ICES WGBIOP REPORT 2017

ACOM/SCICOM STEERING GROUP ON INTEGRATED ECOSYSTEM OBSERVATION AND MONITORING

ICES CM 2017/SSGIEOM:08

REF. SCICOM & ACOM

Report of the Working Group on Biological Parameters (WGBIOP)

2–6 October 2017

Sardinia, Italy

ICES CIEM
International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Recommended format for purposes of citation:

ICES. 2017. Report of the Working Group on Biological Parameters (WGBIOP), 2–6 October 2017, Sardinia, Italy. ICES CM 2017/SSGIEOM:08. 128 pp.

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Executive summary

This was the third year for the multi-annual Terms of References (ToRs) for the Working Group on Biological Parameters (WGBIOP). The group met in Cagliari, Sardinia, Italy, 2–6 October 2017. The overall aim for WGBIOP this year was to review the status of current 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.

ToR a) continued in the task of identifying broad sets of new and existing biological parameters that are emerging as critical components of modern assessment. This work is based on a literature review, input from experts, and collaboration with other ICES Working Groups.

ToR b) further dealt with the issue lists for upcoming benchmark species from 2018 and beyond and formulated the Quality indicators for biological parameters. Guidelines for qualitative evaluation of biological parameters and a flow scheme from data collection to stock assessment were also produced.

ToR c) was a generic ToR for the group handling the reviewing of calibration exercises on biological parameters, their outcomes and recommendations for such actions. All the tables containing detailed information about national experts' contacts, stocks handled and techniques used in age reading, were updated and greatly improved. In addition, the guidelines for age reading and maturity exchanges/workshops were updated following the learned experienced from occurred inter-calibration exercises. The WGBIOP Data Quality Assurance Repository (http://ices.dk/community/Pages/PGCCDBS-doc-repository.aspx) is an open source containing all this kind of information and related reports traced back in time.

Under Tor d) a web meeting was held between ICES Secretariat and WGBIOP in order to endorse the implementation of a new template for categorizing the nature of the recommendations and facilitate an operational recommendation-system. This template, integrated into the already existing fields of the ICES database, clarifies the structure of recommendations and the tasks of each participant in the recommendation system facilitating swift and effective replies.

The major focus within ToR e) was on SmartDots, a new software developed by ILVO (Belgium) and taken on board by ICES. A proof of concept of the SmartDots age reading platform was presented during the meeting and received with great enthusiasm. Following the presentations, demonstrations and hands-on time the group officially adopted the SmartDots platform as the tool for age reading exchanges and workshops from 2018 onwards. This tool will facilitate the carrying out and reporting of events related to age reading, making it an easier process with an improved management system for otoliths metadata.

Given that this is the third year of WGBIOP, future needs in line with the ICES objectives and Science plan were identified and a future/alternative work plan was proposed

1 Administrative details

Working Group name

WGBIOP

Year of Appointment within the current three-year cycle

Year 3

Reporting year concluding the current three-year cycle

Year 3

Chair(s)

Francesca Vitale, Sweden

Pedro Torres, Spain

Lotte Worsøe Clausen, Denmark (Year 1 and 2)

Meeting venue(s) and dates

07–11 September 2015, Fuengirola, Malaga, Spain, (30 participants)

10–14 October 2016, Monopoli, Bari, Italy, (26 participants)

2–6 October 2017, Cagliari, Sardinia, Italy, (35 participants, 2 by correspondence)

2 Terms of Reference

- Identify and assess new biological parameters as input to integrated ecosystem assessments and continue the development of methods and guidelines for best practice in the analysis of biological samples providing such parameters meeting end-user needs
- Evaluate quality of biological parameters: Issues, quality indicators and guidelines
- Plan studies, workshops and exchange schemes or other intersessional work related to interpretation and quality assurance of data on stock-related biological variables and review their outcomes
- Address requests for technical and statistical recommendations/advice related to biological parameters and indicators
- Update and further develop tools for the exchanges and workshops (e.g. SmartDots, other statistical tools, age readers/maturity stagers forum)

3 Summary of Work plan

Year 1	Consolidate WGBIOP workplan (ToR 1). Initiate the collation of a) information related to potential new biological parameters; b) Benchmark Issue Lists; c) Guidelines. ToR 57 are generic ToRs and will be dealt with on a yearly basis in WGBIOP
Year 2	Implement the quality indicator for current Benchmarks; develop methods/guidelines for best practice for the computation of the new required biological parameters; further develop the Guidelines in 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

4 Summary of Achievements of the WGBIOP during 3-year term

During the three years mandate of WGBIOP the intersessional work under each ToR has been carried out by designated subgroups. The deliverables defined during the 2016 meeting were discussed on the first day of the 2017 meeting. Below a short summary of the work up to the meeting in 2017 is provided by ToR, and the further development during the meeting is described in Chapter 5.

The overall aim for WGBIOP this year was to review the status of issues, achievements and developments during the three years of WGBIOP and critically assess the workload of each ToR in relation to the group expertise. A major focus of the 2017 meeting was the hands-on exercise of SmartDots, a new software developed by ILVO (Belgium) and taken on board by ICES. The software will facilitate the carrying out of workshops and exchanges related to age reading. The feedback provided by participants during the meeting was necessary before the official launch in 2018.

Given that this is the third year of WGBIOP, future needs in line with the ICES objectives and Science plan were identified and a future/alternative work plan was proposed (see annex 11).

4.1 ToR a)

Given the almost limitless number of potentially new biological parameters and assessment methods, let alone their definitions and calculations, this WGBIOP subgroup had the task to identify broad sets of new and existing biological parameters that are emerging as critical components of modern assessment. This work was based on a literature review, input from experts, and collaboration with other ICES Working Groups.

A descriptive tabulation of biological parameters used in single and multispecies IEA WG was produced and a series of research questions in collaboration with WGSAM were identified**.** These questions were subsequently linked to a set of parameters for which WGBIOP defined the required data. Moreover, a list of prioritized parameters and data were compiled based on what WGSAM members suggested.

4.2 ToR b)

A close communication between this ToR subgroup and stock coordinators during these three years was essential to a) producing the Issue table evaluating biological parameters for upcoming benchmark species and b) formulating the Quality indicators for biological parameters. Accordingly, guidelines for qualitative evaluation of biological parameters and a flow scheme from data collection to stock assessment were produced.

A critical step is to make end-users aware of potential detected problems. In line with this, the subgroup discussed the possibility of flagging potentially inaccurate input data in ICES databases, e.g. DATRAS, Intercatch, RDB.

Two species, i.e. (sole and mackerel) were used as case studies in for qualitative evaluation of biological parameters. WGBIOP 2017 evaluated the results from this exercise.

Achievements

- Issue tables evaluating biological parameters for benchmarks in 20162019
- Quality indicators for "classical' biological parameters
- Flow scheme from data collection to stock assessment

- Proposal for developing a possibility of flagging quality of biological parameters in databases (e.g. DATRAS, Intercatch, RDB)
- Guidelines for qualitative evaluation of biological parameters
- Case studies quality indicators (sole 7 d and mackerel)

4.3 ToR c)

During the past three years a lot of progress has been made under ToR c as follows:

- Annually updated a series of files: The guidelines for age-and maturity calibration workshops; the interactive table of workshops and exchanges; the age-reader and maturity-stager contact lists; and the database of material, techniques and preparation methods by species and areas to fish ageing
- Reported and critically reviewed results from WKs and Exchanges occurred in the previous and current years
- Drafted resolutions for workshops and exchanges to be approved between 2015—2017 and beyond
- Critically reviewed the utility of the Age Readers and Maturity Stagers Fora, and made recommendations, in collaboration with ICES on how to better integrate the most useful elements of these fora in the new SmartDots software
- Managed Task sharing
- Responded to the 102 recommendations received from other expert groups.

The CRR "Handbook of fish age estimation protocols and validation methods" was actioned during the lifetime of WGBIOP. It was successfully written and submitted to the ICES Publications Committee, was edited and is currently being finally proof-read. The CRR will then be sent to editors for last checks before publication. It will in future be part of the preparatory work for exchanges and workshops since these often need input on available validation studies and/or techniques.

4.4 ToR d)

WGBIOP 2015 identified the need to standardize the ICES recommendations system and thus the approach for making recommendations to WGBIOP. A template consisting in an excel spreadsheet with several drop-down menus that allow categorization of the recommendations was created during WGBIOP 2015 and improved during the following years. The template should guide the workshop chair(s) to a description of the issue that allows WGBIOP to reply to it swiftly and effectively. During the three years mandate of WGBIOP this subgroup attained the following:

- Composing an issue list for the ICES recommendation system
- Drafting a flow chart for the flow of recommendations
- Proposing new fields in the ICES database
- Drafting of guidelines for use of the new database
- Presenting the new propositions to ICES, ICES will evaluate the propositions

4.5 ToR e)

In the period 2015—2017, the objective of this ToR was the rescue of WebGR ensuring the continued existence of the tool and having a tool that will make age reading for workshops and exchanges an easier process with an improved management system for otoliths metadata.

During this process, WGBIOP was notified that in 2014 ILVO (Flanders Research Institute for Agriculture, Fisheries and Food) had developed similar software, named SmartDots as an internal solution for managing the age reading data of the Data Collection Framework (DCF).

At WGBIOP 2017 a proof of concept of the SmartDots age reading platform was presented. The proposed SmartDots age reading platform was received with great enthusiasm, hence it was decided to use the SmartDots age reading platform for ICES age reading workshops and exchanges from 2018 on. A steering group will be set up to govern future needs and related budgets to further maintaining the SmartDots age reading platform.

5 Final report on ToRs, Workplan and Science Implementation Plan

This chapter includes a detailed description of progress and fulfilment within each ToR.

5.1 ToR a) Identify and assess new biological parameters as input to integrated ecosystem assessments and continue the development of methods and guidelines for best practice in the analysis of biological samples providing such parameters meeting end-user needs.

During the past three years WGBIOP formed links between the IEA groups requesting information on the availability of new life-history parameters and scientists undertaking data collection. IEA and related groups' reports were reviewed and 159 parameters or groups of parameters in use were identified (WGBIOP 2016, Table 3.1.1). The parameters include: stomach contents data, body condition, hydroclimate, predation, tagging, biogeochemistry, life-history parameters. Moreover, some future/emerging parameters were also identified, including lower trophic levels (phytoplankton/zooplankton abundance), ichthyoplankton (qualitative and quantitative data), recruitment, species spatial patterns, hydroacoustic data, and climate/environmental data. An initial idea to research and apply calculation methods for new biological parameters was not pursued as the groups' expertise was in the scientific and technical aspects of biological parameters.

Given the wide range of potential data currently used in the integrated trend analysis of the IEA's, the aim was for a prioritized list of parameters to be supplied to WGBIOP. As a first case, the greater North Sea ecoregion IEA group initially prioritized the availability of a benthic macrofauna dataset as well as the standard datasets of plankton occurrence (magnitude and composition), bio-chemical data (temperature, salinity, nutrients, etc.), fish stock composition and size. WKIDEA also regarded stomach sample data as an important link between benthic and demersal communities.

An overall prioritization of possible parameters for IEAs was not provided, partly because the IEAs are data driven and can accommodate any relevant time-series of suitable length. Therefore, WGBIOP extended the scope of its interactions to include WGSAM members and consider multispecies models. Responses and published sensitivity analysis indicated that for size-based models the asymptotic maximum length (L_{inf}) and the diet matrix (derived from stomach sample data) had the most impact out of the parameters considered. Diet information, including for top predators, also featured in influential parameters for age-length multispecies models. WGBIOP 2016 (Annex 3) summarized the latest efforts in compiling existing information and sampling plans for stomach data, and WGBIOP will take this forward work on this topic in the next work plan.

WGBIOP also reviewed the life-history parameters required for models to calculate MSY proxies. These are well-defined fisheries parameters from the growth function, length-weight relationship, natural mortality and length-at-maturity. WGBIOP's work on the quality and best practice for age and maturity data collection and estimation continues to address the need to ensure the quality of the underlying data.

Finally, WGBIOP considered developments on fish condition parameters and their potential to contribute to assessment through stock–recruitment and natural mortality estimates.

Overall, WGBIOP now has a set of life-history parameters for future development of methods and best practice. Where IEA groups identify new, high priority requirements for biological data we recommend they continue to liaise with WGBIOP to investigate the availability, quality and best practice for its collection.

5.1.1 Progress during WGBIOP 2015–2017

Intersessionally, WGBIOP continued discussions with the WKIDEA chair and individual WGSAM members on biological parameter needs and priorities. Recommendations relevant to this ToR were also received from the Workshop on Fish Condition (WKFICON), the Workshop to consider MSY proxies for stocks in ICES category 3 and 4 stocks in Western Waters (WKPROXY) and the Working Group on Integrated, Physical-biological and Ecosystem Modelling (WGIPEM).

WGBIOP studied the eight ICES Ecosystem Overviews focusing on their use of biological parameters and any information on data gaps. We also reviewed the ICES ACOM/SCICOM priorities on the *"Further development of ICES operational management and surveillance indicators"* (Doc 3, ACOM/SCICOM/September 2017), "*ICES products for the integrated ecosystem approach*" (Doc 18, SCICOM and ACOM/September 2015), along with previous work describing potential ecosystem data developments (STECF 2005) and requirements (EU 2010). WGBIOP also notes the large amount of work on developing and testing indicators to support ecosystem based management under the DEVOTES project (www.devotes-project.eu), including the DEVOTool catalogue of indicators for the Marine Strategy Framework Directory (www.devotes-project.eu/devotool/).

The information from ICES ACOM/SCICOM is that the next indicators they are looking to be produced are related to biomass and weight, namely: 1) **guild level biomass** (which can be calculated from stock assessment, survey or multispecies models) and 2) the **mean weight at age of predatory or planktivorous fish species from data** (Shephard *et al.*, 2014).

The life-history parameters required for models to calculate MSY proxies are: von Bertalanffy growth function **L_{inf}** (also referred to as L_∞) (mm), von Bertalanffy **k** (yr-1), **Length-weight** a, Length-weight b, **Natural mortality** M (yr-1), and **Length-at-maturity** (mm).

WKPROXY recommended liaising with WGBIOP to ensure that life-history parameter estimates are identified and their sources documented for all ICES stocks regardless of whether either data-rich or data limited. WGBIOP will aim to document sources of these estimates and continue improving the quality of the underlying data as part of the WGBIOP Terms of Reference. Work on fish condition (described below) may provide a way to improve natural mortality estimates.

The ecosystem overviews, as shown in the examples from the Celtic, Baltic and Barent Sea (Annex 3, table 3.1–3.3), confirm the wide range of parameters and indicators seen in the IEA reports. Age, maturity, length and weight data enter the overviews through the outputs of assessments, such as biomass and recruitment. There is also direct reference to spawning times in a specific case. However, the overviews are not designed to highlight data gaps and additional needs. Discussing these lists of existing and potential parameters for IEAs, the situation remained the same as in 2016. IEAs are data driven so they can incorporate many time-series of data and an overall prioritized IEA list was not established.

The priorities for specific multispecies models were clearer. Sensitivity analysis in Thorpe *et al* (2015) indicated that for size-based models the asymptotic maximum length (**L_{inf}**) and **the diet matrix** (derived from stomach sample data) had the most impact out of the parameters considered. Diet information, including for top predators, also featured in influential parameters for age-length multispecies models (Annex 3, table 3.4).

Fish condition

New studies (Lloret *et al*., 2012, 2014) and the highlights from WKFICON indicate that links between fish condition and the life-history traits of exploited species have intrinsic biological and ecological importance to the monitoring and management of marine resources and ecosystems. Two aspects of the stock assessment process should receive increased attention in relation to the potential use of fish condition information in the assessment models:

- Stock recruitment relationships: condition of the recruits reflects the potential recruitment success (Adams, 1999) and the condition of the spawners influences the reproductive potential of the stock (Marshall *et al*., 1999; Kell *et al*., 2016)
- Natural mortality: the bottleneck for this approach is to define a threshold of lethal condition. This can be estimated with experiments, which is a challenge, but we recommend to investigate this issue with statistical-empirical relationships (Casini *et al.*, 2016).

WGBIOP supported the recommendation from WKFICON to improve data collection of appropriate fish condition measurements, as this will allow development of the topic. Specifically, we recommend that existing surveys and data collection programmes investigate options for sampling to provide data on fish condition, taking into account available resources. The WKFICON report (Table 5.3.1) lists species and which measurements are recommended for each species from the list: **total length**, **total weight**, **eviscerated weight**, **liver weight**, **gonad weight**, visual score of **perivisceral fat,** and **fatmeter measurements to easily estimate total lipid content**. We note that these data collection could be eligible under the DCF provision for pilot studies. WGBIOP conditionally support establishing a working group on fish condition (WGFICON) depending on the availability of new data on fish condition for stock assessment.

WGIPEM aimed to liaise with data provider groups to identify how parameters related to bioenergetics (e.g. energy contents) could be collected and made available to bioenergetics modelers, when parameterizing and validating the models. This aim needs further detail; therefore, we will initially make them aware of the developments in fish condition studies, including methods to collect data such as lipid content.

Data, quality protocols and calculation methods for L_{inf}

In the ICES region the DATRAS database is the main source for trawl survey age and length data that can be used to calculate L_{inf}. (http://www.ices.dk/marine-data/data-portals/Pages/DATRAS.aspx) The data should include older fish, with lengths approaching the asymptotic length to improve the accuracy of L_{inf} . The associated survey manuals describe the required protocols for length measurements. Care is required to use the specified standard for the length measurement taken, e.g. total length or fork length, and the method for rounding measurements.

Calculations methods for fitting growth curves are widely available but for any approach to calculating growth curve parameters the sampling scheme used needs to be considered. If sampling is random, growth curves will represent the population. If length-stratified sampling is used then this must be accounted for. A recent development (Spence & Turtle, 2017) to fitting the von Bertalanffy growth function is a method that estimates the actual age of each fish instead of assuming they all have the same birth date. This allows multiple surveys to be combined and can reduce the uncertainty in the growth parameters. The method requires information on spawning times; maturity staging workshops provide this information which can be used to check and update the published values used. If further developments can be made to the method to account for length-stratified samples this will make it a valuable approach for providing new estimates of growth parameters.

Data and quality protocols for diet matrices

WGBIOP 2016 Annex 3 dealt specifically with stomach data collection and quality protocols, summarizing work that compiled existing information and sampling plans. An important recent development is the **ICES fish stomach database** (http://www.ices.dk/marine-data/data-portals/Pages/Fish-stomach.aspx). An update of North Sea data in these database is scheduled to be released in the next three months. These historic data were stored in a range of formats, so there is a need to use a standard format for recording and uploading new data. There is currently some national data collection for stomach samples and some DCF pilot studies are proposed so it would be advantageous to coordinate the approach these studies used.

WGBIOP discussed how to coordinate sampling, recording and data collection for stomach sampling. We concluded there was not sufficient overlap with age and maturity expertise to carry this out solely within WGBIOP so as will investigate developing a separate workshop on fish stomach sampling and data use.

Pilot studies on ecosystem effects in DCF National Work Plans 20172019

In accordance with the EU Multi-Annual Programme on Data Collection for 20172019 (EU-MAP, Commission Implementing Decision 2016/1251), Member States are requested to collect data *"for estimating the level of fishing and the impact of fishing activities on marine biological resources and on marine ecosystems, such as effects on non-commercial species, predator-prey relationships and natural mortality of fish species in each marine region.*

These data shall be first assessed within pilot studies. Based on the outcomes of these pilot studies, Member States shall determine future data collection specific for each marine region, coordinated at marine region level and based on end-user needs."

This means that **in future, new datasets on e.g. stomach contents and the effects of fishing on the ecosystems will be available for end-users of these data**. The (regional) coordination of the sampling or data acquisition, however, will have to take place in the relevant fora, such as Regional Coordination Groups and survey planning groups, in collaboration with the data end-users.

