metamorphosis from the pelagic to the demersal phase. The comparison between the metamorphosis size and the back-calculated length of the first growth increment clarified the position of the false growth increment on the otolith. Moreover, the analyses of the otolith marginal increments in adult and juvenile specimens allowed us to define the deposition patterns of their annuli.

Likewise the marginal analysis in horse mackerel show the deposition of one annulus per year with one opaque area laid down during the summer-early autumn and one transparent ring during the winter-early spring.

The modal components of the length–frequency distribution analysis (LFDA) were identified in the winter survey (ELEFAN and Bhattacharya methods), and they did not show significant differences from the length back-calculation of the annuli excluding the length of the check before the first winter ring.

Moreover, no significant differences were found between the growth curves calculated by otolith reading (back calculation and direct otolith reading) and the LFDA. The agreement between the

length–frequency results and the otolith age estimation either corroborated or indirectly validated the growth pattern estimated in the otoliths of the red mullet and horse mackerel, mainly when the direct validation methods (e.g. mark recapture, captivity, radiochemical) were difficult to implement, like the case of these species.

Methods of ELASMOBRANCHES maturity data collection: maturity stages estimation and their histological validation

M. C. Follesa, Dipartimento di Scienze della Vita e dell'Ambiente – Macrosezione di Biologia Animale ed Ecologia, Cagliari University, Cagliari, Italy

Follesa M.C. presented the Elasmobranchs macroscopic maturity scales validated through histological analysis. In particular, after a description of the main maturity strategies of this group (categorized as oviparity and viviparity on the base of where the embryonic development occurs), the GFCM macroscales of both oviparous and viviparous Elasmobranches females, converted in the "WKMATCH 2012 maturity scale revised", were analysed stage by stage.

The main features of the oviparous female macro stages (immature, maturing, mature, regenerating and resting) of a Raidae species (*Dipturus oxyrinchus*) and a squaliformes (*Galeus melastomus*), validated by the correspondent oogenesis stages, and were described. Moreover, the viviparous macro scale was described taking into consideration two different squaliformes (E.*spinax* and *S.blainville*). The development of the embryos during the maternal stages was also shown.

Quantitative histology for maturity staging of the plaice (*Pleuronectes platessa*)

Carine Sauger, Institut français de recherche pour l'exploitation de la mer (IFREMER)

In stock assessments, the reproductive capacity of a commercial fish species is a key parameter, thus being able to accurately determine the maturity phase of a fish is of paramount importance. Unfortunately, these methods are very subjective; the maturity cycles of certain fish species are poorly known; the determination of certain maturity phases can show great variability between assessing operators; there are numerous terminologies to describe the fish reproductive system; and often the maturity scales are different between institutes. This led ICES to work on harmonizing the definitions, terminologies and practices used to determine the different maturity phases. In this context, a project to improve the knowledge on the ovarian histology of the female plaice (*Pleuronectes platessa*) and correlate histological with macroscopic analysis was carried out by IFREMER (MATO MATurité Objective des poissons par l'histologie quantitative-Objective maturity using quantitative histology). In MATO project the terminology by Brown-Peterson *et al.* (2011) and the ICES maturity scale, were used. Then the specific issues of the project addressed were:

- Calibration between histology slide readers
- Description and update on plaice oogenesis
- Histology for objective maturity staging (WKMATCH/WKASMSF)

To answer the first issue, a calibration exercise was set up. Three reading operators, read the same 15 histology slides (trichrome stain -Prenant-Gabe). The reading results of all 3 operators were compared for all 20 structures that could potentially be found in each slide. If one structure, on a single, showed a numerical difference of more than 3%, then all three operators looked at the slide together, reading the slide a second time. This calibration exercise allowed the completion and refining of a reading protocol for the histological slides (https://archimer.ifremer.fr/doc/00501/61235/), as well as allowed the readers to reach a mean of over 80% of percentage agreement and fleiss's kappa.

The second issue, regarding incomplete data concerning the gametogenesis of the plaice, was answered through a thorough study of these slides, leading to the establishment of a lexicon describing the full oogenesis of the plaice (https://archimer.ifremer.fr/doc/00501/61234/).

Finally, the last issue was reached, was using a sampling grid of 500 to 600 points to count the different structures found throughout each slide. This later allowed the verification of cellular homogeneity inside a single ovary and between ovaries. The related dataset of the slides and the corresponding reading was curated and published online (https://zenodo.org/record/3463296).

The results obtained throughout this project updates and enriches the existing knowledge on plaice ovogenesis, and allows a comparison between macroscopic and microscopic maturity analysis. Using an objective histological method to determine the sexual maturity phase in *Pleuronectes platessa* is time consuming but yields better results compared to the visual method. Moreover, with these results, less time consuming methods such as image analysis and statistical learning for the recognition of cellular structures, can be put in place. The dataset obtained through this work can also be used as a proxy to calibration stereology readings.

Table 2.7. Summary table of the validation studies presented during the scientific session on age and maturity

Species	Area	Maturity or Age	Method	Age group validated
Cod	Western Baltic, SD22	Age	Chemical Mark (tetracycline) and Re-capture, length-frequency data	0-3
			Edge analysis, length-frequency data	0-1
Cod	Eastern Baltic, SD25	Age	Microelements (Cu, Zn, Rb, Mg, Mn, P, Ba Sr)	0-3
Plaice	Eastern Skagerrak, SD20	Age	Ring Measurements/ Length Frequency Distribution	0
			Edge analysis	0
Horse mackerel	Adriatic Sea	Age	Edge analysis	Whole population
			Back calculation/ Length Frequency Distribution	
Red Mullet	Adriatic Sea	Age	Edge analysis/Marginal increment analysis	Whole population
			Back calculation/ Length Frequency Distribution	
Multispecies	ICES/GFCM	Maturity	Histology/monthly GSI-HSI	Whole population
Elasmobranch	ICES/GFCM	Maturity	Histology	Whole population
Plaice	ICES	Maturity	Quantitative histology	Female population

3 Next meeting

The next WGBIOP annual meeting will take place in Gothenburg, Sweden, on 6–9 October 2020.

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Annex 2: Resolution

The **Working Group on Biological Parameters** (WGBIOP), chaired by Pierluigi Carbonara, Italy, Cindy van Damme, The Netherlands and Julie Coad Davies, Denmark will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	1–5 October	Ghent (Belgium)	Interim report by 9 November 2018 to EOSG, SCICOM& ACOM	
Year 2019	7-10 October	Lisbon, Portugal	Interim report by 8 November to EOSG, SCICOM and ACOM	Chaired by Pierluigi Carbonara, Italy and Julie Coad Davies, Denmark
Year 2020	6-10 October	Gothenburg, Sweden	Final report by "DATE" to EOSG, SCICOM& ACOM	

ToR descriptors

	TorDescription	Background	Science plan codes	Duration	Expected deliverables
a	Plan studies, workshops and exchange schemeson interpretation of fisheries data on stock-related biological variables, and review the output of this work	Review incoming suggestions for inter-sessional work from EGs, WKs and other ICES related groups, e.g. planned benchmarks	3.1, 3.2	Generic ToR	Yearly provision of a prioritized overview of planned studies, workshops and exchanges will be delivered to PGDATA for review
b	Improve training and quality assurance of age reading and maturity staging. Identify the need for validation studies and assign priorities.	Routines for monitoring the quality of age and maturity are currently based on national protocols and these need to be standardized. Validation is essential to ensure the accuracy of biological data used as input for assessment	3.1, 3.2	Generic ToR	Review the current national procedures for quality assurance. Devise best practice guidelines on a regional level. Continuous monitoring of the implemented standardized guidelines.

c	Evaluate the quality of biological parameters: Issues and guidelines	Guidelines were established in 2017 for a qualitative evaluation of biological parameters. This ToR will further develop these guidelines, for (quantitative) quality indicators of biological parameters.	3.1, 3.2, 5.1	3 years /Generic	Generic guidelines for a quantitative evaluation of the quality of biological parameters. Evaluation of issues put forward by the assessment WGs for benchmark species in 2018–2020. Carrying out case studies on one or two species through a specific workshop in close c ooperation with stock assessors.
d	Investigate and develop data availability, documentation and methods to improve identified biological parameter estimates, as input to assessment models.	WGBIOP 2015–2017 identified a series of life-history parameters required by end-users by means of literature review, input from experts and in consultation withExpertGroups on Integrated Ecosystem Assessmentand Multispecies modelling.	3.1, 5.2, 6.6	3years	Document current sources of life-history parameter estimates identified by ICES/GFCM Expert Groups, as critical components and relevant to improvement of modern assessment for ICES/GFCM stocks. Facilitate a closer link between data providers and data end-users.
e	Address requests for technical and statistical recommendations /advice related to biological parameters and indicators	Filled templates for requests send to WGBIOP before a specified deadline will be the basis for this ToR	3.1, 3.2, 3.3	Generic ToR	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
f	Update and further develop tools for the exchanges and workshops (e.g. SmartDots and statistical tools.)	Based on feedback from users of these tools, improvement/alterations will be evaluated	3.1, 4.1	Generic ToR	Potential improvement/alteration of the tools on a yearly basis.

Summary of the Work Plan

Year 1	Continue the collation of ToR d) information related to biological parameters; c) benchmark issue lists and guidelines; ToR a, b, e and f are generic tors and will be dealt with on a yearly basis in WGBIOP. Begin the process of realigning the scheduling of WGBIOP exchanges/Wks with the benchmark cycle.
Year 2	Continue the collation of ToR d) information related to biological parameters; c) benchmark issue lists and guidelines; ToR a, b, e and f are generic tors and will be dealt with on a yearly basis in WGBIOP. Devise and implement best practice guidelines for quality assurance on a regional level under ToR b.
Year 3	Review the current status of issues, achievements and developments that falls under the remit of WGBIOP, 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

Supporting information

Priority	A 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 assessment and mixed fishery modelling, these activities are considered to have a very high priority.
Resource	None.
Participants	All National Age Reader/Maturity Stager Coordinators (ICES and GFCM) will be invited. Experts relevant to the current Benchmark of the year of WGBIOP will be invited as well as relevant external experts such as statisticians or specific EG members.
Secretariat	None.
Financial	None.
Linkages to ACOM and groups under	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 Group: Ecosystem Observation Steering Group (EOSG). 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
Linkages to other	Regional Coordination Groups and PGMed

Annex 3: ToR a

a) 2018 & 2019 Workshops and Exchanges

Workshops Completed in 2018–2019

The following are summaries of the biological variable workshops carried out in 2018 and 2019.

Workshop on Age Estimation of Mackerel (S*comber scombrus*) (WKARMAC2)

WKARMAC2 met on 22–26 October 2018 in San Sebastian, Spain, and was chaired by Jens Ulleweit (Germany) and Rosario Navarro (Spain). Report can be found at WKARMAC2 2018.

The workshop achieved quite a lot in terms of ironing out, through on-screen discussion of difficult and/or old otoliths and calibration, some of the differences in age interpretation between readers. Last workshop (WKARMAC 2010) ageing guidelines were revised and the modifications agreed between the participants. The participants agreed to employ the revised ageing guidelines in their age estimations.

The overall result of the workshop exercise shows an improvement in the agreement between readers (66.8% agreement, 31.4% CV), and especially Expert readers (73.2% agreement, 16.4% CV), regarding the exercise carried out before the workshop, which shows the usefulness of the on-screen discussion of difficult otoliths before the workshop exercise. However, the agreement between readers for otoliths with older ages (from age 6) continues to be very low (40-58% all readers; 53-71% experts).

An image collection of agreed age otoliths will be found in the workshop ICES SharePoint and the Age Forum site. Such otolith collection includes the otoliths with >80% agreement between Expert readers from the WKARMAC2 calibration exercise. In addition, the images of the otoliths from the Small exchange with Norwegian otoliths from the tag-recapture experiments will also be included in the reference otolith collection.

Recommendation	Adressed to:
1 WKARMAC2 recommends that all national databases are adapted according to the agreed mackerel age reading manual. This includes the introduction of a field for the edge structure of the otolith (opaque / hyaline) and the application of the reading grading system / quality indicators 1-3.	Workshop participants, WGBIOP
2. WKARMAC2 recommends that all ageing laboratories use the manual agreed by WKARMAC2.	Workshop participants, WGBIOP
3. WKARMAC2 recommends that exchanges and workshops on age reading of NEA mackerel wil be held regularly. A exchange should be scheduled for 2020, a workshop should be scheduled for 2022.	WGBIOP
4. WKARMAC2 recommends that readers whose age estimations are used in assessment attend the workshops on age estimation of mackerel and participate in the exchanges	National Mackerel Age Coordinators, WGBIOP
5. WKARMAC2 recommends to record the nature of the otoliths edge and a study of the otolith edge formation by area.	Workshop participants, WGBIOP
6. WKARAMAC2 recommends the continuity of the Norwegian experiments ot tag-recapture of mackerel, especially in order to validate older ages (> 5 years old).	Workshop participants, WGBIOP
7.WKARMAC2 recommends the realizaton of validation/corroboration studies of age estimation of NEA mackerel in all distribution areas (L1 width, length–frequency analysis, etc.)	National Mackerel Age coordinators, WGBIOP

WGBIOP supports the recommendations from WKARMAC2

Workshop on Sardine (*Sardina pilchardus*) Age reading of otoliths (NE Atlantic and Mediterranean). (WKARAS 2).

WKARAS 2 met on 18-22 February 2019 in Lisbon, Portugal, and was chaired by Eduardo Soares (IPMA, Portugal), and Pedro Torres (IEO, Spain). This workshop has been completed, and the report is pending.

A few recommendations came out from the discussions held during WKARAS2. Exchanges should preferably be based on the structure analyses of samples of otoliths complemented by their images in SmartDots, the implementation in each area of routine otoliths age reading exchanges, regular age reading validation studies in each area and otoliths' images reference collections should be enriched by more quality images along time.

WGBIOP supports the recommendations from WKARAS2

Workshop on Age reading of Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*Trachurus trachurus, T. mediterraneus* and *T. picturatus*) (WKARHOM3)

The Workshop on Age reading of Horse Mackerel, Mediterranean Horse Mackerel and Blue Jack Mackerel (*Trachurus trachurus, T. mediterraneus* and *T. picturatus*) (WKARHOM3) was held in Livorno (Italy) on 5–9 November 2018. The meeting was chaired by Alba Jurado-Ruzafa (Spain), Kélig Mahé (France) and Pierluigi Carbonara (Italy), and included fifteen age readers from nine countries. The objectives of this workshop were to review the current methods of ageing Trachurus species, to evaluate the new precision of ageing data of Trachurus species and to update guidelines, common ageing criteria and reference collections of otoliths. The exchange results showed a low value of percentage of agreement from 45.1% to 59.1% for the three Trachurus

species. The Coefficient of Variation was lower for *T. trachurus* (17.3–32.2) than for the other Trachurus species (60.1-73.4) because the sampled specimens were older for this species than for the two other species. With feedback from the readers present at the exchange and the discussion during the WKARHOM3 meeting, the main cause of age determination error for *T. trachurus* was identified as otolith preparation techniques (whole/slice). However, for the three Trachurus species, there are several difficulties in age determination: identification of the first growth annulus, presence of many false rings (mainly in the first and second annuli) and the interpretation and identification of the edge characteristics (opaque/ translucent). The second reading was performed during the workshop with 50 images per each species. Each reader read only the images of the species that is read in their laboratory. The percentage of agreement between readers increased to 70.6% with a CV of 18.4 for *T. trachurus* and to 67.8% with a CV of 31.7 for *T. mediterraneus.* Finally, this group reached an agreement on defining an ageing guideline and a reference collection presented in this report and the aim is to employ these tools for all laboratories.

Workshop on Better Coordinated Stomach Sampling (WKBECOSS)

WKBECOSS met on 3-6 September 2019 in Santander, Spain, and was chaired by Izaskun Preciado (Spain) and Stefan Neuenfeldt (Denmark). This workshop has been completed, and the report is pending.

WKBECOSS focused on discussing existing stomach sampling programmes and their guidelines. Stomach sampling was considered to be particularly relevant for multispecies models and Ecosystem Status (i.e. MSFD) indicators. For both types, detailed sampling best practises exist. Currently, there are limited national collection programmes for stomach data which relate to others across ICES, and no common EU stomach sampling ongoing.

WGBIOP supports the recommendations from WKBECOSS and is proposing The Workshop on Operational Implementation of Stomach Sampling (WKOISS) to follow up on the work of (WKBECOSS) and ensure knowledge sharing and coordination.

Exchanges Completed in 2018–2019

The following are summaries of the age reading exchanges carried out in 2018 and 2019.

Megrim (*Lepidorhombus spp.*) Otolith Exchange 2018

Event 160 in SmartDots. Areas 4.a (105 otoliths) and 6.a (75 otoliths). Overall agreement was 40% for all readers, rising to 49% for expert readers only. Overall CV of 35% for all readers and 31% for expert readers. Agreement decreases with increasing modal age. Lower CV between expert readers of images than of hard otoliths. Higher relative bias for images than hard otolith readings.