5.1.2 Workplan for 2017–2018

WGBIOP aim to review the current estimates of life-history parameters required for models to calculate MSY proxies as used by WKPROXY and subsequent WKLIFE meetings. These are: von Bertalanffy growth function $\mathbf{L_{inf}}$ (also referred to as L∞) (mm), von Bertalanffy **k** (yr–1), **Length-weight** a, Length-weight b, **Natural mortality** M (yr-1), and **Length-at-maturity** (mm). We will look to liaise with WKLIFE scientists to work towards documenting sources of these estimates and, through our other ToRs, continue work on improving the quality of the underlying data.

WGBIOP will investigate current or proposed national plans for sampling fish stomachs with the aim of developing a workshop on fish stomach sampling and data use in 2019. This workshop will take into account the first output from national pilot studies both for the Atlantic and Mediterranean context. In the next meeting ToRs and preliminary program will be provided. These plans will be developed with input from WGSAM to consider the data requirements for multispecies models.

We will liaise (mail and/or web meetings) with the Working Group on Integrated, Physical-biological and Ecosystem Modelling (WGIPEM) to better understand their data requirements for parameters related to bioenergetics (e.g. energy contents). Initially WGBIOP will provide information on the developments in fish condition studies, including methods to collect data, such as lipid content, which are the outcome of the Workshop on fish condition (WKFICON).

5.1.3 Deliverables for 2018–2020

WGBIOP will liaise with WKLIFE scientists to deliver improved documentation and data for life-history parameters required for proxy assessment models. WGBIOP will also develop proposals for how length-at-maturity and growth curve parameters could be considered within maturity staging and age-reading workshops.

To address the need for improved diet matrix information for multispecies models, WGBIOP will report on current or proposed national plans for sampling fish stomachs. WGBIOP will assess the case for a workshop on fish stomach sampling and data use. If there is a good case, the aim is to deliver this workshop in 2019.

As this ToR extends the scope of WGBIOP past its substantial role in ToR c) of "planning studies, workshops and exchange schemes and other intersessional work related to interpretation and quality assurance of data on stock-related biological variables", the deliverables may evolve during 20182020.

5.2 ToR b) Evaluate quality of biological parameters: Issues, quality indicators and guidelines

This ToR was designed to 1) evaluate issues for upcoming benchmark species, 2) formulate quality indicators, 3) produce guidelines how quality indicators can and at which point they should be inserted in the ICES benchmark flow. Two case studies were carried to further develop the deliverables of this ToR.

5.2.1 Quality issues and indicators

The biological parameters collected from shared stocks within the EU data collection framework (DCF) are part of a complex work flow from field sampling (commercial catches, fisheries-independent surveys), analysis and estimation of biological parameters to model outputs from stock assessment that are used in advice for decision-makers.

The quality of the biological parameter estimates is not only influenced by the precise and accurate determination of e.g. age or maturity stage itself, it is also affected by previous work steps (e.g. statistically sound catch sampling schemes, quality of scientific survey) and subsequent procedures (e.g. raising procedures). The consequences of poor biological parameter estimates on the fish stock assessment are often inadequately evaluated. Therefore, we developed a quality indicator scheme covering the entire work flow from the data collection to the stock assessment model runs. The source of errors and work flow was subdivided into six topics:

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

Each of the six topics is briefly specified below. The focus of WGBIOP is on topics 35 and within these topics the current emphasis is on age and maturity. In future this will be elaborated to other biological parameters like M and growth and, if applicable, to new biological parameters (see ToR a).

Annex 4, Table 1 contains quality issues and indicators. For each of the six topics, one or more items were listed (e.g. topic "Calibration" with the items relative bias, CV or APE, % agreement, age error matrix). For each item there is a short clarification and for most of the items a grading/evaluation scheme is proposed. The quality indicators will be further developed in the following 3year period. Furthermore, it is necessary to cross-reference with the most recent STECF report on quality assurance for DCF data (STECF, 2017).

1. Sampling design

The use of a statistically sound national catch sampling scheme is the crucial starting point of any data collection. Clear definitions of primary, secondary, tertiary sampling units etc. are needed. The new EUMAP annual work plans will contain this information by country. The work plan will be evaluated by the STECF and their evaluation can be used to assess the quality the national data collection schemes. There should a focus on countries with major TAC of a particular stock.

Fisheries-independent surveys are usually quality-controlled. Statistically sound sampling is usually accounted for by survey working groups, yet there may be shortcomings that may require re-evaluation (e.g. biased or incomplete coverage of subdivisions with biological samples). If a country with minor TAC covers a large area of the scientific survey, a problem in age reading in this country may not have a large effect of the numbers-at-age of the commercial catches but will have a large effect on the age data of the survey indices.

2. Stock identity

If there is evidence of mixing between stocks, researchers should account for this uncertainty in the sampling and the subsequent processing of biological parameters. Efforts should be put to assign fish individuals to their stock of origin to reliably determine spatio-temporal patterns in mixing. Mixing ratios of different spatial and temporal scale could be produced. The use of different stock identification methods are

advised, genetics often providing the baseline. The ICES SIMWG (Stock Identification Methods WG) deals with methods for identification of different stocks.

3. Methods and definitions

In shared stocks, problems may arise by simple differences in routine methods to determine e.g. age or maturity stage between the countries involved in fish stock assessment. This may involve for instance the use of different maturity scales, codes for sexes, birthday definitions, or ways of preparing otoliths. There may also be historical changes in methods that need to be taken into account when preparing long-term dataseries. Accounting of these differences is important to assure the quality of data compiled from different countries.

4. Validation

Validation studies are the backbone to provide accurate estimates of biological parameters such as fish age (Campana 2001). Age validation studies (e.g. mark-recapture studies, daily increment analysis, chemical analysis) are usually costly and consequently have not been carried out for many fish stocks. Validation of maturity staging can be achieved more easily by comparing macroscopic and histological methods.

5. Calibration

Exchanges and workshops usually determine the level of agreement between age readers or maturity stagers for a selection of hard structures or gonads. The level of agreement is then considered to be representative of the routine work of the experts when analysing hard structures or gonads in their national laboratory. Several metrics are used to determine the level of (dis-)agreement between experts.

The multiple age/maturity determinations from an exchange or workshop can be used to construct an error matrix. This probability distribution of repeated measurements can be estimated relative to true age/maturity if validated material is available. If true age/maturity is unknown then usually modal age is used.

6. Stock assessment

Until recently, stock assessment models did not often include errors in estimates of biological parameters in stock assessment. There can be several sources of error, including sampling error and age reading error. The latter can be expressed in the form of an age error matrix (AEM), which is generated from a sample of otoliths that have read by several ageing experts as part of an exchange or a workshop.

WKSABCAL (ICES, 2014) highlighted usefulness of error matrices to quantify the uncertainty in aging and maturity staging. While an error matrix can be easily produced, it is not easily incorporated stock assessment calculations. The stock assessors may have to be convinced and the stock assessment model may have to be adapted to allow for incorporation of an error matrix, or an alternative model applied.

The use of an AEM directly in a stock assessment model requires caution. As mentioned above, the AEM is generated from a sample of ages. However, the ages are distributed in the stock in different proportions to those used in the exchange. Furthermore, the weight of different age readers in the exchange may not reflect their weight in the raised input data for a stock assessment. An age error matrix can alternatively be used in sensitivity analysis. This means that applying the average AEM to the stock numbers-at-age does not correctly take account of incorrect ageing. Furthermore, the average AEM ignores any relative bias between individual readers. Thus, AEMs should ideally be included at the biological parameter estimation stage rather

than at the stock assessment stage, along with other potential sources of error (e.g. sampling error). Also, AEMs should perhaps be calculated and applied on an individual basis, to account for individual age reading errors. Without this approach, we consider that the AEM should only be used in a sensitivity analysis of the model output to input parameters.

The influence of different datasets can be assessed by sensitivity runs of the stock assessment model. This usually involves leaving out certain datasets (e.g. survey series, recreational fisheries) to assess their effect on the stock assessment outcome. Sensitivity analysis can also be carried out using a simulated population and alternative estimates for biological parameters based on for example an age error matrix. Parameters such a M and growth can be key parameters used in stock assessment. However, their estimation is often challenging and estimates other than those ultimately used in the assessment could also be considered. Therefore, a critical evaluation of these parameters using sensitivity may be advisable.

5.2.2 Flagging data in international databases

WGBIOP recommends that the ability to flag issues with data, and to record quality indicators is incorporated into databases. WGBIOP plans to work with ICES data centre to consider how these can be included in ICES databases such as DATRAS, InterCatch, RDB etc.

5.2.3 Benchmark issue tables

Issues regarding biological parameters were evaluated as a kick off towards defining quality indicators and guidelines. The issues tables were created in a two-step process. Issues put forward by assessment WGs for stocks up for benchmark were collated ("top–down" approach). Secondly, survey and assessment group reports were screened for issues ("bottom–up" approach). Due to time-constraints the "bottom–up" approach was only carried out partly in 2016 and 2017. During the creation of the issue tables it became evident that some issue lists and stock annexes were missing. This was reported in 2015 to ACOM. This missing information prevents a proactive approach to advance issues with biological parameters.

It was stressed that the issue tables should contain well-defined and simple descriptions in order to make them comprehendible for outsiders. The structure of the issue tables were therefore revised each year and finalized in 2017.

Issues, where WGBIOP information could aid the assessment, were indicated separately and the responsibility for communicating this information to the stock coordinators was divided among WGBIOP participants. Replies from stock coordinators were collated intersessional and reported in the WGBIOP report in the following year. Most of the stock coordinators replied that information supplied by WGBIOP was very helpful. As a result many of WGBIOPS suggestions were taken into consideration. However, it should be stressed that not all stock coordinators replied.

Issue tables from 2015 and 2016 and replies from 2015 are reported in the WGBIOP reports (ICES 2015, 2016). The stock coordinator replies from 2016 can be found in Annex 4 Table 2; the issue table created in 2017 can be found in Annex 4 Table 3.

5.2.4 Guidelines for creating benchmark issue tables

This chapter describes the different steps to follow for the creation of benchmark issue tables.

1) Acquire overview list of upcoming benchmarks from ICES (former Benchmark Steering Group (BSG))
2) Collating issue lists put forward for upcoming benchmarks from the ICES (former BSG SharePoint).
3) Screening issue lists for biological parameters ("top–down") (Annex 4 Table 3)
4) Screening survey and assessment group reports for issues of biological parameters ("bottom–up") (Annex 4 Table 3)
5) Screening WGBIOP workshop reports for issues and advice on biological parameters ("bottom–up") (Annex 4 Table 3)
6) Based on step 3,4 and 5 create issue tables, using the quality issues and indicators definitions table (Annex 4 Table 1)
7) Indicate for each issue if the stock coordinator should be contacted.
8) Contact stock coordinators.
9) Collate replies from stock coordinators (Annex 4 Table 2)

5.2.5 Case studies

Two species were identified for the case studies, sole 7 d and Northeast Atlantic mackerel. Stock assessors and statisticians were contacted and asked if they could attend the WGBIOP meeting in 2016 to further develop these case studies. However, no one was available. It was decided to create issue tables for these species and for sole it was also trialled to create an age error matrix. This information was sent to the stock coordinators and assessors.

Sole 7 d

Although the initial plan was to also include such a sensitivity analysis for Sole 7 d, it was noted that as the agreement for sole ages is high, the effect on the assessment will be small. Therefore WGBIOP 2017 agreed not to progress this analysis further at this stage.

Mackerel

In 2016 issues and advice concerning biological parameters were collated (ICES, 2016). Both the stock coordinator and assessor were contacted with a request for comments on usefulness of the issue table and advice from WGBIOP for the benchmark and assessment.

Extensive comments were received, some were useful while others were informative but did not aid the benchmark. Specific remarks on the biological parameters are given below.

<u>Maturity</u>

Very useful information, since it combines data from different institutes. Having a reference to a table allowing for standardization across countries is very useful. This however influences the calculation for the maturity ogive used only for the western component. For the two other components constant ogive, defined a long time ago, are

used, but it is unclear if the basis can still be considered valid, or if new information is available.

Natural mortality

As WGSAM only considers North Sea species, mackerel is not included otherwise the information of natural mortality in the WGSAM table would have been considered.

Precision of ageing

Information on precision of ageing is useful too although this is not something that is used currently in assessment models (some models such as stock synthesis can use this information). What would be useful is an estimate of the uncertainty on the catch-at-age data, especially knowing if the data for some age class is more uncertain than for others.

5.2.6 Work plan for WGBIOP 2018–2020

This ToR will build further on the results delivered in 2017.

- Moving from qualitative to quantitative quality indicators. A separate workshop with WGBIOP participants (ToR b) and assessors for test case for quantitative quality indicators will be organized (See Annex 4). The key requirement for a case study is to have either a stock assessor, or a developer of a stock assessment model, interested in testing models to incorporate the quality indicator data or information. Mackerel is identified as a study case for such a workshop in 2018, to build further on the results from WGBIOP 2015–2017. A second workshop might be considered for another species in 2019.
- Continue preparing issue tables and recording feedback from stock coordinators. Positive feedback was received on the issues raised and advice given by WGBIOP on the biological parameters. This will therefore be continued.
- Continue developing quality issues and indicators. With new biological parameters incorporated in advice the quality issues and indicators table will be expanded.
- Update generic guidelines for the evaluation of the quality of biological parameters. The current guidelines will be expanded.

5.2.7 Deliverables for 2018–2020

The current generic guidelines for the evaluation of the quality of biological parameters will be updated using the information and expertise obtained over the past three years. However, this will be a continuous development as our knowledge in these fields will increase with time.

Milestones

- Evaluation of issues put forward by assessment WGs for benchmark species in 2019, 2020, 2021 and 2022
- Consolidate quality indicators for biological parameters
- Case studies from workshops
- Generic guidelines

5.3 ToR c) Plan studies, workshops and exchange schemes or other intersessional work related to interpretation and quality assurance of data on stock-related biological variables and review their outcomes

ToR c is a generic ToR for the group and is part of the WGBIOP remit building on the work that was done in PGCCDBS and WKNARC previously. It looks to; Plan studies, workshops and exchange schemes and other intersessional work related to interpretation and quality assurance of data on stock-related biological variables and review their outcomes. This work done at WGBIOP supports the ICES Strategic Plan 20142018, particularly under Pillar 1 "Building a Foundation of Science "and has relevancy to all the goals set out therein.

The ToR covers the following points:

1) Annually update a series of files: The guidelines for age-and maturity calibration workshops; the interactive table of workshops and exchanges; the age-reader and maturity-stager contact lists; and the database of material, techniques and preparation methods by species and areas to fish ageing.

2) Report and review results from WKs and Exchanges occurred the past and current year

3) Draft resolutions for workshops and exchanges to be approved for 2017 and onwards

4) Respond to the recommendations received from other expert groups

5) Ad hoc issues

Additionally, WGBIOP is keen to interface with the RCGs and the LM to ensure good information flow between these groups and WGBIOP, thus recommendations and views from these groups were also discussed during the three years. A general request from the LM 2014 was to develop a procedure for annual interim calibration in National laboratories delivering age data to stock assessment. Such procedures are outlined in the report from WKNARC2 (ICES, 2013). WGBIOP strongly encourages National Laboratories and age readers to follow the guidelines to implement annual interim calibrations.

5.3.1 Progress during WGBIOP 2015-2017

Annually updated files

The Age Readers Contact List has been reviewed and updated annually and has now become an established and valuable resource for anyone within the scientific community, involved in running exchanges and workshops. The contact list is uploaded annually on the documents repository. After discussions with the SmartDots team and with ICES, it is envisaged to incorporate these contact details into the new SmartDots software, which, it is hoped, will become the commonly used tool for managing exchanges and workshops from 2018 and beyond. The Maturity Stagers Contact List was also maintained and updated. This contact list is also uploaded annually on the documents repository.

The Material, Techniques and Preparation Methods Table was updated annually. This document can be accessed through the documents repository, under ageing manuals. As ICES updated the Ecoregions in Feb 2017, major changes were made to the Ecoregions in the table to correctly represent the ICES statistical areas described for

each. There was a very high response rate from national ageing coordinators in 2017, resulting in slight changes for the majority of national laboratories. A few additional institutes were also added to the table due to new responses.

During WGBIOP an update was made to the "Past workshops and exchanges and other workshops with relevance for biological parameters" table, which can be found in Annex 7. This table details all the age and maturity workshops and exchanges that occurred, or are ongoing, or planned for the coming year. The most updated version can be found in the Data Quality Assurance Repository.

The Guidelines for Age Calibration Exchanges and Workshops and Maturity staging workshops were updated annually. The updated guidelines can be accessed under Guidelines, in the documents repository. They were again updated in 2017, to take into account developments in relation to Smartdots, replacing WebGR. Guidelines were added on how to communicate results from maturity staging workshops with the ICES data centre for implementation if necessary. As well as emphasizing to workshop participants the need to report and implement agreed conclusions from the workshop in the national institutes.

Review of past and proposal of future Workshops and Exchanges

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 WGDATA and ACOM/SCICOM for consideration. Exchanges and workshops are therefore usually planned more than a year before they are supposed to take place. WGBIOP reviews the suggestions for exchanges and workshops in relation to the needs of the data-end-users.

During WGBIOP 2017 Results from past exchanges and workshops were reported and critically reviewed. Recommendations from the outcomes of these reports were evaluated (Annex 5), including proposals for future age calibration workshops from exchanges/workshops held during 20162017. Draft resolutions for suggested Workshops/exchanges using the Recommendation system in ICES were made if endorsed by WGBIOP and can be found in Annex 6.

Additionally, in June 2017 WKBIOPTIM (Workshop on Optimization of Biological Sampling at Sample Level) took place. The workshop focused on practical aspects of sampling effort analysis and was proposed as a joint workshop between WGBIOP and WGCATCH so that effective communication between the groups could be established. A summary of WKBIOPTIM can be found in Annex 6.

Age Readers and Maturity Stagers Fora

A discussion took place on the future of the Age Readers and Maturity Stagers Forum. The Age Readers Forum (ARF) was originally envisaged to be a "One Stop Shop" for all those involved in age reading. It was thought that the forum would provide an important resource for training of new age readers, as well as providing opportunities for sharing and discussing existing age reading manuals, establishing standard operating procedures, and standardizing preparation and interpretation methods. The site was to include the following information:

- The contact details and a mailing list of age reading coordinators as well as those engaged in age reading of fish species in the various European laboratories.

- A home for reference collections of annotated images of otoliths of agreed age.
- A calendar of upcoming exchanges/workshops
- A link to the PGCCDBS documents repository.
- PGCCDBS guidelines for otolith exchanges and workshops.

The SharePoint was established almost 8 years ago but has never been widely used despite the ageing and maturity communities agreeing that it is a good idea to have such a forum. The information contained there at this stage, is quite outdated, making the site virtually redundant.

Having a central repository of: internationally agreed age reading/maturity staging protocols, contact details for age readers/maturity stagers with the stocks they read and their level of expertise, A single location for workshop reports, and the resulting reference collections of both age and maturity images, is still seen as a very positive and necessary resource.

However, as the past 8 years have clearly demonstrated this forum, does not work as a stand-alone concept, and must be integrated with whatever is the widely used software for managing exchanges and workshops, i.e. SmartDots.

Task sharing

The possibility for task sharing between National laboratories was discussed on foot of- feedback from the RCGs in 2016. WGBIOP endorses the principle of task-sharing and suggests that collaborative studies to standardize age reading and the development of cooperation between national institutes on a regular basis would be an essential tool for improvement of age data quality. The mechanizm for task sharing is established through bilateral agreements between National laboratories and WGBIOP acts mainly act as a facilitating organ, where new bilateral agreements are discussed between National age-reader coordinators and then consolidated in the respective laboratories by the appropriate decision-makers.