The plot of distance from the centre of the otolith to the winter rings for expert readers showed general agreement in the placement of the first four annuli for the majority of readings. As the age increases so too did the overlap between the average distances from the centre to the subsequent annuli, which is reflected in the disagreement between readers on the estimated ages and which structures are true annuli. Beyond the fourth ring, the divergence in the placement of the rings by the two French readers compared to the other expert readers becomes evident, where the French readers place the ring at a greater distance from the centre compared to the other readers. This is likely due to reading technique being shared within the institute and highlights the importance of international exchanges in ensuring that age reading techniques remain consistent across all institutes.

The age of some of the otoliths was overestimated by several of the non-expert readers (up to age 25).

Coordinator: Mandy Gault (Scotland). Report will be uploaded to SmartDots when finished.

European anchovy (*Engraulis encrasicolus*) Otolith Exchange 2019

334 otoliths (not images) of anchovy distributed in Atlantic waters of Iberian Peninsula (ICES Division 9a) from the IBERAS 2018 survey. Overall agreement was 93.4% with a CV of 8.4%. The best agreements are reached for age 0 (91%) and age 1 (95.8%), and the lowest agreement for age 2 (75%). No individuals over 2 years of age were assigned in the sample. There are no signal biases of each reader with the modal age and neither between them, which means that they have a good precision in the determination of the age of the anchovy in the studied area. In general, it can be said that in view of the results (high agreements, low CV and without biases) of this calibration the three readers apply well the current age determination criteria updated in the last workshop of the anchovy age (ICES WKARA2, 2016). The biggest discrepancies found in this Calibration were in age 2. This is mainly due to the fact that in some cases the false spawn ring that deposits the anchovy in summer is confused with the annual winter ring.

Coordinators: Begoña Villamor (IEO-Spain), Susana Garrido (IPMA-Portugal) and Pablo Carrera (IEO-Spain).

Lemon sole (*Microstomus kitt*) Otolith Exchange 2019

Event 115 in SmartDots. Areas 4, 4.b and 4.c (North Sea) and 7.d (English Channel), in total 200 otoliths. Three methods were tested: sectioned, broken and burnt otolith and whole otolith. A number of samples were compered in pairs: Broken and burnt otoliths against whole otolith and sectioned otoliths against whole otolith. Overall agreement was 50% for whole, 65% for sectioned and 49% for broken and burnt otoliths.

Coordinator: Joanne Smith and Valerio Visconti (United Kingdom). Report will be uploaded to SmartDots when finished.

Knowledge

Turbot and Brill (*Scophthalmus maximus* and *Scophthalmus rhombus*) Otolith exchange 2019

Event 200 (brill) in SmartDots. Areas 27.4.b (42 otoliths), 27.4.c (29 otoliths), and 27.7.d (53 otoliths). Whole and stained sections (images only) from otoliths from the same fish. Overall agreement was 63% for whole otoliths and 84% for stained sections. Overall CV of 29% for whole otoliths and 15% for stained sections. Much better results for sectioned and stained otoliths, even for basic readers used to reading whole otoliths. No major issues were detected between the advanced readers from the labs for the common method, all used to reading stained sections, but bias with readers used to reading whole.

Comparison of age determinations based on whole and sectioned otoliths from the same fish show that fish were aged older when using sections. 55% had the same modal age for whole and section, 4 % had older age for whole and 41% had older age for sections. Stained sections appear to be a good way to age brill otoliths (no bias between advanced readers). The recommendation is that all labs change to the same method, which would be sectioned and stained, as results are more precise and accurate.

Event 216 (turbot) in SmartDots. Areas 27.4.a (18 otoliths), 27.4.b (68 otoliths), 27.4.c (40 otoliths), and 27.7.d (52 otoliths). Whole and stained sections (images only) from otoliths from the same fish. Overall agreement was 53% for whole otoliths and 68% for stained sections. Overall CV of 50% for whole otoliths and 24% for stained sections. Better results for sectioned and stained otoliths. Bias between readers used to reading sectioned and stained, also between advanced readers.

Comparison of age determinations based on whole and sectioned otoliths from the same fish show that fish were aged older when using sections. 34% had the same modal age for whole and section, 9 % had older age for whole and 57% had older age for sections. "Cliff edge" was not detected in whole otoliths.

There were issues with identification of first winter ring. Agreement was lower for older fish. Ages are now used for stock assessment, so bias can have impact on stock assessment.

Coordinator: Karen Bekaert (Belgium). Report will be uploaded to SmartDots when finished.

Whiting (*Merlangus merlangus*) Otolith exchange 2019

Event 242 in SmartDots. Area IVb (North Sea), 50 otoliths in total (150 images). This was a small scale exchange carried out by a few expert readers to compare accuracy of reading using different methods. Three methods were tested: sectioned, broken and whole otoliths. All the samples were compared in pairs: broken otoliths against whole otoliths, sectioned otoliths against whole otoliths, and sectioned otoliths against broken otoliths. Pending analysis.

Coordinators: Joanne Smith and Valerio Visconti (United Kingdom). Report will be uploaded to SmartDots when finished.

Sandeel (*Ammodytes marinus*) Small otolith exchange 2019

Event 219 in SmartDots. Area North Sea. Pending analysis.

Coordinator: Julie Coad Davies (Denmark). Report will be uploaded to SmartDots when finished.

Plaice (*Pleuronectes platessa*), Otolith Exchange 2019

Event 221 in SmartDots. Areas 7.f (39 otoliths) and 7.g (44 otoliths) (Bristol Channel and Celtic Sea). Whole and sections (images only) from otoliths from the same fish. For whole otoliths, overall agreement was 71% for all readers, rising to 74% for expert readers only. Overall CV of 20% for whole otoliths and all readers, decreasing to 18% for expert readers. For sections, agreement was 59% for all readers with a CV of 26%. Results for sections can be biased due to poor quality of sectioned images and only basic readers used to sectioned images.

Comparison of age determinations based on whole and sectioned otoliths from the same fish show that fish were aged older when using sections. 66% had the same modal age for whole and section, 7 % had older age for whole and 26 % had older age for sections. But quality of the sections was not good enough (lot of AQ3 given).

Difficulties were first wintering, split rings and edge interpretation. Some bias between advanced readers. Whole otoliths appear to be the better way to age plaice otoliths.

Coordinator: Karen Bekaert (Belgium). Report will be uploaded to SmartDots when finished.

Plaice (*Pleuronectes platessa*) Otolith Exchanges 2019

Event 159 in SmartDots. Area 7.h – k (Celtic Sea South, Southwest of Ireland), in total 191 whole otoliths and 64 sectioned. For whole otoliths, overall agreement was 76% for all readers, rising to 78% for expert readers only. Overall CV of 13% for whole otoliths and all readers, decreasing to 12% for expert readers. For sections, agreement was 56% for all readers, rising to 64% for expert readers only. Overall CV of 26% for sectioned otoliths and all readers, decreasing to 17% for expert readers.

Cause of concern regarding low percentage agreement of some readers providing ages for current stock assessment.

Irregular growth and edge interpretation were the main reasons for discrepancies in age determination.

Although the Ageing Manual for Plaice was included in the WKARP 2010 report with specific interpretation guidelines for plaice stock in Celtic Sea some readers did not consistently adhere to those rules. Readers involved in age determination of plaice in 7.h-k should familiarize themselves with current reference sets / interpretation protocols and consistently follow them while ageing.

Coordinator: Marcin Blaszkowski (Ireland). This event has been published, and the report can be downloaded at the following link https://smartdots.ices.dk/sampleImages/2019/159/Plaice%207.h-k%20Otolith%20Exchange%20Report.pdf

Anglerfish (*Lophius piscatorious, Lophius budegassa*), and Hake (*Merluccius merluccius*) Small Scale image Otolith/illicia Exchanges 2019

Proposed for expert readers only. Coordinator: Kélig Mahé (France). Being organised outside the remit of WGBIOP, but the results were presented at WGBIOP 2019.

In 2019, a small age reading exchange took place using SmartDots between the 3 advanced age readers of Great Britain, Norway and Spain to identify the age and the position of growth rings on illicium and otoliths of the same individuals according to the requests of the European project Validating age-determination of anglerfish and hake (EASME/EMFF/2016/1.3.2.7/SI2.762036). The samples included in the exchange were from the ICES areas 7.b-k. 210 samples were selected from quarter 4, 2018. Results showed an overall percentage agreement of 70% and CV of 26%.

European Eel (*Anguilla anguilla*) Otolith Exchange 2019

Coordinator: Esti Diaz (Spain – ASTI). This exchange is being organised by Esti Diaz for the Iberian region through an INTERREG project. This exchange was carried out prior to the workshop. 120 otolith images from eels caught in six aquatic systems from the SUDOE area (2 rivers and a coastal lagoon from the Mediterranean and three rivers from the Atlantic) were included in the exchange. Overall, 33 participants from 13 countries (23 laboratories) participated in the exchange. Precision among the 24 readers who completed their reading was low for both basic readers (PA = 40%; CV = 39%) and advanced readers (PA = 48%; CV = 38%). Following a discussion on causes of error, held during the workshop, participants agreed on performing a second reading. A subsample of 59 otoliths was selected and 18 basic readers completed their reading, but the results showed a weak improvement (PA = 44%, CV = 33%). A discussion on the outcomes and proposals for the next workshop are presented in the report.

Ongoing Work in 2019

Workshops and exchanges scheduled to take place in Q4 2019.

- Workshop on age validation studies of small pelagic species (WKVALPEL) (replaces WKMIAS). Co-Chairs: Pierluigi Carbonara, Italy, Kelig Mahé, France, and, Javier Rey, Spain will meet in Boulogne sur Mer (France), 22–24 October 2019.
- Otolith Exchange Dab (*Limanda limanda*) from North Sea and 5.a. Coordinators: Holger Haslob (Germany) and Loes Bolle (The Netherlands). The exchange was originally proposed for 2018 but was postponed to 2019. This event is ongoing, and the deadline is set on 1 November 2019.
- Otolith exchange of herring (*Clupea harengus*) Area 27.3.d.30. will take place in November 2019. Coordinators: Martina Blass (Sweden), Yvette Heimbrand (Sweden) and Jari Raitaniemi (Finland).

Workshops and exchanges planned for 2019 that did not happen:

- Workshop on Whiting biological Quality Indicators (**WKWHIQI**). No chairs available
- Maturity Exchange Hake (*Merluccius merluccius*) Aras 9a and 8c Coordinators: Ana Costa and Maria Korta. Cancelled
- Otolith Exchanges 2019–Redfish (*Sebastes ssp.*), Coordinator: Lise Heggebakken (Norway). Postponed

b) Work Program 2020 onwards

Workshops planned for 2020

- The Workshop 2 on the identification of clupeid larvae (WKIDCLUP2), chaired by Cindy van Damme*, the Netherlands, and Matthias Kloppmann*, Germany.
- WKOISS – Workshop on Operational Implementation of Stomach Sampling, chaired by Pierre Cresson and Maria Cristina Follesa, Cagliari, Italy.

The **Workshop 2 on the identification of clupeid larvae** (WKIDCLUP2), chaired by Cindy van Damme*, the Netherlands, and Matthias Kloppmann*, Germany, will meet in Bremerhaven, Germany, on 31 August – 4 September 2020 to:

a) Carry out comparative clupeid and similar larvae identification trials following the pattern of trial – analysis – retrial;
b) Review and update available information on the identification of clupeid larvae on the Northeast Atlantic Shelf, with special consideration of the larval appearance and morphology through development;
c) Discuss sources of misidentification of larvae and prepare an uncertainty matrix of clupeid larvae identification
d) Standardize sample processing and data reporting of clupeid larvae surveys.

WKICLUP2 will report by 16 October 2020 (via EOSG) for the attention of EOSG.

Supporting Information

Priority	Different clupeid larvae surveys, e.g. IHLS and MIK are carried out on the Northeast Atlantic Shelf and provide essential data for the assessment of fish stocks in the North Sea, Irish Sea and the Baltic.
Scientific justification	Larvae surveys are carried out by different countries and the result of these surveys are of direct importance for the assessment. In recent years other clupeids besides herring are occurring in the survey samples in increasing numbers. Since clupeid larvae can easily be mixed up, effective quality control and proper larvae identification is essential for reliable survey results. The overall agreement on clupeid larvae identification between participants at the 2014 WKIDCLUP workshop was 66%. It is necessary to repeat these identification workshops regularly in order to keep the level of identification for experienced and train and improve the skills of new survey participants.
Resource requirements	None.
Participants	Mainly scientists and technicians (approximately 12 - 15) involved in the surveys.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	SCICOM, ACOM
Linkages to other committees or groups	HAWG, WGSINS, WGALES, IBTSWG, WGBIOP
Linkages to other organizations	None.

WKOISS – Workshop on Operational Implementation of Stomach Sampling

A Workshop on Operational Implementation Stomach Sampling (WKOISS), chaired by Pierre Cresson, France and Maria Cristina Follesa*, will be established and will meet at Cagliari, Italy in April 2020 to:

a) Review pros and cons of available stomach sampling methods (e.g. volumetric, numeric, gravimetric, DNA-based etc.) and resulting indices (e.g. percentage by number, mass, occurrence, %IRI ,PSIRI,% etc.) taking into account the progress and experience achieved in the Atlantic and North Sea regions.

b) Select the best suited methods / indices to fill in data gaps regarding key parameters previously identified (such as natural mortality or growth rates), by example through the improvement of currently available ecosystemic models with more robust diet data

c) Review factors of variability in diet (ontogeny, time, space, etc.), prioritize the most relevant in terms of effect on stocks variability and propose sampling plan that take it into account.

d) Taking into account WKBECOSS recommendations and WGSAM requirements, propose a standardized selection method for species or species groups to be included in stomach content, that could (1) take into account regional similarities and differences in species abundance and importance in community functioning and fisheries and (2) allow comparison between systems

e) Review formats (e.g. ICES, DAPSTOM as listed in WKBECOSS) for stomach content data and their regional suitability
f) Consider the development of an intercalibration approach that will allow the results obtained separately by several partners at the regional scale to be combined.

Supporting information:

Priority:	The EU Multi-Annual Programme (EU MAP) on Data Collection requests data on predator-prey relationships and planning for future data collection for each marine region. After the Workshop on Better Coordinated Stomach Sampling (WKBECOSS) which was in 2019, this meeting on the operational aspects for stomach contents is needed and is urgently to begin to organize the sampling of new biological data from 2020. Therefore, these activities are considered to have a high priority.
Scientific justification and relation to action plan:	The EU MAP provides a unique opportunity for the regular collection of diet data within fisheries research surveys. To ensure a homogeneous data set with suitable spatio-temporal coverage and make effective and efficient use of available resources, coordination of stomach sampling studies is essential. Stomach sampling is necessary to ensure that multi-species and ecosystem models remain relevant and to support MSFD descriptor 4 regarding the structure and functioning of food webs. This work could benefit to the new research on the food web from the ecosystem models.
Resource requirements:	None
Participants:	In view of its relevance to the ICES quality assurance, the Workshop is expected to attract interest from Mediterranean and Atlantic areas, ICES and GFCM. Participants will be experts from leading labs and universities working in stomach contents. The workshop will work closely with the newly formed RCG Intersessional subgroup on Stomach Sampling.
Secretariat facilities:	None
Financial:	None
Linkages to advisory committee:	ACOM
Linkages to other committees or groups:	WGBIOP, SCICOM, RCGs, WGSAM
Linkages to other organizations cost:	GFCM

Workshops planned for 2021

- The Workshop on Age reading of Sea bass (*Dicentrarchus labrax*) 2 (WKARDL2) will meet in CEFAS UK in 2021, chairs: Mary Brown and Valerio Visconti (CEFAS UK). A draft resolution (see below) will be finalised and sent for approval following WGBIOP in 2020.
- WKARA3 – Workshop on Age reading of European anchovy (*Engraulis encrasicolus*), chairs: Gualtiero Basilone & Andrés Uriarte in Mazara del Vallo (Sicily, IT) October 2021. A draft resolution (see below) will be finalised and sent for approval following WGBIOP in 2020.

The **Workshop on Age reading of Sea bass (*Dicentrarchus labrax*) 2 (WKARDL2)** will meet in CEFAS UK 2021. Coordinators: Mary Brown and Valerio Visconti (CEFAS UK).

a) Clarify the interpretation of annual growth rings using stained otolith sections and scales on the same fish;
b) Continue the guidelines and common ageing criteria;
c) Develop existing reference collections of calcified structures and improve the existing database of scales images;
d) Address the generic ToRs adopted for workshops on age calibration (see 'PGCCDBS Guidelines for Workshops on Age Calibration').