Recommendations

A total of 102 recommendations were addressed to WGBIOP, during this period and each recommendation was discussed and appropriate actions were taken or proposed during the annual WGBIOP meetings. This included filling in the 'Final recipient action' column in the ICES Recommendations database. WGBIOP

Ad hoc issue: maturity scales

Investigations into the maturity data in the ICES database (DATRAS) brought to light that countries are using different maturity scales when reporting their data to ICES. As a consequence maturity data in the ICES databases, consist in a mixtures of scales where the same stage numbers have not the same biological meaning and thus should not be combined. In 2012, WKMATCH proposed an international agreed maturity scale that has been used by all the following maturity staging workshops and yet never put forward or implemented in the ICES databases. This highlights the need for an implementation plan for international agreed maturity scales, so that in the future all maturity data are uploaded in the same maturity scale. In order to tackle this issue WGBIOP proposes a workshop (WKASMSF; Annex 6) in order to create a historical overview of used maturity scales, conversion tables between the various scales and a plan for the implementation of one internationally agreed scale. This plan will need to

be supported by the various expert groups delivering maturity data as well as assessments and expert groups utilizing the data and ultimately SCICOM, ACOM and the ICES data centre.

5.3.2 Workplan for 2017–2018

WGBIOP approached PGDATA for a dialogue on how to evaluate suggested workshops/exchanges for stocks where the need for age-based data may not be urgent in terms of cost–benefit considerations. Both groups agreed on setting the priority level for new exchanges and workshops following the benchmark planning.

Hence, the future working plan for WGBIOP Tor c will be based on a collaboration with ToR b dealing with future benchmarks. The list of stocks to be benchmarked in 2019 and onwards (and have a data compilation workshop in 2018 and onwards) will be used as a baseline for priority.

Additionally, if a stock assessment WG discovers an issue, which requires immediate action to be taken, it can be necessary to diverge from the normal procedure in order to promptly react to sudden problems and provide fast response. In this case WGBIOP will pledge with a "fast-track" calibrations.

WGBIOP will work closely with the ICES secretariat in order to update the repository with all the final files from 2017 and all the links therein.

Routines for monitoring the quality of age and maturity are currently based on national protocols and need to be standardized. Devise and implement best practice guidelines for quality assurance on a regional level will be thus the focus of future workplans for WGBIOP. Standardized procedures will facilitate National Laboratories in their routine work allowing WGBIOP to provide a standardized framework that national laboratories can adapt as appropriate, based on national set – ups. Furthermore it will help to facilitate accurate international comparisons of age readers' and maturity stagers' skills.

Also, validation is essential to ensure the accuracy of biological data used as input for assessment. Hence there will be a new ToR in the next WGBIOP workplan dedicated to identify the need for validation studies, assigning priorities and improve training and quality assurance of age reading and maturity staging.

5.3.3 Deliverables for 2018–2020

Yearly provision of a prioritized overview of planned studies, workshops and exchanges will be delivered to PGDATA for review

WGBIOP will aim to have the annual updates of files done prior to the 2018 meeting in order to facilitate a smooth process. Likewise, the subgroup will present an overview of recommendations and possible actions at the beginning of the 2018 meeting allowing for inputs in the initial phase of handling the recommendations.

WGBIOP will review the current national procedures for quality assurance and finalize the guidelines for standardizing intercalibration procedures, outlined during WKNARC2 (ICES, 2013) for National Laboratories making them available on the repository.

5.4 ToR d) Address requests for technical and statistical recommendations/advice related to biological parameters and indicators

5.4.1 Progress during WGBIOP 2015-2017

In 2015 it was decided that WGBIOP would develop a template for categorizing the nature of the recommendations to facilitate an operational recommendation-system. It was suggested that a recommendation template should be developed to clarify the structure of recommendations and the tasks of each participant in the recommendation system. The need was identified to standardize the approach by making recommendations to WGBIOP so that 1) the group understands clearly, what was intended and 2) the correct person(s) are identified to take the recommendation forward.

In 2016, other issues were also identified: a) chairs are often not aware of the recommendation table that they should fill in; b) the recipient doesn't get any feedback if the answer to a recommendation meets the expectations. Also, to avoid the possibility that chairs would have to fill in two templates (the new one and the ICES actual template), a new approach was investigated, and the previous version of the template (2015) was further developed (see report WGBIOP 2016 for new template and guidelines), following the principles shown in a flowchart (Figure 1) and integrated into the already existing fields of the ICES database. Due to changes in chairs of the WGBIOP and personnel changes at the ICES secretariat, the task to present the proposed changes was not taken up intersessionally.

During WGBIOP 2017, contact was made with the ICES Secretariat (Lotte Worsøe Clausen) during a Webex meeting to discuss how this issue could be taken forward within ICES. Lotte promised to contact the responsible person for the recommendation database at ICES and discuss the proposed changes. She will give feedback intersessionally after having consulted this person.

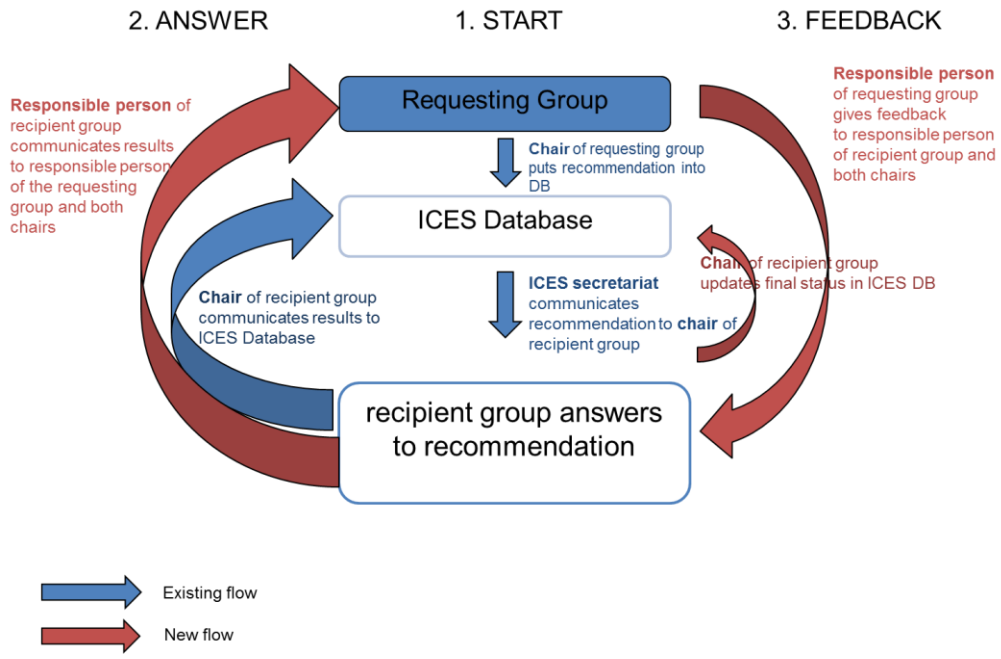

Figure 5.4.1: Flowchart for recommendation database

Furthermore, a discussion was held between with ToR b on how calibration studies (exchanges and workshops) and validation studies could be integrated in the benchmark cycle.

In case continuous ageing (or maturity) problems have been identified in a stock with no help from the age reading calibrations (exchanges and workshops), a validation study could/should be suggested. However, there is often not enough time to use results in the nearest benchmark, as funding is needed and e.g. a tagging study may take years. Thus, the validation studies may not be useful directly in the connection of benchmarks.

Calibration studies are carried out on a regular basis and can be integrated in the benchmark cycle. ToR c is responsible for the planning of exchanges and workshops and will take the benchmark cycle into account. For the stock assessors, it is however good to know the uncertainties observed in calibration studies. Therefore, it was decided to make summary reports of exchanges and workshops which will be send out to the stock assessors. In that way, they will be aware of uncertainties in the biological data.

5.4.2 Workplan for 2017–2018

As mentioned above the development and implementation of a test integrated database originally planned to happen last year was instead discussed this year between WGBIOP and ICES. Hence, WGBIOP 2018 will potentially be able to receive feedback and revise the database and user's guidelines.

The work plan will also depend on the received requests on technical and statistical recommendations.

As mentioned in section 5.3.1. a Workshop on Optimization of Biological Sampling at Sample Level (WKBIOPTIM) took place in June 2017. The workshop focused on practical and quality aspects of sampling effort analysis and was proposed as a joint workshop between WGBIOP and WGCATCH so that effective communication between the groups could be established. WKBIOPTIM identified considerable margin to optimize the sampling effort of some of the case-studies presented without compromising the quality of the data to be used by the end-users. Some possible quality indicators were discussed but a full evaluation and additional quality indicators for length frequency data and other biological parameters are required. WKBIOPTIM2 is proposed and input from WGBIOP and WGCATCH is being requested with the aim of including additional quality indicators in future updates of the R-scripts which are produced at the workshop. WKBIOPTIM will be dealt with within this ToR in future.

5.4.3 Deliverables for 2018–2020

The deliverables for 2018−2020 for this ToR, depend on whether the test database will be built. In this case, clear communication between ICES and all chairs of workshops/working groups/study groups would be necessary. Then, full implementation of the database could be possible. A system of automatic e-mails sent to a chair would be useful e.g. when a new recommendation is made for the respective working group.

The deliverables will also depend on the received requests on technical and statistical recommendations.

5.5 ToR e) Update and further develop tools for the exchanges and workshops (e.g. SmartDots, other statistical tools, age readers/maturity stagers forum)

5.5.1 Progress during WGBIOP 2015-2017

The original focus of this ToR was the rescue of WebGR, a set of Open Source web services developed within an EU tender project in 2008 to support studies of fish growth (age) and reproduction (maturity). In 2015 AZTI, hosting WebGR with no cost for the users, could not give any warranties on the availability of the tool after 2015 due to security flaws of the old software.

Major security flaws were identified by AZTI in 2015 resulting in the drafting of a rescue plan during WGBIOP 2015 (see the report for a detailed description of the rescue plan). WGBIOP 2015 outlined a proposal for the upgrade of WebGR but concluded that getting the service up to an acceptable level was a costly and lengthy process. The rescue plan was implemented in March 2016, in order to avoid the expected total shutdown of WebGR.

At PGDATA 2015 the chairs of WGBIOP were approached by Belgian colleagues and informed of similar software developed by ILVO (Flanders research institute for Agriculture, Fisheries and Food) in 2014. The software was used as an internal solution for managing the age reading data of the Data Collection Framework (DCF).

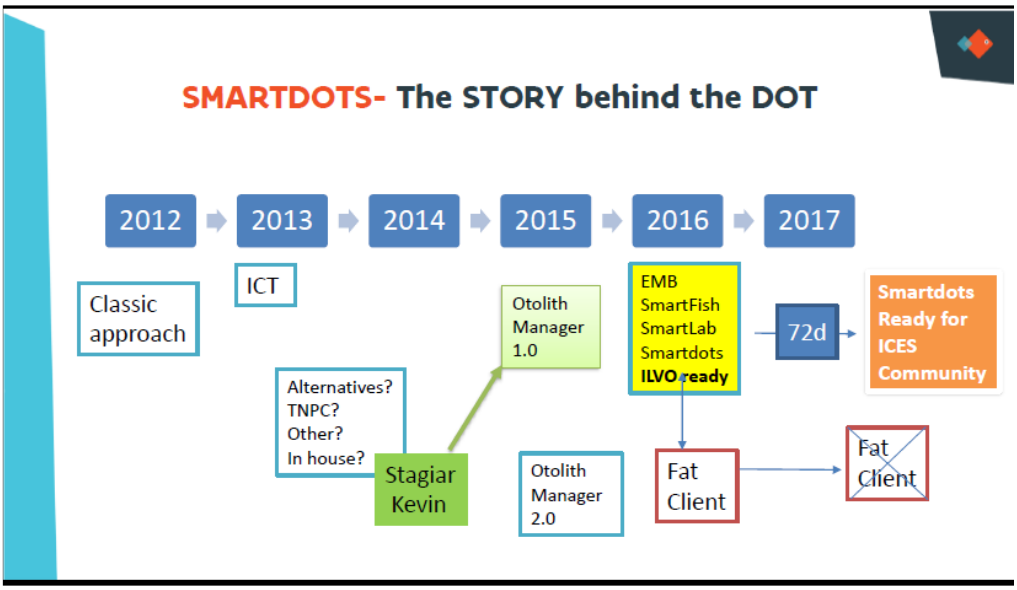

Figure 5.5.1: Development of SmartDots from internal use ILVO towards SmartDots International (open source).

ILVO presented their internal SmartDots software at WGBIOP 2016 and PGDATA 2017. As a result of this presentation a project group was set up to analyse the possibilities of using SmartDots for ICES Workshops and Exchanges. The members of this project group were ICES, ILVO, DTU Aqua and IMR Norway.

Early in 2017 the project group decided to expand SmartDots software with some extra modules in order to fit international needs. ILVO turned the existing SmartDots fat client into a more generic client-server application. ICES developed the database, web

application and Web API to be able to handle and store data at ICES. DTU Aqua analysed the different datasets and created a first version of a workshop / exchange output report.

At WGBIOP 2017 a proof of concept of the SmartDots age reading platform was presented. All national age reader coordinators attending WGBIOP were able to test, during a hands-on exercise, the proposed SmartDots age reading platform.

The SmartDots age reading platform is developed to facilitate age readings based on otolith images.

A set of software tools supports the user in managing all data of ICES age reading. On the one hand the database can manage the meta data related to workshops and exchanges and on the other hand, the age reader can carry out age readings by annotating otolith images. All registered data are available in the connected reporting environment.

The SmartDots age reading platform is an open source solution. All source code is publicly accessible. The SmartDots age reading platform consists of several modules. We distinguish data input, data storage and data output modules (see module scheme, figure 5.5.2).

The SmartDots age reading platform consists of two user interface modules:

- **Web application**
  - This module will be to manage the age readers expertise and events.
  - This is the module that allows the connection with the database.
  - The functionalities of the web application are:
    - Manage age readers and their expertise
    - Manage events meta-data
    - Manage sample data and upload the linked files (e.g. images)
    - Reporting
    - Query the database
    - View and download data

- **SmartDots user interface**
  - SmartDots is a Windows client-server application. This is the main module for the age readers.
  - The functionalities of SmartDots are:
    - Select the activity
    - Create annotations on otolith images by drawing a line on the otolith and adding a dot for each age ring.

The **web API** (Application Programming Interface) is the interface between the SmartDots user interface and the database. All business logic[1] is integrated in the Web API.

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[1] [1]Business logic = the part of the program that encodes the real-world business rules that determine how data can be created, stored, and changed

The output or reporting module contains generic datasets and R-scripts for business intelligence purposes.

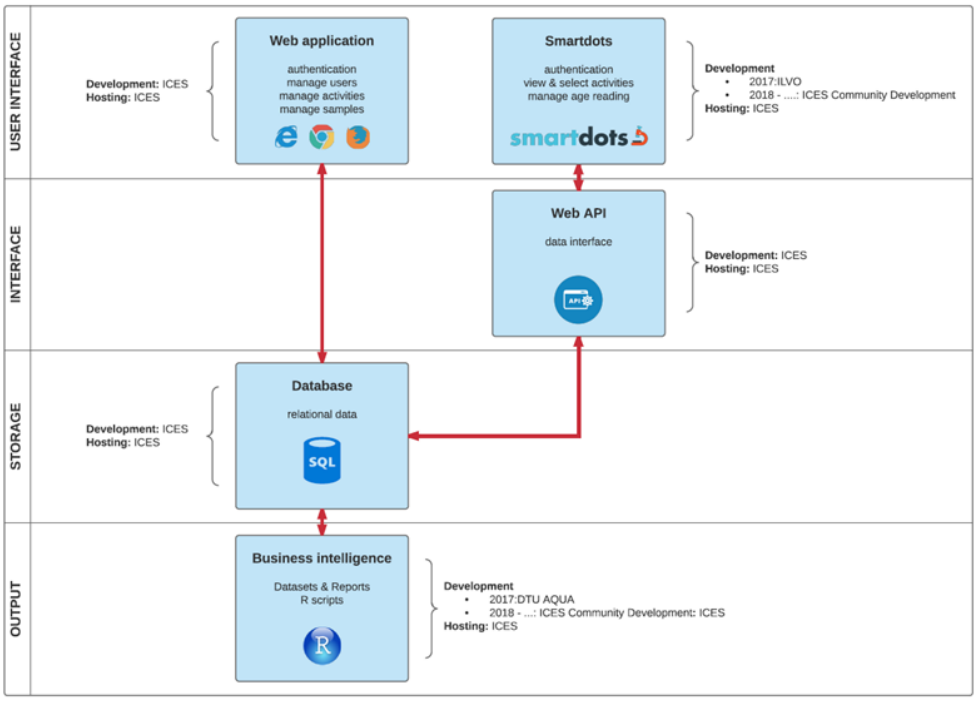

Figure 5.5.2: Module scheme of SmartDots platform

Following the presentations, demonstrations and hands-on time with SmartDots at WGBIOP 2017 the group officially adopted the SmartDots platform as the tool for age reading exchanges and workshops from 2018 onwards (See Annex 8 for insights). During WGBIOP 2017 a meeting was held to discuss the future plans for SmartDots, topics discussed included; development and deployment of the combined modules; planning for "going live" and project governance. The meeting was held by the core SmartDots team who have been working in close collaboration over the last year and the chairs of WGBIOP. Those attending proposed that in the future WGBIOP should look to expand this group to a formal steering group which could include additional expertise to ensure the effective project governance which will require both monetary input and manpower.

5.5.2 Workplan for 2017–2018

Following WGBIOP 2017 all national age reader co-ordinators will return to their laboratories, present SmartDots to their age readers and provide internal training. They will be provided with user manuals and a feedback document with a table where they can enter their comments, both from an age reader and age co-ordinator point of view. They will be requested to deliver this feedback to the SmartDots steering group by December 2017 so that comments can be considered and incorporated into the work plan for 2018 in close collaboration with WGBIOP.

By January 2018 SmartDots will be hosted by ICES and will be ready to "go live".

The North Sea Norway Pout age reading exchange will be the first official ICES age calibration exercise to be set up, annotated and analysed using the SmartDots tool. The group decided to go live with the most recent version of SmartDots that was presented at WGBIOP 2017, however in order for the tool to be fully operational by then a number

of developmental and deployment steps need to be completed by the core development team (ILVO, ICES, DTU Aqua and IMR Norway) intersessionally. These steps are outlined here:

- The source code of SmartDots and the ILVO WebAPI was handed over to ICES (and made available on the SmartDots GITHUB site) so that ICES can proceed with the development of a WebAPI.
- Extraction of the annotation coordinates from the ICES database and subsequent calculation of the measurement output to be included in the reporting module.
- The standardized reporting module (based on R-scripts and SmartDots output) will be finalized by DTU Aqua with input on requirements and layout from a subgroup of WGBIOP members. The code will be available on the WGBIOP GITHUB site.
- Cooperation between ICES and DTU Aqua on the merging of the reporting module with the SmartDots and ICES modules.
- A short SmartDots user manual will be compiled for the SmartDots module.
- A short ICES Database user manual will be compiled for the ICES Database module.
- The final webpage will be created which includes a short summary of SmartDots.

5.5.3 Deliverables for 2018–2020

- A full descriptive *User manual* about the *web application* (2018–2020)
- A full descriptive *User manual* for the *tool SmartDots* (2018–2020)
- *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. (2018–2020).

Transfer of the images from WebGR to the SmartDots platform (all images from history WGs & exchanges to be hosted by ICES).Some of the deliverables to be defined under "Evaluation of quality of biological parameters: Issues, quality indicators and guidelines", can be linked to the further development of the reporting in SmartDots. To date the resources that have been spent developing this tool, which in the future will be available to the entire ICES community, have come from national funds. To ensure the continuation of development, training, maintenance etc. it was proposed that as a first step support should be requested at a regional level and contact was made with the chair of the RCG's Liaison Meeting (to be held the week following WGBIOP) suggesting that SmartDots governance and future prospects be discussed in plenary at the meeting. WGBIOP 2018 will report the feedback at the RCG's Liaison Meeting, included future budget based on national participation.

Beside all the deliverables for 2018 above mentioned (see section 5.5.2), the use of the SmartDots age reading platform on a routine basis for future exchanges and workshops from 2018 will continuously provide feedback to WGBIOP allowing the group to outline a plan on future needs on an annual basis. Participants of WGBIOP 2017 have already expressed wishes to use the platform for maturity exchanges and workshops in the future.

Deliverables for future years beyond 2018 will depend on the identified future needs.

6 Cooperation

During the three years mandate WGBIOP had an active cooperation with several Expert groups.

Cooperation with other WG

WKIDEA, WGSAM, SSGIEOM , PGDATA, WGCATCH, WGPROXY, PGMed, WGIPEM, WKFICON and all the WKs for age reading and maturity staging held during 20152017

Cooperation with Advisory structures

- ACOM/SCICOM Steering group,
- BSG, Benchmark Steering group (currently dissolved) and benchmark EGs 2015–2017
- Close cooperation with the advisory services via the handling of recommendations
- Link to the RCGs and the LM in relation to data-needs and quality.

Cooperation with other IGOs

None

7 Summary of Working Group self-evaluation and conclusions

During 20152017, WGBIOP continued the work initiated in PGCCDBS in relation to QA/QC across national institutes delivery biological data for assessment purpose (Science Plan priority 31). Moreover the group works with end-users, primarily benchmarks, to identify key data gaps (Science Plan priority 27) and data needs, evaluate cost-effectiveness (Science Plan priority 25), and facilitate after evaluating the setting up case studies (Science Plan priority 21). The group is aiming at developing a quality assurance framework for end use of data (Science Plan priority 20). The main outcomes and achievements of the WG are listed in chapter 4 under each ToR paragraph.

WGBIOP contributed to Advisory needs putting forward issues with biological parameters to the stock coordinators of upcoming benchmark species within ToR b. In many cases the response from the stock coordinators was positive and the advice from WGBIOP incorporated in the benchmark.

The initial idea behind Tor a (providing guidance on computational methods) and ToR b (to develop quantitative quality indicators for biological parameters) was not pursued as the groups' expertise was in the scientific and technical aspects of biological parameters. Hence, the future attendance of Stock assessors and statisticians would aid the fulfilment of the initial ideas behind WGBIOP.

WGBIOP is willing to continue working beyond its current terms, as it represents a strong link between data collection and data use, focusing on the quality and accuracy of biological data used in assessment. The group combines the knowledge from both Mediterranean and Atlantic areas, including national experts primarily for age and maturity and for emerging important biological data. Most of WGBIOP Terms of Reference are generic and it is relevant to deal with them on an annual basis.

Annex 1: List of participants

WGBIOP Participants 26 October 2017

Name	Address	Telephone/fax	E-mail
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Annex 2: Recommendations

RECOMMENDATION	ADRESSED TO
1. Quality indicators have been and are being developed for biological parameters. WGBIOP recommends that the ability to flag issues with data, and to record quality indicators is incorporated into the ICES databases. For the incorporation in the databases cooperation with the ICES data centre is vital (see chapter 5.2).	DIG and ICES Data Center
2. In light of the outcomes of WKFICON, WGBIOP recommends that each group proposes a stock that would be a relevant case study for the collection of new biological data (see Table 5.3.1 in WKFICON Report) and the compilation of existing data on fish condition	Survey groups IBTS, BITS, BIAS, MEDITS, MEDIAS
3. Where data gaps or quality issues are identified within key biological parameters these should be highlighted and adressed to WGBIOP.	IEA groups
4. Investigate possible financial resources to support further development of SmartDots (see chapter 5.5)	RCGs
5. Macroscopic maturity staging remains difficult. On national levels quantitave and other approaches are being developed. WGBIOP proposes a theme session for the ASC on 'Quantitative, histological and other approaches to improve sexual maturity staging of marine species'. This will provide a mean for scientists to share, discuss and improve maturity staging, vital for the assessment of many commercial species.	SCICOM, EOSG

Annex 3: Examples of measurements and estimates referred to in ICES Ecosystem Overviews

Table 3.1. Example of Celtic Seas Ecoregion, Version 2, 13 May 2016

Data/Pressure	Environmental	Biological	Fishery
Sea surface temperature	√		
Salinity	√		
Migration, distribution, and onset of spawning of blue whiting *Micromesistius poutassou*		√	
Recruitment of gadoids		√	√
Species richness (number of species)		√	
Phytoplankton abundance and the abundance of diatom and dinoflagellate species		√	
Overall copepod abundance – from CPR survey		√	
The abundance of breeding seabirds		√	
Populations of grey seals		√	
Overall trends in the abundances of cetaceans and harbour seals are not known		√	
Fishing pressure on commercial fish and shellfish stocks			√
Biomass of commercial fish and shellfish stocks			√
Fishing mortality			√
Status of threatened and declining fish species		√	√
Bycatch of seabirds		√	√
Bycatch of marine mammals		√	√
Area and proportion of seafloor trawled			√
Smothering and siltation – overview text			√
Substrate loss – overview text	√		
Nutrient and organic enrichment - overview text	√		
Contaminants - overview text	√		
Non-indigenous species - overview text		√	
Litter - overview text	√		
Underwater sound - overview text	√		
Substrate type		√	
Main benthic species		√	
Zooplankton species biomass		√	
Timing of plankton production		√	
Cephalopod species abundance			√
Fish species abundance and biomass		√	√
Breeding seabird species abundance		√	
Marine mammal species present		√	
Non-indigenous species present		√	
Non-indigenous species discovery rate		√	

Table 3.2. Example of Baltic Sea Ecoregion, Published 4 July 2017

Data/Pressure	Environmental	Biological	Fishery
Bycatch of seabirds and mammals (seals and porpoises) and their related fisheries associated mortality			√
Seabed habitat disturbance		√	
Oxygen content	√		
Surface oxygen consumption	√		
Inflows of North Sea water	√		
Recreational fisheries catches			√
Release rates for species targeted by recreational fisheries			√
Discards and bycatch by species and gear			√
Post-release mortality estimates		√	√
Fishing mortality (F)			√
Biological reference points		√	
Technical interactions between species/stocks when multiple species are captured in the same gear during fishing operations			√
Predation		√	
Spatial and temporal overlap among stocks		√	√
Abrasion of the seabed by mobile bottom-contacting fishing gears		√	√

Table 3.3 Example of Barents Sea Ecoregion, Version 2; 13 May 2016

Data/Pressure	Environmental	Biological	Fishery
Spatial distribution and abundance of zooplankton and fish species		√	
Mesozooplankton biomass		√	
Plankton biomass		√	
Plankton productivity		√	
Capelin biomass		√	
Recruitment		√	√
The North Atlantic Oscillation (NAO)	√		
Ice cover	√		
Fisheries landings			√
Predation		√	√
Ratios of species (pelagic vs demersal)		√	√
Condition (blubber thickness) of whales and seals		√	
Spatial distribution and abundance of invasive species of crabs		√	√
Surface and subsurface abrasion pressure	√		
External contaminants (accidental releases from local activities, and ship fuel emissions)	√		
Benthic species composition		√	
Depth	√		
Salinity	√		
Temperature	√		
Phytoplankton net primary production		√	
Future developments of oil and gas production substrate loss, nutrient and organic enrichment, and introduction of non-indigenous species	√		
Zooplankton/mesozooplankton biomass		√	
Krill abundance		√	
Jellyfish abundance		√	
Abundance and distribution of benthic species and shellfish		√	
Fish abundance, distribution and biological reference points		√	√
Seabird trends in abundance		√	
Mammal trends in abundance		√	
Threatened and declining species and habitats		√	

Table 3.4 Suggested influential and uncertain processes and parameters in age-length multispecies models. These relate in particular to Gadget for the Baltic and are listed without any order of priority (V. Bartolino, *pers. comm.*).

appropriate seasonal and spatial coverage of the stomach data. Concerning the Baltic, coverage on cod stomachs for small and large cod	
data on diet of other top predators such as seal	
parameters describing average and maximum consumption of cod are often derived from experiments with cod from other area and under limited range of environmental conditions	
quantification of predator-prey overlap and its variability in time and space (incl. vertical overlap)	
analysis of uncertainty of different estimators of diet composition from the stomach data (ie, based on the number or weight of preys)	
information on predator-prey size selection and associated parameters	
parameters which relate feed level or consumption to other biological processes such as growth and maturation.	

Not available
Could be implemented

Annex 4: Issues and quality indicators

Table 4.1 Qindicators

Topic	Indicator / issue	Biological parameters	Clarification	Further reading	Grading / evaluation
SAMPLING DESIGN	survey design	all	Were possible weaknesses of the survey design critically assessed?	e.g. ITBSWG, WGBIFS	Quality of biological data not evaluated Preliminary analyses of quality of biological data Detailed analysis of the quality of biological data
	design commercial sampling	all	Has the quality of (national) sampling schemes used to collect biological material been thoroughly evaluated?	WKACCU, WKPRECISE, WGISDAA, WGCATCH, WGPICS, SGPIDS	Refer to annual evaluation of national work plans by STECF
	spatial coverage	all	Is the full range of the stock covered by biological sampling?		E.g. evaluate distribution maps of national VMS tracks and commercial samples

Topic	Indicator / issue	Biological parameters	Clarification	Further reading	Grading / evaluation
STOCK IDENTITY	mixing ratio	all	Is there evidence of mixing? What methods are used to identify stock components? How reliable are spatio-temporal patterns in mixing resolved?	WGSIM	No mixing Mixing exists: not accounted for Mixing exists: accounted for, not validated Mixing exists: genetic study as a baseline Mixing exists: genetic study and poor spatio-temporal coverage of mixing Mixing exists: genetic study and good spatio-temporal coverage of mixing
METHODS AND DEFINITIONS	structure	age, maturity	Documentation of different structures used by country and stock	WGBIOP	No overview table Overview table available Overview table complete and up-to-date
	preparation	age, maturity	Documentation of different preparation techniques used by country and stock	WGBIOP	No overview table Overview table available Overview table complete and up-to-date
	birthdate & "scheme"	age	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")	e.g. WKARA 2009, WKARP 2010, WKARDL 2015, WKARA 2016, WKARBLUE2 2017	No comparisons between labs Differences between labs are known but ingnored Differences clearly documented and considered in data compilation No differences
	scaling	maturity	Do differences between countries exist(ed)? Have different national maturity scales been successfully merged into one international standard?	e.g. WKMSHS, DATRAS, WKMATCH 2012, WGBIOP 2017	No chronicle available Differences between labs are known but ingnored Chronicle clearly documented and considered in data compilation

Topic	Indicator / issue	Biological parameters	Clarification	Further reading	Grading / evaluation
	timing	maturity	Is the maturity staging conducted during the whole year or only during a specified period of the year?	e.g. WKMSHS	Restricted staging period (e.g.: If Q1 is advised: Q1= good, Q2&Q3=bad, Q4=moderate) Staging year-round
	ogive	maturity	If sufficient maturity data are available, then spatially and/or temporally varying ogives can be considered		Careless use of a type of ogive Careful selection of a type of ogive Selection of type of ogive based on thorough analysis of all options
	coding	sex	Different countries use different coding for male and female in their national databases. This should be standardized before the data are submitted to ICES/GFCM, but there is a risk of errors.		Potential errors in international database International database correct
	sex-specific parameters	all	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?	WKPLE, WKBALTFLAT	Sex-specific issues not evaluated Preliminary analyses of sex-specific issues Detailed analysis of sex-specific issues Use of sex-specific issues in the assessment

Topic	Indicator / issue	Biological parameters	Clarification	Further reading	Grading / evaluation
	M	natural mortality	On what information is the value for natural mortality based? Estimated (based on predator–prey studies), extrapolated from neighbouring regions, or assumed?		Assumed Extrapolated Estimated
	growth	growth	Growth parameters are used in Nephrops assessments. On what information are growth parameters based? Eestimated (based on tagging studies), extrapolated from neighbouring regions, or assumed?		Assumed Extrapolated Estimated indirectly Estimated directly
VALIDATION	age validation	age	Is there an age validation study available? What was the method of age validation?	Table 1 of Campana 2001	No validation study Only one method with major limitations Several complementary age validation methods showing similar results
	maturity validation	maturity	Where gonad stages compared with macroscopic and histological methods?	e.g. WKMATCH, WKMSSPDF, WKMSTB, WKMSHS, WKMSMAC, WKMSGAD	No validation study Validation by histology available Validation criteria on histology available
	absolute bias	age, maturity	Measure for accuracy in relation to true age (seldom available) or histological analysis of maturity	WKNARC2	Quantitative estimate; evaluation stock-specific

Topic	Indicator / issue	Biological parameters	Clarification	Further reading	Grading / evaluation
	absolute age error matrix	age, maturity	Probability distribution of repeated measurements relative to true age / maturity	WKSABCAL, WKNARC2	Quantitative estimate; evaluation stock-specific
CALIBRATION	exchange/workshop	age, maturity	When was the last exchange including age readers from major data contributors?	WKNARC2, see repository at http://www.ices.dk/community/Pages/PGCCDBS-doc-repository.aspx	No exchange Exchange long time ago and poor results Exchange recently, results poor Exchange long time ago and good results Exchange recently, good results Exchange recently, very good results
	relative bias	age, maturity	Measure for accuracy in relation to modal age or modal maturity	WKSABCAL, WKNARC2	Quantitative estimate; evaluation stock-specific
	CV or APE	age, maturity	Measure for precision	WKSABCAL, WKNARC2	Quantitative estimate; evaluation stock-specific
	% agreement	age, maturity	Percentage agreement between age readers	WKSABCAL, WKNARC2	Quantitative estimate; evaluation stock-specific
	relative age error matrix	age, maturity	Probability distribution of repeated measurements relative to modal age / maturity	WKSABCAL, WKNARC2	Quantitative estimate; evaluation stock-specific

Topic	Indicator / issue	Biological parameters	Clarification	Further reading	Grading / evaluation
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		New parameters not used in assessment New parameters used in assessment
	error matrix	age, maturity	Variance structure can directly be incorporated into stochastic stock assessment models	WKSABCAL, WKNARC2	Error matrix not used in assessment Error matrix used in assessment
	sensitivity analysis	all	Sensitivity runs will show effects of different biological datasets (e.g. age) on the assessment outcomes in terms of key parameters such as fishing mortality F and spawning-stock biomass (SSB).		No alternative input datasets produced 2 alternative datasets produced and sensitivity runs tested Numerous sensitivity runs with alternative datasets tested

Table 4.2 Replies

Species / stock	Biological parameter	Replied to WGBIOP	Advice taken on-board / considered	Follow-up
Cod in Subdivision Vb1	Length and weight parameters, maturity ogive	Yes	Yes	The survey data were to be worked up.
Haddock in Division Vb	Length and weight parameters, maturity ogive	Yes	Yes	The survey data were to be worked up.
Haddock in Division VIb	Age-at-length/age-at-weight	Yes	Yes	The stock coordinator believes that a small-scale exchange between MSS and PINRO would be a good idea.
Herring in Subdivision 30	Maturity ogive	Yes	Yes	Maturity issue was that maturity is used from Q1 but some areas were from Q2 due to ice cover in Q1. No solution as unable to sample in Q1.
Herring in Subdivision 31	Maturity ogive	Yes	Yes	Maturity issue was that maturity is used from Q1 but some areas were from Q2 due to ice cover in Q1. No solution as unable to sample in Q1.

Table 4.3

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	ane.27.9a	Anchovy in Division 9.a (Atlantic Iberian waters)	WGHANSA	all	Stock identity. Providing one management advice for the anchovy in the whole of Division IXa may be inadequate, since survey results and the fishery demonstrate independent dynamics of the anchovy in the northwestern part of Division IXa from the dynamics of the population in Division IXa South. Recent genetic studies suggest separated stocks for anchovy in IXa South from anchovy in the remaining waters in the Division.	To compile information from anchovy in all subdivisions and in close areas to the boundaries of the Division, such as morphometrics, genetics, parasites, distribution and, any modelling assessing migration taking place between areas will be examined in the benchmark (and summarized prior to it)	
				age	Catches-at-age are only available from the Spanish fishery in IXa South (only in 2011 has been provided this kind of data from other subdivisions, i.e. only when the anchovy abundance was high).	Investigate availability of these data to obtain a consistent dataseries allowing a further (analytical) assessment.	WKARA2 2016, PA = 59–91% depending on region
				maturity, weight	Maturity ogives, weight at age in the stock, etc, are only available for the Spanish part of the IXa South.	Ditto	
				M	Natural Mortality is assumed to be equal to the one estimated for Bay of Biscay Anchovy.	Explore different approaches (empirical, etc.) to derive the estimate of Natural Mortality.	

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	anf.27.1–2	Anglerfish in Subareas 1 and 2 (Northeast Arctic)	AFWG	age	Only historic readings for limited time. The illicium is the structure used. Work has to be initiated to provide such data.	Look to Iceland for verification of age reading	Ex/WK 2017 postponed till outcome of CALL FOR TENDERS: Validating age determination of anglerfish and hake. Last WK in 2004: PA = 8–27% depending on structure and species.
				maturity	Harmonize international view. Different maturity ogives.	Ref. Nordic project	
2018	anf.27.3a46	Anglerfish in Subareas 4 and 6, and Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)	WGCSE	age	Validity of age readings	Estimate the precision of the age readings in the survey data. Examine potential validation techniques for anglerfish age readings.	Ex/WK 2017 postponed till outcome of CALL FOR TENDERS: Validating age determination of anglerfish and hake. Last WK in 2004: PA = 8–27% depending on structure and species.

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
				weight, maturity, sex ratio at age. Growth rates.	Species/stock Identity	Examine the life-history traits of Lophius budegassa to determine how different these are from those of Lophius piscatorius. These would include: weight at age, maturity-at-age, sex ratio at age, geographical distribution; and growth rates. Determine whether L.budegassa life-history traits are sufficiently different from those of L.piscatorious to warrant an adaptation or separation within the stock assessment and advice of Northern shelf anglerfish.	
2018	ank.27.78ab mon.27.78ab	Black anglerfish in divisions 7.b–k, 8.a–b, and 8.d (west and southwest of Ireland, Bay of Biscay). White anglerfish in	WGBIE	growth parameters	No reliable growth parameters	Analysis of survey LFD to track cohorts in order to estimate growth parameters. Tagging data available?	