Supporting Information

Priority:	Essential. Age determination is an essential feature in fish stock assessment to estimate the rates of mortalities and growth. Age data are provided by different countries and are estimated using international ageing criteria. It is necessary to continue to clarify this guideline of age interpretation. Therefore, an appropriate otolith and scale exchange programme will be carried out in 2019 for the purpose of inter-calibration between ageing labs. Results of this otolith exchange will be discussed during WKARDL2.
Scientific justification:	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 specific resource requirement beyond the need for members to prepare for and participate in the meeting.
Participants:	In view of its relevance to the DCF, and ICES WG, the Workshop will try to join international experts on growth, age estimation and scientists involved in assessment in order to progress towards a solution. Participants should announce their intention to participate in the WK no later than two months before the meeting.
Secretariat facilities:	
Financial:	
Linkages to advisory committees:	ACOM, SCICOM
Linkages to other committees or groups:	WGBIOP, WGCSE, WGBIE
Linkages to other organizations:	There is a direct link with the EU DCF.

A **Workshop on Age estimation of European anchovy** (***Engraulis encrasicolus)*** (WKARA3) chairs: Gualtiero Basilone & Andrés Uriarte in Mazara del Vallo (Sicily, IT) October 2021 to:

a) Review information on anchovy age determination, otolith exchanges, workshops and validation works done so far;
b) Analyse growth increment patterns in anchovy otoliths and to improve (if necessary) the guidelines for their interpretation;
c) Analyse the results of the exchanges carried out in 2018 and the potential source of discrepancies, in light of ToRs a) and b);
d) Increase existing reference collections of agreed aged otoliths by stocks and areas.
e) Address the generic ToRs adopted for workshops on age calibration (see 'WGBIOP Guidelines for Workshops on Age Calibration)

WKARA3 will report the attention of WGBIOP, SCICOM and ACOM.

Supporting Information

Priority:	Age determination is an essential feature in fish stock assessment to estimate the rates of mortality and growth. In order to arrive at appropriate management advice ageing procedures must be reliable. Age data are provided by different laboratories and countries using internationally agreed ageing criteria. It is necessary to continue to clarify the guideline of age interpretation. Therefore, otolith exchanges should be carried out on a regular basis, and if serious problems exist age reading workshops should be organised to solve these problems.
Scientific justification and relation to action plan:	The aim of the workshop is to identify potential problems in *Engraulis encrasicolus* age determination, assess variability of growth patterns among different ecosystems, improve the accuracy and precision of age determination, and share the methods and procedures used between different ageing laboratories. An otolith exchange was made in 2018 and at WKARA3 results from this otolith exchange will be presented and discussed. In view of the poor precision of age determination resulting from the exchange, for the workshop presentation of validation studies will be encouraged.
Resource requirements:	No specific resource requirements beyond the need for members to prepare for and participate in the meeting.
Participants:	In view of its relevance to the ICES quality assurance, the Workshop is expected to attract wide interest from both Mediterranean and Atlantic areas, ICES and GFCM. The Workshop tries to bring together international experts on anchovy age reading and fish growth and scientists involved in stock assessment to assess the accuracy and precision of the age determination.
Secretariat facilities:	None.
Financial:	
Linkages to advisory committees:	ACOM , GFCM
Linkages to other committees or groups:	SCICOM, WGBIOP, WGCOMEDA and WGHANSA
Linkages to other organisations:	WGSASP from GFCM

Age Calibration Exchanges to be completed in 2020:

- Otolith Exchange Haddock (*Melanogrammus aeglefinus*) from Rockall and North Sea (areas 4.a and 6.a) has been expanded to also include subareas 1 and 2, to align with the upcoming benchmark review in 2020 for this stock. Coordinator: Mandy Gault (Scotland). This event is ongoing, and report will be ready in early 2020.
- Otolith age reading exchange on Blue whiting (*Micromesistius poutassou*). Coordinators: Patrícia Gonçalves (Portugal) and Jane Godiksen (Norway). The exchange was originally proposed for 2019 but has been postponed to 2020.
- Otoliths Exchanges of Red mullet and striped red mullet (*Mullus barbatus* and *Mullus surmuletus*). Coordinator: Pierluigi Carbonara (Italy). The exchange was originally proposed for 2019 but has been postponed to 2020.
- Sea bass (*Dicentrarchus labrax*) scale and otolith exchange in 2020. With a follow -on workshop (WKARDL2) to take place in 2021. Coordinators: Mary Brown and Valerio Visconti (UK-England). The exchange was originally proposed for 2019 but has been postponed to 2020.
- Scale exchanges of Salmon (*Salmo salar*). Coordinator: Zuzanna Mirny and Adam Lejk (Poland). The exchange was originally proposed for 2019 but has been postponed to 2020. The initial plan to include samples from both Baltic and North Atlantic salmon may not be fulfilled as the continued effort to involve the North Atlantic group in this exchange has to date not been successful.
- Maturity staging exchange on elasmobranch spp. Coordinator: Maria Cristina Follesa (Italy). This exchange will follow up on recommendations by WKMSEL and will take place in 2020. It was originally proposed for 2019 but has been postponed to 2020.

Age and maturity calibration exchanges planned for 2020 and 2021

- Otolith exchange of Megrim (*Lepidorhombus whiffiagonis*) Areas 7.b-k, 8.a-b, and 8.d. will take place in 2020. Coordinator: Jorge Landa (Spain).
- Otolith exchange of Megrim (*Lepidorhombus whiffiagonis*) Areas 8.c and 9.a. will take place in 2020. Coordinator: Jorge Landa (Spain).
- Otolith exchange of Four- spotted megrim (*Lepidorhombus boscii*) Areas 8.c and 9.a. will take place in 2021. Coordinator: Jorge Landa (Spain).
- Vertebrae exchange of Elasmobranchs in Mediterranean and Atlantic will take place in 2020. Coordinators: Maria Cristina Follesa (Italy), Karen Bekaert (Belgium) and Kelig Mahe (France).
- A small-scale otolith exchange for NEA mackerel will take place by the end of 2020, Coordinators: Rosario Navarro Rodrigues (Spain) and Jens Ulleweit (Germany).
- Sole and Plaice maturity staging exchange 2020 to include immature fish. Coordinators: Karen Bekaert (Belgium), Maria Krüger-Johnsen (Denmark).
- Otolith exchange of Plaice in Skagerrak and the North Sea will take place in 2020. Coordinators: Francesca Vitale (Sweden) and Julie Davies (Denmark).
- Deepwater spp. otolith images exchange will take place in 2020. Coordinator: Torfinn Erling Larsen (Norway).
- Otolith exchange of Sprat (*Sprattus sprattus*) from Baltic Sea will take place in 2020. Coordinators: Julita Gutkowska (Poland) and Annelie Hilvarsson (Sweden).
- Otolith Exchange Sole (*Solea solea*), in subdivisions 20–24 (Skagerrak and Kattegat, western Baltic Sea). Coordinator: Julie Davies (Denmark). The basis for this exchange is a Danish EMFF project "Improvement of the biological advice for Common Sole in Danish Waters", to be expanded upon to include addition samples sol.27.20-24. This event has been postponed because of the benchmark being postponed and will take place once the benchmark year is decided.

Annex 4: ToR c

a) Benchmark Issue Lists with WGBIOP's comments, questions and actions

Benchmark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coordinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2021	bss.27.47	Seabass (*Dicentrarchus labrax*) in Divisions 4.b-c, 7.a, and 7.d-h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, and Celtic Sea)	WKARDL2 (2021)	30/12/2021	lisa.readdy@cefas.co.uk	stock identity	Further research is needed to better understand the spatial dynamics of seabass (mixing between stock areas; effects of site fidelity on fishery catch rates; spawning site–recruitment ground linkages; environmental influences on recruitment).	Assessment model including assessment of Bss 47 stock should be revised according to the results of undergoing tagging programs.	-	-
						mortality	Natural mortality is considered as constant over time at a value of 0.24, set for all ages. Inappropriate treatment of M could bias the assessment and reference points	Examine sensitivity of assessment and advice to this. Develop parameter inputs for future assessments.	-	-

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						age	Studies are needed to investigate the accuracy/bias in ageing and errors due to historically age sampling schemes.	-	Otolith and scale ex-change carried out in October 2019, results being analysed. Previ-ous overall age calibra-tion 2015 (Age range 4-13, overall agreement 78%). WKBASS carried out in 2018.	Find chairs for WKARLD 2. Stock coordina-tor to be informed of otolith exchange and work-shop.
						maturity	-	-	IFREMER only institute to collect data in 2014/15 so no action needed.	-
2021	pol.27.8c.9a	Pollack (*Pol-lachius pol-lachius*) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Ibe-rian waters)	-	TBD	paz.sampedro@ieo.es	stock iden-tity	Stock identity unknown.	Review available infor-mation.	-	
						age	-	-	Age not used in assess-ment and no age cali-bration available for this stock.	-

Benchmark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coordinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						maturity	-	-	Maturity not used in assessment and no maturity calibration available for this stock.	-
2021	rng.27.5b6712b	Roundnose grenadier (*Coryphaenoides rupestris*) in subareas 6-7 and divisions 5.b and 12.b (Celtic Seas and the English Channel, Faroes grounds, and western Hatton Bank)	-	TBD	lionel.pawlowski@ifremer.fr	growth	Intrinsic growth rate is suspected to be too high in surplus production model	Use new methods to estimate growth dynamics of the stock based on other indicator such as length distribution	-	-
						age	-	-	Last exchange carried out in 2011 and reviewed at WKAMDEEP 2013. Overall agreement 30%. Age is not used in the assessment	

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						maturity	-	-	No calibration data are available for maturity staging of roundnose grenadier and no new data on maturity has been collected in recent years. Maturity is not used in the assessment.	-
2021	sol.27.8ab	Sole (*Solea solea*) in divi-sions 8.a-b (northern and central Bay of Biscay)	-	TBD	muriel.lis-sardy@ifremer.fr	Biological parameter	Old maturity ogive	Update the maturity ogive. Fishing sample from the first quarter (under the commercial size).	last benchmark WGHMM 2013	
						Age			last age calibration was an exchange in 2011 (age range= ?; agree-ment all readers= 89%)	WGBIOP could or-ganize an exchange of sole including these ar-eas

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						Maturity			last overall sole ma-turity calibration was a WK in 2012 (maturity range= 2 & 5; agree-ment= 82%)	Sole ma-turity staging exchange will take place in 2020; Co-ordina-tor: Ka-ren Beka-ert (Bel-gium), Maria Krüger-Johnsen (Den-mark)
2021	meg. 27.8c 9a (file name ldb.2 7.8c9 a)	Megrim (*Lepidorhom-bus whiffiag-onis*) in divi-sions 8.c and 9.a (Canta-brian Sea and Atlantic Ibe-rian waters)	-	-	es-ther.abad @ieo.es	Biological parameter	Old maturity ogive	Update the new maturity ogive presented in WD 07 in this report. Statistical method review. Continue with sampling on board fishing vessels in the repro-duction period. Biology/re-production experts in IEO (Rosario Dominguez, Jorge Landa)	Last benchmark WKSOUTH 2014	

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
						Age			last megrim age calibra-tion was an exchange and WK in 2004. Origin of otoliths (spe-cies/stocks) was not specified. (Age range= 2-11 & 13; agreement all readers= 48%)	Exchange will take place in 2020. Jorge Landa is going to coordi-nate it.
						Maturity			No maturity calibration data available for this species. (Assessment uses fixed ogive; BI-OSDEF 1998)	WGBIOP has de-cided to give this a low pri-ority be-cause maturity data are not used, or a fixed ogive is used for all the Lepi-dorhom-bus stocks

Benchmark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coordinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
2021	meg.27.7b-k8abd (file name mgw.27.7b-k8abd)	Megrim (*Lepidorhombus whiffiagonis*) in divisions 7.b-k, 8.a-b, and 8.d (west and southwest of Ireland, Bay of Biscay)			airiondo@azti.es	Biological parameter	Old maturity ogive	Update the new maturity ogive presented in WD 07 in this report. Statistical method review.	Last benchmark IBP Megrim 2016	
						Age			last megrim age calibration was an exchange and WK in 2004. Origin of otoliths (species/stocks) was not specified. (Age range= 2-11 & 13; agreement all readers= 48%)	Exchange will take place in 2020. Jorge Landa is going to coordinate it.
						Maturity			No maturity calibration data available for this species. (Assessment uses fixed ogive; BIOSDEF 1998)	WGBIOP has decided to give this a low priority because maturity data are not used, or a fixed ogive is used for all the Lepi-

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
										dorhom-bus stocks
2021	whg. 27.3a	Whiting (*Merlangius merlangus*) in Division 3.a (Skagerrak and Kattegat)	-	TBD	henrik.sve-dang@slu.se	Biological parameter	Maturity ogive	Maturity studies		
						Age				This stock is cat 5 so no action is needed
						Maturity				This stock is cat 5 so no action is needed
2021	hke.27.8c9a	Hake (*Merluccius merluccius*) in divisions 8.c and 9.a, Southern stock (Cantabrian Sea and	-	TBD	santiago.cervino@ieo.es	growth and mortality	Hake is sex dimorphic species. Accounting for differences on growth, maturity and mortality by sex. Hake is an active cannibal species having a great impact on M at younger classes. Predation by cetaceans too. Growth. Annual length-weight	Explore life history methods to support new parameters figures (Linf, k, M, etc.). Multispecies model combined with life history		

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
		Atlantic Ibe-rian waters)				maturity			WKMSGAD (2013) - overall agreement 78% for females and 75% for males (range 1-3)	
						age				otoliths are col-lected, but age readings are not per-formed, as the level of accuracy is not satisfying to use readings, no action is needed
	hke.27.3a46-8abd	Hake (*Mer-luccius mer-luccius*) in subareas 4, 6, and 7, and di-visions 3.a,			dgarcia@azti.es	growth and mortality	Hake is sex dimorphic species. Ac-counting for differences on growth, maturity and mortality by sex. Hake is an active cannibal species having a great impact on M at younger classes	Explore life-history methods to support new parameters figures (Linf, k, M, etc.)		

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
		8.a–b, and 8.d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay)				maturity			WKMSGAD (2013) - overall agreement 78% for females and 75% for males (range 1-3)	
						age				otoliths are col-lected, but age readings are not per-formed, as the level of accuracy is not satisfying to use readings, no action is needed
2021			-	-		*no issue list available*				

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
	ank.27.78abd	Black-bellied anglerfish (*Lophius budegassa*) in divisions 7.b–k, 8.a–b, and 8.d (west and southwest of Ireland, Bay of Biscay)				Age			WGBIOP waits for the results of the project concerning age validation using otolith microchemistry	results of the project would be available before WGBIOP 2020
						Maturity				
2021	ank.27.8c9a	Black-bellied anglerfish (*Lophius budegassa*) in divisions 8.c and 9.a (Cantabrian Sea, Atlantic Iberian waters)	-	TBD			*no issue list available*			
						Age			WGBIOP waits for the results of the project concerning age validation using otolith microchemistry	results of the project would be available before WGBIOP 2020
						Maturity				
2021			-	-			*no issue list available*			

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
	gur.27.3-8	Red gurnard (*Chelidonichthys cuculus*) in subareas 3-8 (North-east Atlantic)				Age			Study proposal 2011 NO age calibration. lack of regular sampling for red gurnard in commercial landings and discarding to provide series of length or age composi-tions usable for a pre-liminary analytical as-sessment.	This stock is cat 6. WGBIOP could evaluate if age ex-change of by-catch species is valid
						Maturity			no maturity data	
2021	mon.27.78ab	White an-glerfish (*Lophius piscatorius*) in divi-sions 7.b-k, 8.a-b, and 8.d (southern Celtic Seas, Bay of Biscay)	-	TBD			*no issue list available*			
						Age			WGBIOP waits for the results of the project concerning age valida-tion using otolith micro-chemistry	results of the pro-ject would be available before WGBIOP 2020
						Maturity				
2021				TBD			*no issue list available*			

Bench-mark year	Stock code	Species / stock	Proposed WK	WK dates	Stock coor-dinator email	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions	WGBIOP actions
	mon.27.8c9a	White anglerfish (*Lophius piscatorius*) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)				Age			WGBIOP waits for the results of the project concerning age validation using otolith microchemistry	results of the project would be available before WGBIOP 2020
						Maturity				

b) WGBIOP Quality Indicator Table

The table has been split by work flow step:

1. Sampling Design & Implementation (Table 4.b.1)
2. Stock identity (Table 4.b.1)
3. Methods and Definitions (Table 4.b.2)
4. Data Collection Table 4.b.2)
5. Validation (Table 4.b.3)
6. Calibration Table 4.b.4)
7. Stock Assessment (Table 4.b.5)

Following Table 4.b.1 to Table 4.b.5 there is Table 4.b.6 which gives further clarification of the indicators, a grading/evaluation and references to the relevant literature.

Table 4.b.1

			1. Sampling Design and Implementation			2. Stock Identity
			All			All
Expert Group	**Spe-cies**	**Stock**	**Survey Design**	**Design Commercial Sampling**	**Spatial Coverage**	**Mixing Ratio**
			Were possible weaknesses of the survey design critically assessed?	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)	Is the full range of the stock covered by biological sampling? (E.g. evaluate distribution maps of national VMS tracks and commercial samples)	Is there any evidence for mixing? What methods are used to identify stock components? How reliable are spatio-temporal patterns in mixing resolved?