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
		divisions 7.b–k, 8.a–b, and 8.d (southern Celtic Seas, Bay of Biscay)		age	Age data exists but quality unknown.	Compare length-at-age data from existing sources with growth curves derived from length–frequency analysis of the surveys. Identify if certain ageing methods produce realistic results.	Ex/WK 2017 postponed till outcome of CALL FOR TENDERS: Validating age determination of anglerfish and hake. Last WK in 2004: PA = 8–27% depending on structure and species.
				all	Stock identity is unknown (but this is the case for most stocks)	Review publications on genetic or tagging studies. New genetic or tagging studies	
				M	Limited data	Estimate natural mortality using published methods	
				maturity	Limited data	Provide existing maturity data or increase sampling levels.. Review knowledge of spawning females???	
				sex ratio	Limited data	Provide sex-ratio data from surveys	

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	ank.27.8c9a mon.27.8c9a	Black anglerfish in Divisions 8.c and 9.a (Cantabrian Sea, Atlantic Iberian waters). White anglerfish in Divisions 8.c and 9.a (Cantabrian Sea, Atlantic Iberian waters)	WGBIE	age	The ageing criteria proposed in 2007 was rejected at the assessment working group (WGHMM) due to its inconsistencies.	Try to get a ageing criteria accepted, or a growth model accepted (especially for black anglerfish).	Ex/WK 2017 postponed till outcome of CALL FOR TENDERS: Validating age determination of anglerfish and hake. Last WK in 2004: PA = 8–27% depending on structure and species.
				maturity	An updated and reliable maturity model is needed.	To investigate a maturity model, for both sexes combined, based on recent commercial samplings and survey data (if there are any).	
2018	cod.21.1	Cod in NAFO Subarea 1, inshore (West Greenland cod)	NWWG				no issue list available
2018	cod.2127.1f14	Cod in ICES Subarea 14 and NAFO Division 1.F (East Greenland, South Greenland)	NWWG				no issue list available

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	fle.27.3a4	Flounder in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)	WGNSSK	weight, length, maturity, age, sex	To collate and compile available data on weight, length, maturity, age, sex and spatial distribution.	Standard approaches currently applied to stocks such as haddock and plaice could be applied to collate these data.	WKMSSPDF2 2012, WKARFLO 2008 (only Baltic flounder), PA = 70%
2018	her.27.20–24	Herring in Subdivisions 20–24, spring spawners (Skagerrak, Kattegat, and western Baltic)	HAWG	age	Age and size at age (ageing comparison, descriptive purposes)	Revision of the precision of ageing and the sampling for age structures. Age-calibration prior to benchmark (recommendation to WGBIOP 2017)	WKARBH 2008, PA = 80%. Baltic AR ex ongoing.
				M	Constant natural mortalities are currently used (only use simple scaling)	Revision of natural mortalities	
				maturity	Constant maturity ogives are currently used/Fecundity	Revision of maturity ogives; probability of spawning: We need a time-series for an annual varying maturity ogives to have an effect.	WKMSHS2 2017

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	her.27.3a47d	Herring in Subarea 4 and Divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)	HAWG	M	Best-practice in predicting natural mortality for years where no multispecies assessment is available needs to be investigated (already available)	Recommendation to WGSAM	
				growth	Consider effect of decreased growth in herring during the past decades	Evaluate impact on l@age and w@age	
				age, maturity			AR ex 2015, PA = 69–78%. WKMSHS2 2017
2018	her.27.irls	Herring in Divisions 7.a South of 52°30′N, 7.g–h, and 7.j–k (Irish Sea, Celtic Sea, and southwest of Ireland)	HAWG	M	Could there be other factors explaining mortality of herring?	What has been the development in body condition of herring	2 issues?
				age, maturity			AR ex 2015, PA = 69–78%. WKMSHS2 2017

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	lem.27.3a47 d	Lemon sole in Subarea 4 and Divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	WGNSSK	weight, length, maturity, age, sex	To collate and compile available data on weight, length, maturity, age, sex and spatial distribution.	Standard approaches curently applied to the stocks. Much of the required information can be obtained from DATRAS, but national institutes also need to be approached about the availability of relevant (and unsubmitted) data from survey and catch-sampling programmes.	First AR ex planned for 2018
2018	reb.27.1–2	Beaked redfish in Subareas 1 and 2 (Northeast Arctic)	AFWG	weight at age	Poorly explained fluctuations in WAA lead to important variations in SSB. The weight at age in the catch and stocks may be different, but this is not currently considered.	1) Re-analyse historical weight data from the fishery and from surveys. 2) allow the model to use 2 different datasets for WAA.	
				age			AR ex 2011, PA = 34–38% depending on experience
2018	reg.27.1–2	Golden redfish in Subareas 1 and 2 (Northeast Arctic)	AFWG	age			No biological parameter issues on issue list. WKADR 2008, PA = 37–47% depending on set

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	rng.27.5b67 12b	Roundnose grenadier in Subareas 6–7 and in Divisions 5.b and 12.b (Celtic Seas and the English Channel, Faroes grounds, and western Hatton Bank)	WGDEEP	growth parameters	Estimates of r (intrinsic growth rates of the surplus production model) are possibly too high in regards of stock dynamics. Work is proposed to derive r from annual length distribution rather than the current fixed distribution for the whole time-series.	Analysis on length structure to derive yearly changes in biomass and derive its gross rate	
				age			Results not yet available for AR ex in 2016. WKAMDEEP2 planned for 2018
2018	sal.27.22–31	Salmon in Subdivisions 22–31 (Baltic Sea, excluding the Gulf of Finland)	WGBAST				no issue list available
2018	spr.27.3a spr.27.4	Sprat in Division 3.a (Skagerrak and Kattegat). Sprat in Subarea 4 (North Sea)	HAWG	all	Stock structure. Genetic analyses of stock (on the way, Norwegian/Danish project) to investigate whether 4 and 3a sprat are separate stocks, Moray Firth and Eng-lish channel probably not well resolved, coastal sprat also an issue.	Genetic analyses results from IMR and DTU	

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
				age, maturity			WKARSPRAT 2016, PA = 95%. WKMSHS2 2017
2018?	tur.27.4	Turbot in Subarea 4 (North Sea)	WGNSSK				issue list available but stock not on BSG benchmark list
				age	Landings at age and age-composition only from NL data in recent years	Age data for landings from other countries. Other countries e.g. Denmark and UK to deliver age data for landings (and discards)	WKART 2008, PA = 82,8%. AR ex planned for 2018
				maturity			WKMSTB 2012, PA = 94%
2018	whg.27.47d	Whiting in Subarea 4 and Division 7.d (North Sea and eastern English Channel)	WGNSSK	maturity	Compile and evaluate available data on maturity	IBITS Survey data (DATRAS), commercial sampling data	WKMSGAD 2013
				age			WKARWHG2 2016, PA = 80,7%

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2018	wit.27.3a47d	Witch in Subarea 4 and Divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	WGNSSK	maturity	The series are available and need to be updated. Ongoing maturity studies.	SLU AQUA will collate and update the biological data	
				age	MS to submit landings information (number-at-age and weight at age) for the entire time-series	SLU AQUA will collate and compile the biological data	
2019	bll.27.3a47de	Brill in Subarea 4 and divisions 3.a and 7.d–e (North Sea, Skagerrak and Kattegat, English Channel)	WGNSSK	growth parameters, sex ratio	When using length based indicators, correct information on length at maturity (Lmat), and length von Bertalanfy growth curve (L inifinity) are needed. Determine the sex ratio in the stock area.	van der Hammen *et al* (2013) suggested values for Linf and Lmat based on Dutch market samples; check whether these are representative for the entire fleet fishing on brill	
				age, maturity			WKMSTB 2012 AR ex 2007, PA = "very high" AR ex planned for 2018

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2019	cod.27.22–24	Cod in Subdivisions 22–24 (western Baltic Sea)	WGBFAS	age	Consider DE age validation results from SD22 in age reading routine (1,9 mm diameter of first ring); discuss progress in otolith preparation (brokenvs.sliced)	Training course or workshop with age readers	Was the DE validation study published? WKAVSG 2013 (Workshop on age validation studies of Gadoids)
				age	Organize yearly exchange of otoliths in order to include an age error matrix in the routine assessment (consider experience from otolith exchange in 2015)	Otolith exchange SD22 2015 done, 2016 onwards?	No results for an AR exchange held in 2015 was found in the WGBIOP tables or on the docs repository. WKAEBcod (WK on Age Estimation of Baltic cod) postponed until further notice given from RCMBaltic

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
				all	Stock structure/identity. Why restrict mixing to SD24? Mixing between SD22–24–25? Otolith shape: Extending and completing the existing time-series; More years with genetic validation; Compare data from same year (2015)	See WKBALTCOD 2015 report Exchanging otolith shape data	WKSIBCA2 (WK on Scoping for Integrated Baltic Cod Assessment) postponed until further notice is given from RCMBaltic
				maturity			WKMSGAD 2013
2019?	cod.27.25–32	Cod in Subdivisions 25–32 (eastern Baltic Sea)	WGBFAS				Issue list available but stock not on BSG benchmark list No biological parameter issues on issue list.
				age			see comments for western Baltic cod
2019	cod.27.7e-k	Cod in Divisions 7.e–k (western English Channel and southern Celtic Seas)	WGCSE				no issue list available
2019	gur.27.3–8	Red gurnard in Subareas 3–8	WGWIDE				no issue list available

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
		(Northeast Atlantic)					
2019	had.27.6b	Haddock in Division 6.b (Rockall)	WGCSE				no issue list available
2019	had.27.7b–k	Haddock in divisions 7.b–k (southern Celtic Seas and English Channel)	WGCSE				no issue list available
2019	her.27.28	Herring in Subdivision 28.1 (Gulf of Riga)	WGBFAS	all	Stock identity. Mixing of Gulf of Riga herring and Central Baltic herring in SD 28. The populations are discriminated in the catches on the base of otolith structure.		
				age			WKARBH 2008, PA = 80%. Baltic AR ex ongoing.
				maturity			WKMSHS2 2017
2019	her.27.25–2932	Herring in Subdivisions 25–29 and 32, excluding the Gulf of Riga	WGBFAS	all	Stock identity. Mixing of Western Baltic spring spawners and CBH in SD 24–26. To what extent is this occurring and do we have a way to account for this?	To test the separation fuction developed by germany to separate the two stocks	

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
		(central Baltic Sea)		mortality	Investigate new estimates for natural mortality.	Estimate M from life-history traits and models Update SMS model with new cod stomach data for recent years	
				maturity	Currently maturity is held constant over the time-series. Do we need to update this?	Analyses of maturity data and sensitivity analyses of SAM model outputs to changing maturity.	WKMSHS2 2017
				weight	Mean weight in the stock currently equals mean weight in the catch! Do we have something better?		
				age			WKARBH 2008, PA = 80%. Baltic AR ex ongoing.
2019	lez.27.4a6a	Megrim in Divisions 4.a and 6.a (northern North Sea, West of Scotland)	WGCSE				no issue list available
2019	ple.27.7fg	Plaice in Divisions 7.f and 7.g (Bristol Channel, Celtic Sea)	WGCSE				no issue list available

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2019	sal.27.22–31	Salmon in Subdivisions 22–31 (Baltic Sea, excluding the Gulf of Finland)	WGBAST				no issue list available
2019	sol.27.7fg	Sole in Divisions 7.f and 7.g (Bristol Channel, Celtic Sea)	WGCSE				no issue list available
2019	sol.27.20–24	Sole in Subdivisions 20–24 (Skagerrak and Kattegat, western Baltic Sea)	WGBFAS	all	Stock structure. Genotyping spawning fish in order to identify stock structure in the entire stock assessment area SD 20–24 and also to evaluate main migration patterns	Samples will be col-lected from fishery and survey; analysis conducted by DTU Aqua	
				age	Improvement of ageing by means of otolith calibration between readers and otolith structure to validate age	A calibration workshop/exchange will be arranged	This AR workshop/exchange is not listed in the WGBIOP exchanges & workshops table. AR ex for North Sea sole 2015, PA = 90%
				maturity			WKMSSPDF2

Benchmark year	Stock code	Species / stock	WG	Biological parameter	Issue (source: issue lists)	Solution proposed (source: issue lists)	WGBIOP comments or questions
2019?	whg.27.3a	Whiting in Division 3.a (Skagerrak and Kattegat)	WGCSE				Issue list available but stock not on BSG benchmark list
				maturity	Maturity ogive	Maturity studies needed	What exactly is the problem/issue? WKMSGAD 2013
				age			WKARWHG2 2016, PA = 80%
2019	whg.27.6a	Whiting in Division 6.a (West of Scotland)	WGCSE				no issue list available
2019	whg.27.7b-ce-k	Whiting in divisions 7.b –c and 7.e–k (southern Celtic Seas and western English Channel)	WGCSE				no issue list available
2019	tur.27.3a	Turbot in Division 3.a (Skagerrak and Kattegat)	WGNSSK				no issue list available

Annex 5: Review of past workshops and exchanges

Workshops

The following are summaries of the age reading workshops carried out in 2016 and 2017.

Workshop on Age estimation of European anchovy (*Engraulis encrasicolus*) (WKARA2)

Based on the results of a full-scale otolith exchange held in 2014, the Working Group on Biological Parameters (WGBIOP 2015) identified the need for an age reading workshop on European Anchovy otoliths (WKARA2). This workshop (chaired by Andrés Uriarte, Spain, Begoña Villamor, Spain and Gualtiero Basilone, Italy), was held in Pasaia, Guipuzcoa (Spain), 28 November2 December 2016. Five countries took part in this workshop (Spain, Italy, Croatia, Greece and Tunisia), with a total of 16 participants from 9 laboratories. In total 17 areas/stocks were analysed (4 from the Atlantic area and 13 from Mediterranean Sea)

The aim of this workshop was to review the information on age determination, discuss the results of the previous exchange (2014), review the validation methods existing on these species, clarify the interpretation of annual rings and update the age reading protocol and a reference collection of well-defined otoliths.

Age validation studies, in the Bay of Biscay and preliminary validation studies in Division 9a, Alboran Sea and Strait of Sicily areas were presented, including a compilation of age validation studies of this species as well in the literature. There are several areas/stocks in which validations of the anchovy annual age determination have not been done yet.

Due to the poor percentage of agreement achieved in the 2014 Exchange (mean agreement of 66%; mean CV of 58%), the workshop proceeded with a detailed and joint discussion on the growth patterns shown by otoliths from the different areas to find out the major reasons for discrepancies in age determination among readers. At the same time, the joint discussion allowed a better understanding of the pattern of otolith growth increments by areas to improve the guidelines for their interpretation. The discussions on examples among otoliths which generated discrepancies in the age determination led to conclude that there were two major sources of disagreements: a) Divergent otolith interpretation: different interpretations of the marks, growth bands and edges in terms of their conformity with the expected growth pattern of the anchovies, seasonal formation of the otolith by ages and most common checks. and b) wrong application of the age allocation Rules: it was corroborated during the workshop that for the birthdate first July (or first June) in some cases the age determination rule was not being correctly applied during the first half of the year (January–June).

Following the workshop discussions there has been a progressive change in the perception of the growth pattern applicable to these anchovy otoliths in many areas which led to some revisions of the otolith interpretation and assigned ages, by which growth at ages 0 and 1 are far prominent than at older ages and the occurrence of checks became more frequently admitted. Furthermore, there have been evidences that the age determination rules have in some instances been inconsistently applied. All these evidences led to conclude on the need to review past age determinations. Although this task should be delayed until running an exchange in 2018 to be sure that all the readers apply the protocol and the current criteria of this workshop coherently, since current

criteria would change the otoliths interpretation and the age determination in many areas. In addition, for the Mediterranean regions the convenience of midyear birthdates was put in question compared with the simplicity of the conventional birthdates at first of January (as these anchovies are in the northern hemisphere).

As a corollary of the former statements, intercalibration exercises by areas, for the different countries taking part in the age reading of the same exploited stock, are still required.

Finally, this Workshop adopted a common protocol for all areas in order to standardize the anchovy age assignments and to improve the coherence of the age estimates. An agreed collection of otoliths by areas were produced and upload to the Age Readers Forum.

RECOMMENDATIONS	ADRESSED TO
1. WKARA2 recommends to carry out validation studies on age determination for the different areas inhabited by the anchovy populations either via micro-increment preparation (at least to validate the first annulus for each area) or by other methods as studies of progression of length frequency modes throughout time, for tracking cohorts, etc.	WGBIOP, WGHANSA,
2. WKARA2 recommends to review the convenience of setting date of birthdate at the middle of the year for anchovies in some Mediterranean areas and to consider to move to 1st January, because of the difficulties perceived during the workshop on the application of a changing rule for the first and second halves of the year (as associated to birthdate 1 July) and for simplicity and coherence in naming age classes in correspondence with the year classes used in the assessments based on natural calendar year (Jan-Dec).	WGBIOP
3. WKARA2 recommends, as far as possible, that only the age readings of the most expert readers are used for the assessment inputs and second that new readers pass a training processes from validated set of otoliths of the area they have to work with.	WGBIOP, WGHANSA
4. WKARA2 recommends the realization of a small exchange to be carried out during 2018 in order to see if the update Age reading protocol have been adopted by all readers (at least the participants in WKARA2) and to see if the accuracy and precision has improved.	WGBIOP, WGHANSA
5. WKARA2 recommends the realization of the intercalibration exercises by areas (for the different countries taking part in ageing reading on the same stocks). This becomes compulsory for regions where several countries exploit the same stock.	WGBIOP, WGHANSA
6. WKARA2 recommends that all age readers who participate in an exchange should also participate (preferably attending physically) in the subsequent workshops.	WGBIOP

WGBIOP 2017 acknowledges the work done and supports the age validation study through micro-increment studies to determine at least the first true annuli and other validations and corroboration methods in different areas. WGBIOP supports to review the convenience of setting date of birthdate at the middle of the year for anchovies in some Mediterranean areas and to consider moving to January 1st. This should be discussed and adopted in anchovy assessment

WGs of GFCM and STECF. WGBIOP agrees on carrying out a small-scale otolith exchange to determine if accuracy and precision has improved with the updated age reading protocol. WGBIOP recognizes the importance the realization of the intercalibration exercises for regions where several countries exploit the same stock of anchovy. Moreover, WGBIOP support that only the age readings of the most expert readers should be used for the assessment inputs and that all age readers who participate in an exchange should also participate in the subsequent workshops.

Workshop on Age estimation of Sprat (*Sprattus sprattus*) (WKARSPRAT)

The Workshop on Age Estimation of Sprat (*Sprattus sprattus*) (WKARSPRAT) met in Galway, Ireland on 15–18 November 2016. The meeting was chaired by Julie Coad Davies of DTU Aqua, Denmark and Claire Moore of MI, Ireland and included eight age readers from five national laboratories (Ireland, Northern Ireland, Germany, Norway, Sweden, and Denmark). The samples included in the workshop represented three stocks; North Sea (4), Skagerrak and Kattegat (3.a), and the Celtic Seas Ecoregion (Divisions 7 (excluding 7.d, e) and 6). The objectives of the workshop were to standardize procedures and provide guidelines for reliable age interpretation, to complete an age reading exercise for each stock, to provide age error matrices for the stock assessment working group, and to create an agreed age reference collection of otoliths. The age reading of sprat is confounded by some features of the otoliths which make correct age determination difficult, such as the presence of faint translucent rings and bands of alternating opaque and translucent zones. These problems were addressed for each stock separately and much time was spent discussing image examples of otolith in plenary. Age estimation and age validation studies were used to support the compilation of age interpretation guidelines which are an outcome of the workshop, an agreed age reading protocol, in which area specific annuli characteristics are considered and a reference collection of agreed age otoliths. The results of the age reading exercises and the plenary discussion of otoliths at the workshop indicate that there are regional differences in the readability of the otoliths which is reflected in the levels of agreement and precision seen in the results of the age reading exercises. Otoliths from the Celtic Seas Ecoregion are much easier to interpret compared with those from the North Sea, while those from the Skagerrak and Kattegat are complex and very difficult to age reliably. For stock assessment purposes, the age error matrices can be used as an indication of the quality of the age data used directly in the models e.g. North Sea, or used for exploratory assessments e.g. Skagerrak and Kattegat and the Celtic Seas Ecoregion. The low levels of accuracy and agreement for the Skagerrak and Kattegat need to be improved, the full exchange set of 100 otoliths will be reread following the age reading protocol agreed by WKARSPRAT and the exercise will be re-analysed. Otolith microstructure analysis will be carried out in participating laboratories to further reduce the uncertainties in the age estimates of fish from each stock.

RECOMMENDATIONS	ADRESSED TO
1. Formulation of a readability scale for short lived species which considers the degree of uncertainty by number of years.	WGBIOP
2. For exchange purposes the annotation mark should be placed at the end of the translucent zones.	WGBIOP
3. That a future workshop should include a presentation on the biological drivers within the sprat stocks.	HAWG

WGBIOP 2017 acknowledges the work done. The formulation of a readability scale for short lived species which considers the degree of uncertainty by number of years will be taken up under ToR b in 2018. The guidelines for exchanges and workshops now includes a point which refers to the placement of the annotation mark on the images. WGBIOP supports the placement of the annotation mark at the end of the translucent zones for exchange purposes.