Table 4.b.2

			3. Methods and Definitions			
			Age			Growth
Expert Group	**Species**	**Stock**	**Structure**	**Preparation**	**Birthdate & "Scheme"**	**Growth**
			Documentation of different structures used by country and stock	Documentation of different preparation techniques used by country and stock	Consistency in the definition of the birthdate *(usually January 1st)* and in the interpretation of the seasonality in deposition of opaque and translucent material *(the "scheme")*	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?

			3. Methods and Definitions contd.				
			Maturity				
Expert Group	**Species**	**Stock**	**Structure**	**Preparation**	**Scaling**	**Timing**	**Ogive**
			Documentation of different structures used by country and stock	Documentation of different preparation techniques used by country and stock	Do differences between countries exist*(ed)*? Have different national maturity scales been successfully merged into one international standard?	Is the maturity staging conducted during the whole year or only during a specified period of the year?	If sufficient maturity data are available, then spatially and/or temporally varying ogives can be considered

		Stock	**3. Methods and Definitions contd.**	**4. Data collection**

Expert Group	Species	Sex	All	Natural Mortality	Maturity	Sex
		Coding	**Sex-specific Parameters**	**M**	**Length/age at Maturity**	**Sex Ratio**
		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.	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?	On what information is the value for natural mortality based? Estimated *(based on predator-prey studies)*, extrapolated from neighbouring regions or assumed?	Was length/age at maturity estimated or extrapolated from neighbouring stocks?	Was sex ratio estimated or extrapolated from neighbouring stocks?

Table 4.b.3

Expert Group	Species	Stock	5. Validation					
			Age			Maturity		
			Age Validation	Absolute Bias	Absolute Age Error Matrix	Maturity Validation	Absolute Bias	Absolute Age Error Matrix
			Is there an age validation study available? (*What was the method of age validation?)*	Measure for accuracy in relation to true age (seldom available) *(Quantitative estimate; evaluation stock-specific)*	Probability distribution of repeated measurements relative to true age *(Quantitative estimate; evaluation stock-specific)*	Were gonad stages compared with macroscopic and histological methods?	Measure for accuracy in relation to true maturity *(histological analysis) (Quantitative estimate; evaluation stock-specific)*	Probability distribution of repeated measurements relative to true maturity *(Quantitative estimate; evaluation stock-specific)*

Table 4.b.4

Expert Group	Species	Stock	6. Calibration				
			Age				
			Exchange / Workshop	Relative Bias	CV or APE	% Agreement	Relative Age Error Matrix
			When was the last exchange that included age readers from major data contributors?	Measure for accuracy in relation to modal age *(Quantitative estimate; evaluation stock-specific)*	Measure for precision *(Quantitative estimate; evaluation stock-specific)*	Percentage agreement between age readers *(Quantitative estimate; evaluation stock-specific)*	Probability distribution of repeated measurements relative to modal age *(Quantitative estimate; evaluation stock-specific)*
		Stock	6. Calibration contd.				

Expert Group	Species	Maturity				
		Exchange/Workshop	**Relative Bias**	**CV or APE**	**% Agreement**	**Relative Age Error Matrix**
		When was the last exchange that included maturity readers from major data contributors?	Measure for accuracy in relation to modal maturity *(Quantitative estimate; evaluation stock-specific)*	Measure for precision *(Quantitative estimate; evaluation stock-specific)*	Percentage agreement between maturity readers *(Quantitative estimate; evaluation stock-specific)*	Probability distribution of repeated measurements relative to modal maturity *(Quantitative estimate; evaluation stock-specific)*

Table 4.b.5

Expert Group	Species	Stock	7. Stock Assessment			
			Age	**Maturity**	**All**	**New Parameters**
			Error Matrix	**Error Matrix**	**Sensitivity Analysis**	**New Parameters**
			Variance structure can directly be incorporated into stochastic stock assessment models	Variance structure can directly be incorporated into stochastic stock assessment models	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)	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?

Table 4.b.6 Clarification, evaluation and references for quality indicators (following work flow steps 1-7)

	Biological parameters	Indicator / issue	Clarification	Grading / evaluation	Further reading	Comments
sampling design	all	survey design	Were possible weaknesses of the survey design critically assessed?	0. Quality of biological data not evaluated 1. Preliminary analyses of quality of biological data 2. Detailed analysis of the quality of biological data	e.g. ITBSWG, WGBIFS	
	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	WKACCU, WKPRECISE, WGISDAA, WGCATCH, WGPICS, SGPIDS	
	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	e.g. PGCCDBS	
stock identity	all	mixing ratio	Is there evidence for mixing? What methods are used to identify stock components? How reliable are spatio-temporal patterns in mixing resolved?	0. No evidence 1. No mixing 2. Mixing exists: not accounted for 3. Mixing exists: accounted for, not validated 4. Mixing exists: markers study as a baseline 5. Mixing exists: markers study and poor spatio-temporal coverage of mixing 6. Mixing exists: markers study and good spatio-temporal coverage of mixing	WGSIM	
methods and definitions	age	structure	Documentation of different structures used by country and stock	0. No overview table 1. Overview table available 2. Overview table complete and up-to-date	WGBIOP	
	age	preparation	Documentation of different preparation techniques used by country and stock	0. No overview table 1. Overview table available 2. Overview table complete and up-to-date	WGBIOP	

Biological parameters	Indicator / issue	Clarification	Grading / evaluation	Further reading	Comments
age	birthdate & "scheme"	Consistency in the definition of the birthdate (usually January 1st) and in the interpretation of the seasonality in deposition of opaque and translucent material (the "scheme")	0. No comparisons between labs 1. No differences 2. Differences between labs are known but ignored 3. Differences clearly documented and considered in data compilation	e.g. WKARA 2009, WKARP 2010, WKARDL 2015, WKARA 2016, WKARBLUE2 2017	
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 2. Extrapolated 3. Estimated indirectly 4. Estimated directly		
maturity	structure	Documentation of different structures used by country and stock	0. No overview table 1. Overview table available 2. Overview table complete and up-to-date	WGBIOP	
maturity	preparation	Documentation of different preparation techniques used by country and stock	0. No overview table 1. Overview table available 2. Overview table complete and up-to-date	WGBIOP	
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 1. Differences between labs are known but ignored 2. Chronicle (standard scale) clearly documented and considered in data compilation	e.g. WKMSHS, DATRAS, WKMATCH 2012, WGBIOP 2017	
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) 2. Staging year-round	e.g. WKMSHS	
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 2. Careful selection of a type of ogive 3. Selection of type of ogive based on thorough analysis of all options		

	Biological parameters	Indicator / issue	Clarification	Grading / evaluation	Further reading	Comments
	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 2. International database correct		
	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 samples sizes per strata representative to allow for sex-specific conclusions?	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	WKPLE, WKBALTFLAT	
	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 2. Extrapolated 3. Estimated		
data collection	sex	Sex ratio	Was sex ratio estimated or extrapolated from neighbouring stocks?	0. Not estimated 1. Not estimated but extrapolated 2. Estimated	WGBIOTIM-3	
data collection	maturity	Length/age at maturity	Was length/age at maturity estimated or extrapolated from neighbouring stocks?	0. Not estimated 1. Not estimated but extrapolated 2. Estimated	WGBIOTIM-3	
validation	age	age validation	Is there an age validation study available? *What was the method of age validation?*	0. No validation study 1. Only one method with major limitations 2. Several complementary age validation methods showing similar results	Campana (2001) (Table 1)	

	Biological parameters	Indicator / issue	Clarification	Grading / evaluation	Further reading	Comments
	age	absolute bias	Measure for accuracy in relation to true age (seldom available)	Quantitative estimate; evaluation stock-specific	WKNARC2	
	age	absolute age error matrix	Probability distribution of repeated measurements relative to true age	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	maturity	maturity validation	Were gonad stages compared with macroscopic and histological methods?	0. No validation study 1. Validation by histology available 2. Validation maturity criteria based on histology available	e.g. WKMATCH, WKMSSPDF, WKMSTB, WKMSHS, WKMSMAC, WKMSGAD	
	maturity	absolute bias	Measure for accuracy in relation to true maturity (histological analysis)	Quantitative estimate; evaluation stock-specific	WKNARC2	
	maturity	absolute age error matrix	Probability distribution of repeated measurements relative to true maturity	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
calibration	age	exchange/workshop	When was the last exchange including age readers from major data contributors?	0. No exchange 1. Exchange long time ago and poor results 2. Exchange recently, poor results 3. Exchange long time ago and good results 4. Exchange recently, good results 5. Exchange recently, very good results	WKNARC2, see repository at http://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx	
	age	relative bias	Measure for accuracy in relation to modal age	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	age	CV or APE	Measure for precision	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	age	% agreement	Percentage agreement between age readers	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	