Workshop on Age reading of Whiting (*Merlangius merlangus*) (WKARWHG2)

Based on the results of a full-scale otolith exchange held in 2015 (Smith, 2015) The Working Group on Biological Parameters (WGBIOP) identified the need for an age reading workshop on whiting otoliths (WKARWHG2). This workshop was hosted by Centre for Environment Fisheries and Aquaculture Science (Lowestoft, UK 22–25 November 2016). Seventeen age readers from nine countries (Belgium, France, Denmark, Norway, Germany, UK, Northern Ireland, Southern Ireland, and Scotland) participated in the workshop. The workshop was chaired by Joanne Smith (UK) and Suzy End (UK) acted as a Workshop supporting expert.

Two otoliths sets, an exercise set of 105 otoliths and a subsample set of 50 otoliths from the original exchange otolith set were aged during the workshop. The exercise set were read first, to highlight any issues/disagreements between age readers and the possible reasons for these. Following recommendations from WGBIOP otoliths from area ICES Division 4b were included in this exercise as this area was not covered in the original exchange set. Readers had the option of ageing the otolith using both an image and the actual otolith under a stereomicroscope. Only a small number of readers chose to use both methods, most choosing to age using images only. After the exercise set was read, the results were presented and differences between interpretations were discussed.

In addition, a small group of experienced section and whole otolith readers carried out a reading exercise (20 otoliths) to compare the percentage agreement obtained by readers using different otolith preparation methods. Since the results from this small exercise were not encouraging, the conclusion from this exercise was that action needed to be taken to ensure that agreements remain high regardless of preparation method used. Also, there were few examples from 4a in the original exchange, which is an area used by Norway, Denmark, and Scotland. The additional mini exchange will provide them with a more complete dataset to work with which should help with future exchanges. Post workshop, readers who routinely read whiting otoliths, whole or broken, agreed to conduct an otolith exchange in an attempt to clarify, the level of agreement between these readers and where disagreements occur, the possible reasons for these.

The group also carried out discussions on sectioned vs. whole otoliths as reading methods for whiting. The main conclusions from the exercise and the discussion on whole vs. sectioned otoliths were

- There can be difficulties interpreting the first annual ring due to splits and the wide range of growth that can occur;
- The edge can often be misread causing under/over age estimations;
- Misinterpretation of split rings and Humphries shadow can lead to over ageing of the otolith;
- If the otolith is not cut correctly it can often cause readers problems interpreting true rings.

Subsequently, the subsample of exchange otoliths was re-read to examine if the discussions throughout the week had led to improvement in the consistency of age reading.

For this exercise it was agreed that only a subsample of the exchange otoliths (50 otoliths) would be read, to allow more time during the week to be spent on discussions. The subsample set was selected using the following criteria:

- The age range which occurred in the exchange was between 1–8 years, but since only one otolith was at age 1 and two otoliths were at age 8, all three of so these were included;
- The remaining otoliths were selected across the age range 2–7 years;
- Two otoliths from each quarter were selected, one with high percentage agreement and one with low;
- After this selection, nine otoliths were required to complete the set so these were selected from ages 2–3 and 6–7, selected as above, representing problematic ages.

The results of this exercise did show an improvement in age reading compared to the same 50 read in the 2015 exchange.

No validation studies have been carried out for whiting age reading as of yet. We propose an otolith chemistry study to validate the true deposition of opaque and translucent material throughout the otolith. WKARWHG2 strongly recommends such a study, as the results will facilitate resolving the most frequent problem encountered when ageing whiting, namely the split rings/Humphry shadow'.

RECOMMENDATIONS	ADRESSED TO
WKARWHG2 recommends an age validation study using otolith chemistry to determine the true annuli and to gain a better understanding of 'Humphries shadow' and splits	WGBIOP
WKARWHG2 recommends small-scale otolith exchange between Denmark, Norway and Scotland to determine the accuracy of reading whole otoliths vs. sectioned.	WGBIOP
WKARWHG2 recommends that the guidelines for workshops should be re-written to help chairs understand the stages of organising and running a workshop and to make the workshop more beneficial to age readers that attend.	WGBIOP
WKARWH2 recommends to organize a new ageing exchange and workshop for *Merlangius merlangus* to check the use of ageing criteria and the progress in the precision	WGBIOP

WGBIOP 2017 acknowledges the work done and supports the age validation study through otolith chemistry to determine true annuli as well as a continuous clarification of guidelines for workshops. WGBIOP agrees on carrying out a small-scale otolith exchange between Denmark, Norway and Scotland to determine accuracy of reading different preparation methods. Moreover, WGBIOP recognizes the importance on scheduling a future exchange and workshop for Merlangius merlangus. WGBIOP updated the guidelines accordingly.

Workshop on fish condition (WKFICON)

The ICES workshop on fish condition (WKFICON) was held at the University of Girona (Girona, Spain) 17–18 November 2016, and was chaired by Josep Lloret (University of Girona), Pierluigi Carbonara (Coispa, Italy) and Claire Saraux (Ifremer-Marbec, France). The workshop was attended by 16 participants from different countries (Spain, France, Italy, and Germany). The WKFICON workshop was aimed at opening up new directions in marine fish condition (FC) research with a potential impact on the

assessment and management of exploited resources and marine ecosystems. It brought together marine scientists with different expertise in the field of fish condition (e.g. fish physiology, fisheries biology, fish reproduction, fish parasitism) to discuss, in a European context, the future research needs, and the necessity to integrate fish condition indicators to better manage fishery resources to safeguard the quantity and quality of marine resources. Participants discussed on recent advances in that field, the gaps in knowledge, the future research needs and the use of fish condition as indicator of population and marine ecosystem conditions. A major consideration of the workshop was how fish condition indices can be used as indicator of stock health and ecosystem status. This is especially important in the context of fish stock assessment but also of the Marine Strategy Framework Directive (MSFD), which aims at defining indicators of the health of the seas and more particularly of exploited species. After introductory presentations by all participants, the workshop held plenary sessions to address four different topics: (1) State-of-the-art, (2) Methodological aspects (3) Application of condition indices in the assessment of marine resources and ecosystems and (4) Future research and monitoring. The following main conclusions / recommendations were drawn:

Because condition is proved to be a good indicator of stock and ecosystem health, it is recommended to monitor regularly fish condition (e.g. individual length-weights and liver and gonad weights) in the new national Data Collection Programme (landings, discards, and surveys).

Because fish condition affects other life-history traits of fish such as growth, re-production, and natural mortality, it is recommended that body condition indicators must be included in stock assessments.

Based on the evidences that body condition is a good indicator of habitat quality, it is recommended using fish condition in the implementation of spatial management measures including the effect of habitat protection (Marine Protected Areas, spatio-temporal closures). Condition should be also considered in the Integrated Ecosystem Assessment (IEA).

The activity of the WKFICON group needs to be continued in order to answer the open questions regarding the methodological aspects and the integration of the FC into the stock assessment models. Taking into account that only 60% of participants of this group are involved in the Data Collection Framework (DCF), it is essential that a specific financial support is provided to continue in future its activities.

RECOMMENDATIONS	ADRESSED TO
1. Because condition is proved to be a good indicator of stock and ecosystem health, WKFICON participants recommend to monitor regularly fish condition (e.g. individual length-weights and liver and gonad weights) in the new national Data Collection Programme (landings, discards and surveys). In order to progress in this issue , the new WGFICON working group will invite to the first meeting the responsible scientists of the different organisms to which this recommendation is addressed (right column)	WGBIOP WGIPS Regional Coordination Meeting (RCM) Data Collection Reference Framework (DCRF) of the General Fisheries Council of the Mediterranean (GFCM) Experimental fisheries surveys: MEDITS, MEDIAS, IBTS, BITS, etc.
2. According to the results presented during the WKFICON workshop and the discussions carried out, participants recommend that body condition indicators must be included in stock assessments. In order to progress in this issue , the new WGFICON working group will invite to the first meeting the responsible scientists of the different organisms to which this recommendation is addressed (right column)	ICES assessment working groups Scientific, Technical and Economic Committee for Fisheries (STECF) GFCM WGSA
3. Based on the evidences that body condition is a good indicator of habitat quality, we recommend using fish condition in the implementation of spatial management measures including the effect of habitat protection (Marine Protected Areas, spatio-temporal closures). Condition should be also considered in the Integrated Ecosystem Assessment (IEA). In order to progress in this issue , the new WGFICON working group will invite to the first meeting the responsible scientists of the different organisms to which this recommendation is addressed (right column)	WKIDEA WGCOMEDA EC Directorate-General for Maritime Affairs and Fisheries, focal point of multi-annual plans EC Directorate-General for Environment Secretariat of the Network of marine protected area managers in the mediterranean (MedPAN) Regional Activity Centre for Specially Protected Areas (RAC/SPA) secretariat
4. The activity of the WKFICON group needs to be continued in order to answer the open questions regarding the methodological aspects and the integration of the FC into the stock assessment models. Taking into account that only 60% of participants of this group are involved in the Data Collection Framework, it is essential that a specific financial support is provided to continue in future its activities.	ICES Secretariat ACOM General Fisheries Council of the Mediterranean (GFCM) Secretariat

WGBIOP 2017 acknowledges the work done, supports the continuous monitoring of fish condition and the inclusion of indicators in stock assessments analysis.

Workshop on age reading of Blue whiting (WKARBLUE2)

The workshop on age reading of Blue whiting (WKARBLUE2) took place at IPMA, Lisbon, 69 June 2017. The meeting was chaired by Patricia Gonçalves (IPMA) and Jane A Godiksen (IMR) and included 17 readers from 8 institutes.

The objectives of this workshop were to review, document and make recommendations on current methods of ageing blue whiting (*Micromesistius poutassou*).

This workshop was preceded by an otolith exchange, which was undertaken using WebGR in the year prior to the workshop. The actual otoliths were also sent round to all participating institutes. The exchanged otolith collection included 245 images. The overall agreement with modal age of the pre-workshop exercise was 64.1%.There were no clear signs of seasonal misinterpretations, but the Mediterranean and most northern areas (ICES area 14b and NAFO 1C) proved to be quite difficult.

The main issues during this workshop were identification of the position of the first annual growth ring, false rings and interpretation of the edge. These issues are the same as has been mentioned in previous reports, and thus a reoccurring problem among age readers. A reference collection of images with annotations from the workshop is available in an annex of this report. It will be uploaded to SmartDot as soon as it is up and running on the ICES server. This reference collection of annotated images will hopefully be helpful when running into these issues during future age reading.

Different methods to help age readers determine a zone were discussed during the workshop. The burning of otoliths showed some potential in interpreting the inner ring, but is not to be used as a routine. The sliced technique is time consuming and does not help with interpretation and may introduce misinterpretation of ageing.

During the workshop some of the otoliths from the exercise were polished, to help readers in the cases where the age rings were not so evident, completely absent, or showing a growth pattern different from the expected. The polished results proved useful for ring interpretation and helped during the plenary discussion, although we do not recommend this technique to be used as routine procedure, as it is very time consuming. A Plug-in for ImageJ which can detect variation in opacity in the otolith was presented. Also, a table with possible otolith ring diameters from an IPMA study was tested during the workshop. The table showed potential, but a larger dataset is still needed before it can be adopted as a guideline.

The results from the pre-workshop exchange and from the exercises conducted during the workshop reveal some difficulties on interpreting the blue whiting age rings. Based on those results we further recommend the implementation of daily ring studies and validation of the 1st ring for blue whiting across areas.

Blue whiting otoliths has proven to be quite difficult to age, and though guidelines have been constructed, the experience of the reader determines the interpretation of the otolith structure. It is therefore recommended to have regular exchanges and workshops in order to improve the agreement between readers.

RECOMMENDATIONS	ADRESSED TO
1. WKARBLUE3 Workshop in 2021	WGBIOP, ACOM
2. Age validation study on daily growth rings to solve the growth rings interpretation.	WGBIOP, ACOM, WGWIDE
3. Analyse first year growth from different areas using a subset of at least 150 otoliths per area.	WGBIOP, ACOM, WGWIDE
4. Otoliths Exchange of *M. poutassou* in 2019 covering northern and southern subpopulations. Images and structures to be included.	WGBIOP, ACOM, WGWIDE
5. Update guideline of ageing criteria	WGBIOP, ACOM, WGWIDE

WGBIOP 2017 acknowledges the work done and agrees on scheduling the future workshop in 2021 (WKARBLUE3) and otolith exchange in 2019 where the shortcomings of the present workshop should be considered. Moreover, WGBIOP recognizes the need for an age validation study on daily growth rings to solve interpretation problems. WGBIOP updated the guidelines accordingly.

Workshop on ageing validation methodology of *Mullus* species (WKVALMU)

The Working Group on Biological Parameters (WGBIOP) meeting in 2016 (ICES, 2016) recommended a Workshop of Ageing Validation methodology for *Mullus* species (WKVALMU). This workshop (Co-chairs: Kélig Mahé, France; Pierluigi Carbonara, Italy and Chryssi Mytilineou, Greece) has been held in Conversano (Italy) 1518 May 2017. Five countries took part in this meeting (Italy, Spain, Greece, France, Croatia) for a total of 16 participants. This meeting was organized to try to clarify the rules which are applied on the ageing of mullet species (*Mullus surmuletus and M. barbatus*). At the beginning of the workshop, a lot of presentations were discussed focusing on the used ageing methodologies by each institute and all ageing validation studies. A synthesis of validation methods was conducted during the workshop aiming to identify a) the first false ring coinciding with the demersal check formation for both species (for the fish around 5 cm of total length), b) the period with opaque edge in otoliths (from May to October) and c) the mean length at the first age groups derived from the length distribution analysis. Various schemes for the age interpretation are used by the readers. This is a source of bias in the readings. As a consequence, schemes for the age interpretation have been discussed. Two main age interpretation schemes were decided to be applied on a set of 40 images. These otoliths had also been used in the 2011 exchange. The bias between the two age interpretation schemes was estimated. According to this, the bias between readers was smaller for the scheme 1 (birthdate: 1st January) than scheme 2 (birthdate: 1st July). Differences in ageing were detected during the first semester. Moreover, these results showed the low agreement between readers for each interpretation scheme. Comparing the modal age obtained by each interpretation scheme, a significant difference was observed. For stock assessment and management purposes, it would be desirable that all countries use the same age interpretation scheme. Based on several discussions on the age interpretation results of this exercise, a new age interpretation scheme was proposed during this workshop. The WKVALMU proposed recommendations for the next exchange which will be organized in 2018. In 2019, the new workshop (WKCAM3; Split; co-chairs: P. Carbonara, Italy; K. Mahé, France; D. Medvesek, Croatia) will focus on the analysis of the new exchange results, validation studies and will formalize guidelines on the ageing of *Mullus surmuletus* and *M. barbatus*. During the present workshop, it was noted that the difficulty and the low agreement in age interpretation makes necessary the development of a European project on age validation methods. Consequently, a draft proposal has started to be written during this workshop.

RECOMMENDATIONS	ADRESSED TO
1.WKACM3 Workshop in 2019	WGBIOP, ACOM
2. Otoliths Exchange of *M. surmuletus* and *barbatus* from the Mediterranean sea in 2018	WGBIOP, ACOM
3. Age validation study to solve the growth rings interpretation	WGBIOP, MEDITS Group, RCMED, RCM NS-EA, RCM NA, PGMED, ACOM,GFCM, WGSAD
4. Ageing protocol must follow the new ageing scheme in the Mediterranean sea	WGBIOP, GFCM, WGSAD, MEDITS Group, EASTMED,ADRIAMED, MEDSUDMED

WGBIOP 2017 acknowledges the work done and support an otolith exchange in 2018 and if needed a new workshop in 2019. An age validation study is also supported in order to solve the growth rings interpretation.

Workshop on Optimization of Biological Sampling at Sample Level (WKBIOPTIM)

The Workshop on Optimization of Biological Sampling at Sample Level (WKBIOPTIM), chaired by Ana Cláudia Fernandes (Portugal) and Julie Coad Davies (Denmark) was held in Lisbon, Portugal, from 20–22 June 2017. Twenty-two participants from 12 countries within the ICES and Mediterranean communities were represented. The workshop focused on practical aspects of sampling effort analysis and was proposed as a joint workshop between WGBIOP and WGCATCH so that effective communication between the groups could be established. Prior to the workshop, two sets of R-scripts were developed that used the current exchange format of the Regional Data Base (RDB) as input. The first set of scripts is useful for cases where there is considerable a priori evidence of oversampling (e.g. many samples, several hundreds of measurements per sample, over a relatively short size/age-class range). The script implements several types of simulations (user defined) and produces a set of graphical and numerical outputs that allow the visualization of the consequences of measuring different number of individuals per sample. The second set of scripts can be used to determine the number of fish, hauls and trips that should be taken without loss of precision in the estimation. In both cases scripts were prepared to use "lengths" as the biological parameter to be analysed but can be extended to other biological parameters. Participants brought their own case-studies and three subgroups were formed: one that tested the first script (sample level), one that tested the second script (multilevel analysis) and one that discussed quality indicators for length/age frequency data. Workshop time was spent introducing participants to the analyses carried out in the scripts, adapting data inputs to different formats (e.g. length frequency vs. length of individual specimens), debugging coding errors and running simulations of the case-studies. The outputs of the case-studies were analysed during and after the workshop. Some possible quality indicators were discussed but a full evaluation and additional quality indicators for length frequency data and other biological parameters are required alongside consideration of end-users needs. WKBIOPTIM identified considerable margin to optimize the sampling effort of some of the case-studies presented without compromising the quality of the data to be used by the end-users. In what concerns both sample-level and multilevel sampling effort analysis, the approach tested can be used as tool to simulate and analyse a range of different sampling scenarios whose outputs can be taken into account in the national and regional plans. Following the workshop, concrete reduction in the sample sizes collected for some species have been achieved after dialog with data end-users that resulted in time savings for data collection in other stocks. In what concerns quality indicators for other biological parameters and additional quality indicators for length frequency data, input from WGBIOP and WGCATCH will be requested with the aim of including them in future updates of the R-scripts and in view of possible end-users needs. The expansion of the application of the R-scripts to other biological parameters (weights, ages and maturity) was not performed during the workshop but it is considered of high importance since biological data collection is inherently multivariate and multi-purpose frequently extending far beyond collection of length data. Future developments of the scripts are expected to happen as part of WKBIOPTIM2 which will aim to, among other, include additional biological parameters in the analyses, the integration of additional quality indicators and a discussion of the most appropriate balance between them (based on end-users needs). It is envisioned that a harmonized toolbox of R-scripts and R-vignettes will ultimately be produced that aids national labs in the planning of their work.

RECOMMENDATIONS	ADRESSED TO
1. Give input on quality indicators of biological parameters; identify suitable case studies for sampling effort analysis based on commonly collected/used parameters	WGBIOP, WGCATCH
2. Discuss and comment on outcomes of the workshop in what concerns sample level and multi-level analyses	WGCATCH
3. Provide guidelines which identify various end-users needs under optimization procedures	PGDATA

WGBIOP 2017 acknowledges the work done and endorses WKBIOPTIM2. WGBIOP members will be encouraged to attend and intersessional work will be carried out to identify relevant case studies. Full support will be provided under ToR e of the new WGBIOP 3 year work plan.

Workshop on Sexual Maturity staging from histological tools (WKMATHIS)

Report is due in November 2017. Executive summary will be included in the report from WGBIOP 2018.

Exchanges

The following are summaries of the age reading exchanges carried out in 2016 and 2017.

Herring (*Clupea harengus*) Exchange 2016

Based on the task decided in WKNARC meeting in 2013 for 2015, an intercalibration of herring age determination in the Baltic Sea was conducted in 2015–2017.

Two main methods are used in herring age determination in the Baltic Sea area: reading from whole otoliths in reflected light and reading from stained thin sections of otolith cross section in transmitted light. In the largest part of the Baltic Sea, herring otoliths are aged from whole otoliths. The herring from the Gulf of Bothnia, and partly from SD 29 and SD 32, are aged from stained otolith thin slices.

This intercalibration was conducted in two parts: one from SD 26 with whole otoliths from 150 specimens (including three samples with otoliths from 50 specimens each), and the other from SD 30 & SD 32 including 173 otolith thin slices, stained with neutral red. Two samples from SD 26 (S1 & S2), were collected by the Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Russia, and one sample (S3), by National Marine Fisheries Research Institute, Poland. The SD 30 and 32 samples (S4) were collected in BIAS survey by Finland and Sweden. Altogether 11 readers participated the intercalibration with whole otoliths of herring from SD 26 and 5 readers with the otolith slices from SD 30 and 32.

With S1, the results were mostly good, however, readers with experience from different types of herring stocks could have problems in the interpretation of the annuli. The PA ranged between 88−94%, the CV ranged from 1.9−7.5% and relative bias from ±0.00−0.24. With S2 (PA=52−85%, CV=1.9−7.5%, bias=±0.04−0.49) and S3 (PA=52−81%, CV=11−20%, bias=±0.02−0.52), there was more variation, i.e. smaller precision in the results than with S1. The results from the stained otolith slices from herring in subdivisions 30 and 32 showed the highest percentage agreement (PA=87−96%, CV=4.0−8.1%, bias=±0.08−0.12), but the difference from S1 results with the most experienced readers was not very large. As ageing from stained otolith slices seems less sensitive to local differences in otolith features, staining a limited number of otoliths, to be examined side by side with the normally used whole otoliths of the same specimens, could be one way to improve the accuracy in reading whole otoliths.

Coordinated by Jari Raitaniemi (Finland).

WGBIOP 2017 acknowledges the work done.

Sandeel (*Ammodytes marinus)* Exchange 2016

In 2016 the North Sea Sandeel otolith exchange took place and was completed by age readers from Norway, Denmark and Scotland (only 1 of which does not provide age data for assessment purposes). Images of whole otoliths from 145 individual fish were used for this exchange; two samples from Sandeel area (SA) 1 and one from SA 3. The aim of this combined exchange was to assess the accuracy of the age readings i.e. the proximity of the estimated ages to the modal age which is determined by an index of average percentage error (APE), percentage agreement and relative bias values, and to assess the precision i.e. the reproducibility of age estimates between readers which is determined using the coefficients of variation (CV). In addition, growth curves were compiled based on the distance data between annotations made on the otolith images hosted on the online annotation tool, WebGR. The growth curves allow for detailed

examination of where the main problems with age interpretation are. Finally, Age Error Matrices were compiled for each area.

For SA 1 and 3 combined (based only on those readers providing age data for assessment purposes) the overall percentage agreement is 86.9% and CV 17%. The average percentage error (APE) is 12.8%. At modal age 0, four of the readers are in 100% agreement with modal age and the other two readers (one Danish and one Norwegian) show a positive bias and estimate the fish to be 1 year older.

Regarding SA 3, 25 pairs of otoliths were included in the exchange for discussion purposes; where there is often a faint translucent zone visible in the highly opaque center. Based on expert readers only, the overall percentage agreement is 66% and CV 37.3%. The average percentage error (APE) is 28.6%.

Results for SA 1 show a high level of agreement between the readers who are providing ages for stock assessment; percentage agreement is 91.2%, CV is 12.7% and APE is 9.4%.

The following issues were identified and need to be clarified with readers:

- Otoliths where there appears to be a faint opaque zone between the highly opaque center and the otolith edge
- Otoliths where there is often a faint translucent zone visible in the highly opaque center
- Correct identification of the edge type

Coordinated by Julie Coad Davies (DTU Aqua, Denmark).

WGBIOP 2017 acknowledges the work done.

Plaice (*Pleuronectes platessa*) Exchange 2016

In 2015 a request was made from the Baltic Fisheries Assessment Working Group (WGBFAS) to the Working Group on Biological Parameters (WGBIOP) to conduct an otolith exchange for plaice in the Baltic Sea. The current exchange was initiated by DTU Aqua, National Institute of Aquatic Resources, Denmark and Thünen Institute of Baltic Sea Fisheries (OF), Rostock, Germany and both institutes provided the samples and corresponding otolith images. The exchange was completed by 7 participants from 4 countries (Denmark, Germany, Poland and Sweden) who supply age data for the stock assessment of plaice in Kattegat, the Sound and Western Baltic (PLE2123) and Baltic Sea (PLE2432). These readers use different otolith preparation methods when age reading plaice, thus images of whole and sectioned otoliths from the same fish were provided. The aim of the exchange was to assess the accuracy of the age readings i.e. the proximity of the estimated ages to the modal age which is determined by percentage agreement and relative bias values, and to assess the precision i.e. the reproducibility of age estimates between readers which is determined using the coefficients of variation (CV) and an index of average percentage error (APE). In addition, growth curves were compiled based on the measurements between annotations made on the otolith images, thus allowing for a more detailed examination of where the main age interpretation problems are. The results show varying levels of accuracy and precision depending on reader expertise, method applied and sample origin. A higher level of agreement was reached when only expert readers were included in the analysis and also for PLE2432 when compared against PLE2123. The level of agreement on sectioned otoliths was slightly higher than whole otoliths but there were no consistent patterns where one method always produced better results compared to the other. It is recom-

mended that a plaice age reading workshop be held to help resolve the age determination differences outlined in the report and that WGBIOP provide input on how best to proceed with resolving discrepancies between methods.

RECOMMENDATIONS	ADRESSED TO
1. A plaice age reading workshop to be held with a pre-workshop exchange including samples from ICES Subdivisions 21–26	WGBIOP
2. Otolith image collections are compiled from years/areas with obscure growth patterns	Age reading laboratories
3. Age readers should closely follow the instructions provided for annotation procedures for a specific exchange.	Age reading laboratories

Coordinated by Julie Coad Davies (DTU Aqua, Denmark).

WGBIOP 2017 acknowledges the work done. An age validation study will be underway shortly and the scheduling of the future workshop and otolith exchange is postponed until the outcomes of this study become available.

Sprat (*Sprattus sprattus*) Exchange 2016

From April to September 2016 a sprat otolith exchange took place for the North Sea (4) and Celtic Seas Ecoregion (Divisions 7 (excluding 7.d, e) and 6). 18 readers from 8 institutes took part. Images were made available on WebGR for annotation and the otoliths were provided to all readers for visual examination. The otoliths of 200 individuals sampled from 2014 to 2016 in the North Sea (ICES area: 4.b, 4.c n=100) and from 2009 to 2016 in the Celtic Seas Ecoregion (ICES areas: 6.a, 7.b, 7.g, 7.j n=100) were used for this exchange. Results and images were discussed in plenary at WKARSPRAT (the Workshop for Age Estimation of Sprat). Age reading issues identified included the interpretation of a translucent band in otoliths from the North Sea, identification of the edge type and when to include the transparent outer most edge in the count of age. Readers should refer to the age reading protocol and agreed age reference collection compiled at WKARSPRAT, see workshop summary above.

Coordinated by Julie Coad Davies (DTU Aqua, Denmark).

WGBIOP 2017 acknowledges the work done.

Blue whiting (*Micromesistius poutassou*) Exchange 2016

From March 2016 until March 2017, a blue whiting otolith exchange was undertaken using WebGR. The exchanged otolith collection included 245 images of samples from various areas and sampled throughout the year. These, were annotated by 29 readers from 11 countries. For each of the 245 otoliths pairs, otolith total length, otolith weight and ring diameter by age were determined. In this analysis the data from the fish total length and the ICES area where fish were caught was used. The relationship between the modal age with fish length, otolith length and otolith weight was linear.

The overall agreement with modal age of the pre-workshop exercise was 64.1%. There were no clear signs of seasonal misinterpretations, but the Mediterranean and most northern areas (ICES area 14b and NAFO 1C) proved to be quite difficult.

The main issues during this workshop were identification of the position of the first annual growth ring, false rings and interpretation of the edge.

Main recommendations are the implementation of daily ring studies and validation of the 1st ring for blue whiting across areas.

Coordinated by Patrícia Gonçalves (IPMA, Portugal) and Jane Godiksen (IMR, Norway).

WGBIOP 2017 acknowledges the work done.

Annex 6: Draft resolutions for suggested exchanges and workshops

Work plan for 2018–2019

Workshops planned for 2018:

- **WKSEL 3** A Workshop on Elasmobranchs maturity will be established (Maria Cristina Follesa Italy; Pierluigi Carbonara, Italy) and will meet in Cagliari (Italy), March 2018
- **WKVALPEL** Workshop on age validation studies of small pelagic species (replaces WKMIAS) (Co-Chairs: Javier Rey, Spain, Kelig Mahé, France, and Pierluigi Carbonara (Italy), will meet in Boulogne sur mer (France), 20–24 November 2018.
- **WKARHOM3** A workshop on Age reading of Horse Mackerel, Mediterranean Horse Mackerel and blue Jack Mackerel (*Trachurus, T. Mediterranean and T. picturatus*). Co-chairs: Alba Jurado, Spain, Pierluigi Carbonara (Italy) and Kelig Mahé, France will meet in Livorno (Italy), 7–12 May 2018.
- **WKAMDEEP2–**A Workshop on Age Estimation Methods of Deep Water Species 2, chaired by Ole Thomas Albert (Norway), Juan Gil Herrera (Spain) and Kélig Mahé (France) will meet in Cadiz, Spain, 17–21 September 2018
- **WKFATHOM–**Workshop on Egg staging, Fecundity and Atresia in Horse mackerel and Mackerel (WKFATHOM) chaired by Matthias Kloppmann (Germany) and Maria Korta (Spain) will meet twice in autumn 2018.
- - Egg staging: chaired by Matthias Kloppmann (Germany) will meet in Bremerhaven, Germany, 8–12 October.
- -Fecundity: Chaired by Maria Korta (Spain), will meet in IJmuiden, The Netherlands, 19–23 October
- **WKASMSF** Workshop for Advancing Sexual Maturity Staging in Fish (WKASMSF), chaired by Cristina Follesa, Italy, and Cindy van Damme, The Netherlands, will meet in Copenhagen, Denmark, 30 April–4 May 2018
- **WKMACQI** Workshop for Mackerel Biological parameter Quality Indicators (WKMACQI), chaired by Cindy van Damme, The Netherlands, will meet in IJmuiden, The Netherlands, TBD June 2018.

Workshops planned for 2019–2020:

- **WKACM3** A Workshop on Age reading red mullet (*Mullus barbatus*) and striped red mullet (*Mullus surmuletus*), co-chaired by Pierluigi Carbonara (Italy), Kélig Mahé, (France) and Damir Medvesek, (Croatia) will meet in Split, Croatia, 18–22 March 2019
- **WKMSMAC3** A Workshop on Maturity Staging of mackerel (*Scomber scombrus*) and horse mackerel (Trachurus trachurus). (Chairs: TBD) will meet at TBC) in 2020 (exact dates TBC)

Otolith Exchanges

The following age reading exchanges have been initiated in 2017:

- Otolith/scale exchange 2017–**Norwegian Spring-spawning herring** (*Clupea harengus*). Coordinator: Jane Godiksen (Norway). **Ongoing**
- Otolith exchange 2017–**Norway Pout** (*Trisopterus esmarkii*). Coordinator: Mandy Gault (Scotland). **Ongoing**
- Small Otolith exchange 2017–**Whiting** (*merlangus merlangus)*. Coordinator Joanne Smith (United Kingdom). **Ongoing**
- Otolith Exchanges 2017–**Sardine** (*Sardina pilchardus*) in Areas 7, 8, 9a and Mediterranean. Coordinator: Eduardo Soares (Portugal) and Pedro Torres (Spain). **Ongoing**
- Otolith Exchanges 2017–**Haddock** (*Melanogrammus aeglefinus*) from Rockall and North Sea. Coordinator : Mandy Gault (Scotland). **Ongoing**
- Otolith Exchange 2017–**Megrim** (*Lepidorhombus spp*). Coordinator: Gordon Henderson (Scotland). **Ongoing**
- Otolith Exchange 2017–2018–**Chub Mackerel** (*Scomber collias*) from Bay of Biscay, Portugal, Mediterranean and Mauritanian waters. Coordinator: Rosario Navarro (Spain) and Andreia V. Silva (Portugal). **Ongoing**
- Otolith Exchanges 2017–**Lemon sole** (*Limanda limanda*) from North Sea and 7 d. Coordinator: Joanne Smith (United Kingdom). **Ongoing**
- Otolith Exchanges 2017–**Dab** (*Limanda limanda*) from North Sea and 5a. Coordinators: Holger Haslob (Denmark) and Loes Bolle (The Netherlands). **Ongoing**
- Otoliths exchange 2017–**Mackerels** (Horse Mackerel, Mediterranean Horse Mackerel and blue Jack Mackerel (*T.Trachurus, T. Mediterranean and T. picturatus Engraulis encrasicolus*). Coordinators : Kélig Mahé (France), Pierluigi Carbonara (Italy) & Alba Jurado-Ruzafa (Spain). **Ongoing**

Otolith Exchanges proposals for 2018

- Otolith exchange–**Turbot and Brill** (*Scophthalmus maximus* and *Scophthalmus rhombus*). Coordinator: Karen Bekaert (Belgium).
- Otoliths exchange–**European anchovy** (*Engraulis encrasicolus*). Coordinators : Andrés Uriarte, Begoña Villamor & Gualtiero Basilone (Spain). March-April 2018
- Otoliths exchange–**red mullet and striped red mullet** (*Mullus barbatus and Mullus surmuletus*), Coordinators: Pierluigi Carbonara (Italy), Kélig Mahé (France).
- Otoliths exchange–**Sandeel** (*Ammodytes marinus*), Coordinator: Julie Coad Davies (Denmark)
- Otolith Exchange–**Redfish** (*Sebastes ssp*), Coordinator: Lise Heggebakken (Norway)

Vertebrae Exchanges proposals for 2018

- Vertebrae exchange Elasmobranchs (Raja spp), Coordinators: Pierluigi Carbonara (Italy), Maria Cristina Follesa (Italy).

Draft resolutions for workshop planned for 2018

WKARMAC2 – Workshop on Age estimation of Mackerel (*Scomber scombrus*)

A **Workshop on Age Estimation of Atlantic Mackerel (*Scomber scombrus)*** (WKARMAC2), chaired by Jens Ulleweit, Germany, and Maria Rosario Navarro, Spain, will be established and take place in San Sebastian, Spain, 22–26 October 2018 to:

a) Review the information on the biology, age estimation, workshops, otolith exchanges and validation works done so far.

b) Analyse the results of the otolith exchange carried out in 2014 and the potential source of discrepancies, particularly in fish over the age of 6 years.

c) Analyse growth increment patterns in mackerel otoliths and continues to improve the guidelines for their interpretation.

d) Create a reference collection of agreed age otoliths.

e) Address the generic ToRs adopted for workshops on age calibration (see 'WGBIOP Guidelines for Workshops on Age Calibration')

WKARMAC2 will report by DATE for attention to ACOM, SCICOM and WGBIOP.

Supporting information:

Priority:	Essential. 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. Otolith processing methods and age reading methods might differ considerably between countries and laboratories. Therefore, otolith exchanges should be carried out on a regular basis, and if serious problems exist age reading workshops should be organized to solve these problems.
Scientific justification:	To identify the present problems in age determination for this species (i.e. low agreement between age readers particularly for fish over the age of 6 years), to improve the accuracy and precision of age determinations and to share information of the methods and procedures used between different ageing laboratories.
Resource requirements:	Institutes to supply otolith samples for potential inclusion in a reference set.
Participants::	The Workshop will include international experts on growth and age estimation In view of its relevance to the ICES quality assurance, the Workshop is expected to attract interest from ICES Member Countries.
Secretariat facilities:	None
Financial:	None
Linkages to advisory	ACOM
Linkages to other committees or	WGBIOP, SCICOM, RCM
Linkages to other organizations cost:	None.

WKAMDEEP 2– Workshop on Age Estimation Methods of Deep Water Species

A Workshop on Age Estimation Methods of Deep Water Species 2 (WKAMDEEP2), chaired by Ole Thomas Albert, Norway, Kélig Mahé, France and Juan Gil Herrera, Spain will meet in Cádiz, Spain, 17–21 September 2018, to:

a) Collect and review the consistency of age data used in stock evaluations of deep-water fish, including, but not restricted to, tusk (*Brosme brosme*), ling (*Molva molva*), blue ling (*Molva dypterygia*), roundnose grenadier (*Coryphaenoides rupestris*), greater silver smelt (*Argentina silus*), black scabbardfish (*Aphanopus carb*o), black-spotted sea bream (*Pagellus bogaraveo*), greater forkbeard (*Phycis blennoides*) and orange roughy (*Hoplostethus atlanticus*);

b) Review new information on precision and accuracy of age estimation of the seven first species listed above, for which WKAMDEEP1 agreed on individual ageing protocols, and revise those protocols as appropriate;

c) Review age estimation procedures, and propose new ageing protocols for deep-water species not considered by WKAMDEEP1;

d) Assemble age reading experts on deep-water species for training on age reading of several species, following the recommendation from WKAMDEEP1 to conduct age reading comparisons collectively for the whole group of slow-growing deep-water fish;

e) Conduct a small-scale comparison of otolith images from 100 individuals of each species and report on precision and between-reader biases.

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

WKAMDEEP 2 will report by DATE for attention to ACOM, SCICOM and WGBIOP.

Supporting information:

Priority:	Essential. Age data are essential in evaluation of fish stocks. Age data are provided by different countries and are estimated using standard ageing criteria. These are generally not fully validated, and regular workshops are needed to increase the knowledge base, harmonizing interpretations and estimating precision and relative bias. A basis was established in 2013 by the previous WKAMDEEP. Therefore, a WKAMDEEP-2 should be carried out in order to update the methodology, and evaluate new information on otolith growth and age determination issues for commercially harvested deep-water fish species. And as well for the purpose of bringing scattered experts together to develop a coherent approach to age estimation of these typically hard-to-interpret otoliths needed to increase the knowledge base, harmonizing interpretations and estimating precision and relative bias. A basis was established in 2013 by the previous WKAMDEEP. Therefore, a WKAMDEEP-2 should be carried out in order to update the methodology, and evaluate new information on otolith growth and age determination issues for commercially harvested deep-water fish species. And as well for the purpose of bringing scattered experts together to develop a coherent approach to age estimation of these typically hard-to-interpret
Scientific justification:	The necessity of accurate and precise age data for all species assessed in WGDEEP is massive. The stock-assessment is severely hampered by the lack of valid age-structured data and the fact that the agreement in the age-data supplied to the assessment is very low (as seen in previous exchanges). The aim of the workshop is to establish or update age reading protocols for each species based on recent validation and corroboration studies, and based on these protocols conduct an age reading comparison across labs and for each species in order to increase the reliability of age estimates to be used in stock assessments.
Resource requirements:	No specific resource requirements beyond the need for members to prepare for and participate in the meeting.
Participants:	Participants should include a mixture of scientists and key technicians with expertise in age determination methods, deep-water species biology and assessment, as well as data analyses and scientific publication.
Secretariat facilities:	None
Financial:	Travel costs will be eligible for participants from Member States of the European Union through the EU Data Collection Framework (DCF). Funding for external experts on the age determination methods may be required.
Linkages to advisory	ACOM
Linkages to other committees or	WGBIOP, WGDEEP
Linkages to other organizations	There is a direct link with the EU DCF

WKASMSF–Workshop for Advancing Sexual Maturity Staging in Fish

The **Workshop for Advancing Sexual Maturity Staging in Fish** (WKASMSF), chaired by Cristina Follesa, Italy, and Cindy van Damme, The Netherlands, will meet in Copenhagen, Denmark, 30 April–4 May 2018 to:

a) Prepare a historical overview of (national) maturity scales used for uploading sexual maturity staging data into the ICES and GFCM databases;
b) Create an overview, or prepare new, conversion tables from national maturity scales to the international agreed maturity scales;
c) Establish an implementation plan for the international agreed maturity scales of WKMATCH and MEDITS, as the only scales for reporting to ICES and GFCM databases, respectively.
d) Expand general histological criteria, for validation of macroscopic maturity staging, as established bij WKMATHIS for the different reproductive strategies in teleosts.