	Biological parameters	Indicator / issue	Clarification	Grading / evaluation	Further reading	Comments
	age	relative age error matrix	Probability distribution of repeated measurements relative to modal age	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	maturity	exchange/workshop	When was the last exchange including maturity readers from major data contributors?	0. No exchange 1. Exchange long time ago and poor results 2. Exchange recently, poor results 3. Exchange long time ago and good results 4. Exchange recently, good results 5. Exchange recently, very good results	WKNARC2, see repository at http://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx	
	maturity	relative bias	Measure for accuracy in relation to modal maturity	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	maturity	CV or APE	Measure for precision	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	maturity	% agreement	Percentage agreement between maturity readers	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
	maturity	relative age error matrix	Probability distribution of repeated measurements relative to modal maturity	Quantitative estimate; evaluation stock-specific	WKSABCAL, WKNARC2	
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 2. New parameters used in assessment		
	age	error matrix	Variance structure can directly be incorporated into stochastic stock assessment models	1. Error matrix not used in assessment 2. Error matrix used in assessment	WKSABCAL, WKNARC2	

Biological parameters	Indicator / issue	Clarification	Grading / evaluation	Further reading	Comments
maturity	error matrix	Variance structure can directly be incorporated into stochastic stock assessment models	1. Error matrix not used in assessment 2. Error matrix used in assessment	WKSABCAL, WKNARC2	
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 2. Two alternative data sets produced and sensitivity runs tested 3. Numerous sensitivity runs with alternative data sets tested		

Annex 5: ToR f

a) Overview of exchanges in SmartDots and issues raised

Name WK/Exchange	SmartDots yes/no	No Participants	Countries involved	If Yes: suggestions for improvements	If No, reason why	General comments
Exchange Turbot and Brill	Yes	7	3 institutes: NL, BEL, FR			
Exchange lemon sole	Yes	11	6			
Exchange Megrim	Yes	10	7 Institutes: MS, CEFAS, IEO, AZTI , HAFOGVATN, ILVO & Marine Institute	Difficult to interpret some plots generated by SmartDots owing to the high number of rings marked (ex: Average distance from centre to winter rings) Would be great to be able to have some more control over the graphical output e.g. axis limits.		importance of international exchanges in ensuring that age reading techniques remain consistent across all institutes
Exchange Plaice 7.h-k	Yes	11	4 Institutes: BEL, FRA, IRL, UK			WGBIOP to Define a framework/roadmap for improved reader agreement, i.e. regular mini exchanges utilising the SmartDots platform, revised protocol, unbalanced sample size for 7h and 7jk divisions
Multicriteria approach for validating first winter ring deposition in Eastern North Sea plaice (*Pleuronectes platessa*) otolith	No	NA	NA.		The study was before the full instalment of SmartDots. With the new feature of length measurements possible in SmartDots, age validation as done in this study should be possible.	

Name WK/Exchange	SmartDots yes/no	No Partici-pants	Countries involved	If Yes: suggestions for improvements	If No, reason why	General comments
WKAREA3 Eel	Yes	33	countries: FR, SP, POR, NOR, SWE, FIN, DEN, IRE, UK, POL, GER, GRE, TUR	Issues with using 0 age when otolith is unreadable (AQ3).		Importance of using a scale and mag-nification on images. Also using the right light for the images.
Age validation of west-ern Baltic cod	No	NA	na		na	
WKARA2 Anchovy	Yes	25	institutes: Thuenen, CEFAS, IFREMER, AZTI, IEO, IPMA, INSTM, CNR, COISPA, IOR, HCMR, FRI	Raw data from SmartDots used in Eltink spreadsheet for better handling. Due to 0 age when otolith is unreada-ble (AQ3). And to get results by differ-ent stocks and by different group of readers. Difficulties due to different birthdays (1. July). SmartDots assigns age to number of winter rings.		
Bass otolith & scale exch.	?	8	countries: UK, FR, BEL	NA	NA	Not started yet due to difficulties choosing reading material
Plaice in 7.fg	Yes	13	countries: FR, BEL, GB, IE, DK	NA		
WKARHOM3		15	IT, FRA, GER, NOR,NDL,GRE, ESP POR, IRL	NA	NA	
WKARMAC2	yes	23	PT, ESP, NDL, GER, DEN, NOR, UK, IRL, FAE, ISL, GRL, GRE	NA	NA	recommends recording the edge of the otolith
WHG 27.4b	Yes	8	4 Institutes:	NA		

b) List of exchanges in SmartDots to date

Link	ID	Name of the event	Purpose	Year	Species	Start Date	Status	Organizer Email
	74	2018 North Sea Norway Pout Age Reading Exchange - Whole and Broken	Age reading	2018	*Trisopterus esmarkii*	10/01/2018	Published	xxxxx@aqua.dtu.dk
	77	2018 North Sea Norway Pout Age Reading Exchange - Sectioned	Age reading	2018	*Trisopterus esmarkii*	11/01/2018	Published	xxxxx@aqua.dtu.dk
	81	Anchovy Exchange 2018	Age reading	2018	*Engraulis encrasicolus*	01/05/2018	Published	xxxxxxxxxxxxxxx@ieo.es
86		Trac Med 2018	Age reading	2018	*Trachurus mediterraneus*	09/04/2018	Completed	xxxxxxxxxx@ifremer.fr
87		Trac trac 2018	Age reading	2018	*Trachurus trachurus*	22/06/2018	Completed	xxxxxxxxxx@ifremer.fr
95		trachurus pict 2018	Age reading	2018	*Trachurus picturatus*	22/06/2018	Completed	xxxxxxxxxx@ifremer.fr
102		PRE-WKARMAC2 Exercise	Age reading	2018	*Scomber scombrus*	03/10/2018	Completed	xxxxxxxxxxxxxxx@ieo.es
104		Black scabbardfish 2018	Age reading	2018	*Aphanopus carbo*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr
105		Greater forkbeard 2018	Age reading	2018	*Phycis blennoides*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr
106		Ling 2018	Age reading	2018	*Molva molva*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr
107		Blueling 2018	Age reading	2018	*Molva dypterygia*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr
108		Greater argentine 2018	Age reading	2018	*Argentina silus*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr
109		Tusk 2018	Age reading	2018	*Brosme brosme*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr
110		Blackspot seabream 2018	Age reading	2018	*Pagellus bogaraveo*	02/10/2018	Completed	xxxxxxxxxx@ifremer.fr

Link	ID	Name of the event	Purpose	Year	Species	Start Date	Status	Organizer Email
112		cod validation	Age reading	2018	*Gadus morhua*	05/09/2018	Completed	xxxxxxxxxxxxxxxx@slu.se
114		Store Tpicturatus Canary Islands Samples	Age reading	2018	*Trachurus picturatus*	06/09/2018	Ongoing	xxxxxxxxxx@ifremer.fr
144		WKARMAC2 calibration exercise	Age reading	2018	*Scomber scombrus*	21/10/2018	Completed	xxxxxxxxxxxxxxx@ieo.es
157		2018 Sole ICES SD 21 & 22	Age reading	2018	*Solea solea*	08/10/2018	Ongoing	xxxxx@aqua.dtu.dk
	159	Age Calibration Exchange for Plaice in 7h-k 2019	Age reading	2019	*Pleuronectes platessa*	01/04/2019	Published	xxxxxxxxxxxxxxx@marine.ie
160		Megrim 6a and 4a	Age reading	2018	*Lepidorhombus whiffiagonis*	01/11/2018	Completed	xxxxxxx@MARLAB.AC.UK
195		2018 North Sea Sandeel	Age reading	2018	*Ammodytes*	18/11/2018	Completed	xxxxx@aqua.dtu.dk
196		workshop 2018 T trachurus	Age reading	2018	*Trachurus trachurus*	07/11/2018	Completed	xxxxxxxxxx@ifremer.fr
197		WKARHOM3 2018 T mediterraneus	Age reading	2018	*Trachurus mediterraneus*	07/11/2018	Completed	xxxxxxxxxx@ifremer.fr
211		Sardine Small Exchange	Age reading	2019	*Sardina pilchardus*	10/02/2019	Completed	xxxxxxxxxxxx@ieo.es
220		SUDOANG//WKAREA 2019	Age reading	2019	*Anguilla anguilla*	08/04/2019	Ongoing	xxxxxxxxxxxxxxxxx@irstea.fr