WGASMSF will report by 15 June 2018 for the attention of the WGBIOP, SCICOM, ACOM, EOSG and DIG.

Supporting information

Priority	Macroscopic stages of gonadal development are an essential feature in fis stock assessment to estimate the maturity ogive and Spawning-stoc biomass (SSB). In 2012 WKMATCH has prepared a general internation agreed maturity staging scale for macroscopic mturity staging. Subsequer maturity staging workshops have used this scale for calibration. Howeve this scale has never been introduced and implemented into the ICE databases. As a results the current maturity data uploaded to th international databases are based on various (national) maturity scales. Als data uploaded on the GFCM database are sometimes subject to confusio due to a mismatch between the MEDITS agreed scale and the national scal It is vital that a historic overview is created of the scales used to uplaod da by the individual institutes. Together with conversion tables to convert th historic maturity data to the international agreed maturity sca (WKMATCH and MEDITS). A convertion table between WKMATCH an MEDITS scales is also auspicable in order to harmonize the maturity stagir between ICES and GFCM. Secondly, an implementation plan for th international agreed maturity scale in the internatinal databases wit restricted uploading needs to be developed. For validation of macroscopic maturity staging, histology is essentia WKMATHIS has prepared general histological descriptions for teleosts to g with the maturity staging scales. However, these general descriptions nee to be expanded for the various reproduction strategies in teleosts.

Scientific justification	Term of Reference a) A historical overview of the scales used by each institute for uploading dat into the ICES and GFCM databases is necessary. Currently data are uploaded in the ICES M6 scale, but the actual scale used by national institutes does not always correspond to the the ICES and/or GFCM vocabulary. As a result the maturity data in the ICES and/or GFCM databases is misinterpreted. Term of Reference b) Conversion tables are necessary to be able to convert the historic maturity data to the new agreed international maturity staging scale. A specific conversion from WKMATCH and MEDITS is also essential. This should include an interpretation of which stages are immature and mature. Term of Reference c) An implementation plan needs to be prepared so that all parties concernec (i.e. ICES, GFCM, national institutes, survey groups, assessment groups) are aware that the international agreed maturity scale is implemented in th ICES nd GFCM databases respectively and that new uploaded data can only be uploaded in the new scale. Term of Reference d) The generic histological descriptions of the international maturty scale nee to be expanded to the different reproductive straregies.
Resource requirements	No specific resource requirements beyond the need for members to prepar for and participate in the meeting.
Participants	Participants should include an expert from the ICES and GFCM data centr and a mixture of scientists and key technicians with expertise in maturit scales used at the national institutes, macroscopic stages of gonad development and histological methods, as well as stock assessment. Th implementation plan needs to be developed in close cooperation with th ICES and GFCM data centre.
Secretariat facilities	None.
Financial	Travel costs will be eligible for participants from Member States of the European Union through the EU Data Collection MAP (DCMAP).
Linkages to advisory committees	ACOM
Linkages to other committees or groups	WGBIOP
Linkages to other organizations	There is a direct link with the EU DCF.

WKMACQI–Workshop on Mackerel biological parameter Quality Indicators

The **Workshop on Mackerel biological Quality Indicators (WKMACQI**), chaired by Cindy van Damme, The Netherlands, will meet in IJmuiden, The Netherlands, 15–17 May 2018 to:

a) Review and consider quality indicators for and issues with biological parameters of western, southern and North Sea mackerel;
b) Prepare and update the Age Error Matrix and Maturity Staging Error Matrix;
c) Carry out sensitivity analyses of the mackerel assessment with regards to the quality indicators of mackerel biological parameters.

WKMACQI will report by 15 September 2018 for the attention of the WGBIOP and WGWIDE.

Supporting information

Priority	WGBIOP has prepared quality indicators for biological parameters fo upcoming benckmark stocks in the first 3-year term 2015–2017. The origin ToR for WGBIOP included the incorporation of the quality indicators in th assessment proces. This goal has not been reached because WGBIOP has no been able to get stock assessors involved in the WGBIOP meetings in 2016 o 2017. However, contact has been established with the stock coordinators an issues and quality indicators on biological parameters have been put forwar to them. Positive reactions from them let to incorporating the issues in qualitative way. However, it is necessary to improve the assessment proce to include the quality indicators further in the assessments. This worksho with mackerel as a case study will be an example of how the qualit indicators can be further incorporated in the assessment.
Scientific justification	Term of Reference a) WGBIOP has prepared information on the quality indicators and issues with biological parameters of mackerel. The mackerel stock coordinator ha formulated further needs with regards to the biological parameters. These need to be combined and evaluated to come to the final quality indicators and issues with biological parameters for mackerel. Term of Reference b) Age Error Matrices (AEM) have been developed for some species, for mackerel an (unpublished) matrix has been developed some time ago. However, since then a new age reading workshop has been executed. The AEM need to be updated with the results of the latest workshop. A calibration of the maturity staging has been carried out in 2015. With the results of this workshop a Maturity Staging Error Matrix (MSEM)can be developed. Term of Reference c) Sensitivity analyses using the quality indicators and the AEM and MSEM will show the impact on the assessment.
Resource requirements	No specific resource requirements beyond the need for members to prepar for and participate in the meeting.
Participants	It is vital that the stock assessor of western, southern en North Sea macker will participate in this workshop. WGBIOP participants involved in quality indicators and issues with biological parameters.
Secretariat facilities	None.
Financial	Travel costs will be eligible for participants from Member States of the European Union through the EU Data Collection MAP (DCMAP).
Linkages to advisory committees	ACOM

Linkages to other committees or groups	WGBIOP, WGWIDE
Linkages to other organizations	There is a direct link with the EU DCMAP.

WKACM3–Workshop on Age reading red mullet (*Mullus barbatus*) and striped red mullet (*Mullus surmuletus*)

A Workshop on Age reading red mullet (*Mullus barbatus*) and striped red mullet (*Mullus surmuletus*), (**WKACM3)** co-chaired by Pierluigi Carbonara, Italy; Kélig Mahé, France and Damir Medvesek, Croatia) will meet in Split, Croatia, 18–22 March 2019 to:

a) Review of available data through new validation studies

b) Analysis of the results of last exchange between ageing labs, according to the information from the WKVALMU;

c) Clarify the interpretation of annual growth rings particularly the first growth ring ;

d) Improve the age reading protocols produced during the WKACM2;

e) Increase existing reference collections of otoliths and improve the existing database of otolith images during the WKACM2;

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

WKACM3 will report by DATE to the attention of ACOM and SCICOM

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 which have not been validated. There is necessary to continue to clarify this guideline of age interpretation in the Mediterranean sea for Mullus species. Therefore, an appropriate otolith exchange programme will carry out in 2018 for the purpose of inter-calibration between ageing labs according to the results of the WKVALMU meeting. Results of this otolith exchange will discuss during WKACM3 (2019).
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 DC-MAP, and ICES WG, the Workshop 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
Linkages to other committees or groups:	WGBIOP, MEDITS Group, RCMED, PGMED, ACOM,GFCM, WGSAD
Linkages to other organizations:	There is a direct link with the EU DCF.

WKVALPEL Workshop on age validation studies of small pelagic species

A Workshop on age validation studies of small pelagic species (WKVALPEL**)**. Replace WKMIAS
(Co-Chairs: Javier Rey, Spain, Kelig Mahé, France, and Pierluigi Carbonara, Italy, will meet in Boulogne sur mer (France), 20–24 November 2018 to

a) Review information on age estimations, otolith exchanges, workshops, and validation works done for each pelagic species

b) Assemble and compare the results of different validation methods (i.e. marking and recapture, marking the calcified structure, marginal increment analysis, marginal analysis, modal progression analysis, length back-calculation, microincrement analysis, etc.);

c) Discuss and propose the most appropriate validation methods of age and growth pattern of calcified structures (CS), for each species and stock;

d) Propose the appropriate validation methods to recognize the growth checks.

WKVALPEL will report by DATE to the attention of ACOM and SCICOM

Supporting information:

Priority:	The current activities of this Group will lead ICES into issues related to the ecosystem affects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority
Scientific justification:	Based on main results produced in previous ICES workshops and Exchanges on ageing adult anchovy and sardine (WKARA 2009, WKARAS 2011, Anchovy Exchange 2014), a focal point was to correctly identify the right position of the first ring (annulus) on sagittal otoliths of these species, being one of the main sources of error affecting ageing precision. Improving precision in age reading is extremely important in general, even more in short-lived species such as anchovy and sardine. One of the most common method to validate the timing and position of the first ring consists of counting of otolith micro-increments (daily rings) in juveniles (young-of-the-year). Daily growth studies of anchovy and sardine are currently carried out in different European laboratories, principally to analyse the effects of environmental parameters on growth and survival, and thus to understand the factors affecting recruitment processes of these species. However, given the wide span of methodologies already existing within laboratories, ageing data are often difficult to compare, actually masking the contribute of environmental conditions of different growth rate patterns observed among areas. The aim of the workshop is to collate these different protocols as starting point to produce single validated protocol to better standardize age estimates, either on daily or annual basis.
Resource requirements:	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible
Participants::	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities:	None
Financial:	None
Linkages to advisory committee:	ACOM, GFCM
Linkages to other committees or groups:	WGBIOP, WGHANSA
Linkages to other organizations cost:	There is a direct link with the EU DCF

Annex 7: Past workshops and exchanges and other workshops relevant to biological parameters

SPECIES	Stock code	Stock description ICES	2018	2017		2016	2015		2014	2013		2012		2011	2010	2009		2008	2007	2006	2005		2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991
Melanogrammus aeglefinus	had.27.1-2	Haddock (Melanogrammus aeglefinus) in subareas 1 and 2 (Northeast Arctic)		WKAVBS (12)						WKAVBS - Workshop on age, ageing and ageing bias in Haddock, Saithe, Redfish, Greenland Halibut and Redfish Rfs. - Spain Mallorca - Spain	WKMSRA 10 - Workshop on sexual maturity staging of cod, whiting, haddock, saithe and hake 24-28 October 2011 - Lowestoft - Lowestoft Wade, Hooper and Mario Korta - Spain San Sebastian - Spain				ex PGCCDBS 2010_p41																			
	27.6a is now included in had.27.46a20														ex PGCCDBS 2010_p41																					
	had.27.46a20	Haddock (Melanogrammus aeglefinus) in Subarea 4, Division 6.a and Subdivision 20 (North Sea, West of Scotland, Skagerak)				Exchange Coordinators to be decided																														
	had.27.5b	Haddock (Melanogrammus aeglefinus) in Division 5.b (Faroes grounds)																																		
	had.27.5a	Haddock (Melanogrammus aeglefinus) in Division 5.a (Iceland grounds)																																		
	had.27.7b-k	Haddock (Melanogrammus aeglefinus) in divisions 7.b-k (southern Celtic Seas and English Channel)																																		
	had.27.7a	Haddock (Melanogrammus aeglefinus) in Division7.a (Irish Sea)																																		
	had.27.6b	Haddock (Melanogrammus aeglefinus) in Division 6.b (Rockall)				Exchange Coordinators to be decided																														
Salmo salar	sal.21.2-6	Salmon (Salmo salar) from North America										WKNPDS Pathway on Age Determination of Salmon		WKAGE Workshop on Age Determination of Salmon														WKLIS								
		former sal-nea		Exchange 77																																
		former sal-wg																																		
	sal.27.22-31	Salmon (Salmo salar) in subdivisions 22–31 (Baltic Sea, excluding the Gulf of Finland)																		WGSAD																
	sal.27.32	Salmon (Salmo salar) in Subdivision 32 (Gulf of Finland)														SGSAD Dissolved 2009									SG	SG										Homa: Anonym
Clupea harengus	her.27.25-24	Herring (Clupea harengus) in subdivisions 25–24, spring spawners (Skagerak, Kattegat, and western Baltic)					Herring (Clupea harengus); Baltic Sea; Coordinator Jan Raitaniemi, Finland											WKARH - Workshop on Age Reading of Baltic Herring																			
	her.27.25-2932	Herring (Clupea harengus) in subdivisions 25–29 and 32, excluding the Gulf of Riga (central Baltic Sea)												WKNSHS - Workshop on Sexual Maturity Staging of Herring and Sprat		WKARDH Dissolved 2009							ing stolth samp			BHARSG dissolved 2001	Ex Age Reading Study Group, (BHARSG)		SG	SG	SG (In section 4 of the 1996 SG report)					
	her.27.30	Herring (Clupea harengus) in Subdivision 30 (Bothnian Sea)																																		
	her.27.31	Herring (Clupea harengus) in Subdivision 31 (Bothnian Bay)																																		
	her.27.28	Herring (Clupea harengus) in Subdivision 28.1 (Gulf of Riga)																																		
	her.27.3a47d	Herring (Clupea harengus) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerak and Kattegat, eastern English Channel)			WKMSS2 Workshop on Sexual Maturity Staging of Herring (Clupea harengus) and Sprat		Herring (Clupea harengus); Celtic Sea, Irish Sea, North Sea and Vlir Coordinator Julie Coad Davies, Denmark														PK + PO	Campen																
	her.27.nis	Herring (Clupea harengus) in divisions 7.a South of 52°30'N, 7.g-h, and 7.j-k (Irish Sea, Celtic Sea, and southwest of Ireland)																																		
	her.27.6a7bc	Herring (Clupea harengus) in divisions 6.a and 7.b-c (West of Scotland, West of Ireland)																																		
	her.27.nirs	Herring (Clupea harengus) in Division 7.a North of 52°30'N (Irish Sea)																																		
	her.27.6a	Herring (Clupea harengus) in Division 6.a, summer-spawning herring (Iceland grounds)																							ing time determination										t ICES Statute	

	her.27.20-24	Herring (Clupea harengus) in subdivisions 20-24, spring spawners (Skagerrak, Kattegat, and eastern Baltic)					Herring (Clupea harengus), Baltic Sea; Coordinator: Jan Raitaniemi, Finland																															
	her.27.25-2932	Herring (Clupea harengus) in subdivisions 25-29 and 32, excluding the Gulf of Riga (central Baltic Sea)											WKMSHS: Workshop on Sexual Maturity Staging of Herring and Sprat			WKAREH Dissolved 2009		WKAREH: Workshop on Age Reading of Baltic Herring									BHARSG dissolved 2001											
	her.27.30	Herring (Clupea harengus) in Subdivision 30 (Bothnian Sea)																																						
	her.27.31	Herring (Clupea harengus) in Subdivision 31 (Bothnian Bay)																																						
	her.27.28	Herring (Clupea harengus) in Subdivision 28.1 (Gulf of Riga)																																						
Clupea harengus	her.27.3a47d	Herring (Clupea harengus) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)			WKMSHS2: Workshop on Sexual Maturity Staging of Herring (Clupea harengus) and Sprat		Herring (Clupea harengus), Celtic Sea, Irish Sea, North Sea and Vla; Coordinator: Julie Coad Davies, Denmark																																
	her.27.rix	Herring (Clupea harengus) in divisions 7.a South of 52°30'N, 7.g-h, and 7.j-k (Irish Sea, Celtic Sea, and southwest of Ireland)																																						
	her.27.6a7bc	Herring (Clupea harengus) in divisions 6.a and 7.b-c (West of Scotland, West of Ireland)																																						
	her.27.nirs	Herring (Clupea harengus) in Division 7.a North of 52°30'N (Irish Sea)																																						
	her.27.5a	Herring (Clupea harengus) in Division 5.a, summer-spawning herring (Iceland grounds)																																						
Clupea harengus		former her-stan now included in her6a7bc					Herring (Clupea harengus), Celtic Sea, Irish Sea, North Sea and Vla; Coordinator: Julie Coad Davies, Denmark																																
	her.27.1-2ab14a	Herring (Clupea harengus) in subareas 1, 2, b and divisions 4.a and 14.a, Norwegian spring spawning herring (the Northeast Atlantic and Arctic Ocean)		WKARN: SSH postponed		Exchange Herring; Coordinators: Jane A. Godliscon, Norway and Julie Coad Davies, Denmark		WKNSAS: Workshop on Age estimation of Norwegian Spring Spawning Herring, between Norway, Denmark, Iceland and the Faroe Islands, 6-10 November	NSS Herring Coordinator: Jane A. Godliscon, Norway																															
Sprattus sprattus	spr.27.3a	Sprat (Sprattus sprattus) in Division 3.a (Skagerrak and Kattegat)				WKARSS (ex): Workshop on Age estimation of Sprat, Sprattus sprattus, 5 - 10 November										Tex Area IV? WKARBS Dissolved 2009		WKAREH: Workshop on Age Reading of Baltic Sprat		The results of t		Nth samples were																	
	spr.27.22-32	Sprat (Sprattus sprattus) in subdivisions 22-32 (Baltic Sea)											WKMSHS: Workshop on Sexual Maturity Staging of Herring and Sprat																											
	spr.27.7de	Sprat (Sprattus sprattus) in divisions 7.d and 7.e (English Channel)																					WK																	
Sprattus sprattus	spr.27.4	Sprat (Sprattus sprattus) in Subarea 4 (North Sea)			WKMSHS2				Sprat (North Sea and Celtic Sea) - Full scale exchange	Ex. Full scale exchange Sprat Latvia IV, Classen Denmark, HAWG recommended inclusion of agreed ICES stock PICCOSHS 2012 Report p22			PG_11 small ex. North Sea										WK			s inconsistent, with an													References: T			
	spr.27.67a-cf-k	Sprat (Sprattus sprattus) in Subarea 6 and divisions 7.a-c and 7.f-k (West of Scotland, southern Celtic Seas)																																						
Sardina pilchardus	pil.27.8c9a	Sardina (Sardina pilchardus) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)	Exchange ???	WKMIAS: Postponed to 2019 Dates and Chairs TBD	Exchange Coordinator: Eduardo Soares (Portugal) and Pedro Tomas (Spain)	Exchange Postponed, Coordinator: Isabel Riveiro (Spain), Eduardo Soares (Portugal) and Pedro Tomas (Spain)				WKSAWG: Workshop on stock assessment, early growth in European anchovy and Sardine			WKIBAD (Workshop on Age Reading in European Atlantic Iberian Sardine	Ex. PICCOSHS 2011_spat_01									WK			WK						WK								
Pil.27.8abd		Sardine (Sardina pilchardus) in divisions 8.a-b and 8.d and in Subarea 7 (Bay of Biscay, southern Celtic Seas, and the English Channel)																																						
Pil.27.7																																								

Herring (Clupea harengus) in Subarea 4 and divisions 3.a and 7.d, autumn spawners (North Sea, Skagerrak and Kattegat, eastern English Channel)

Herring (Clupea harengus) in Division 5.a, summer-spawning herring (Iceland grounds)

Herring (Clupea harengus) in subareas 1, 2, b and divisions 4.a and 14.a, Norwegian spring spawning herring (the Northeast Atlantic and Arctic Ocean)

Sprat (Sprattus sprattus) in Division 3.a (Skagerrak and Kattegat)

Sprat (Sprattus sprattus) in subdivisions 22-32 (Baltic Sea)

Sprat (Sprattus sprattus) in divisions 7.d and 7.e (English Channel)

Sprat (Sprattus sprattus) in Subarea 4 (North Sea)

Sprat (Sprattus sprattus) in Subarea 6 and divisions 7.a-c and 7.f-k (West of Scotland, southern Celtic Seas)

Sardina (Sardina pilchardus) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)

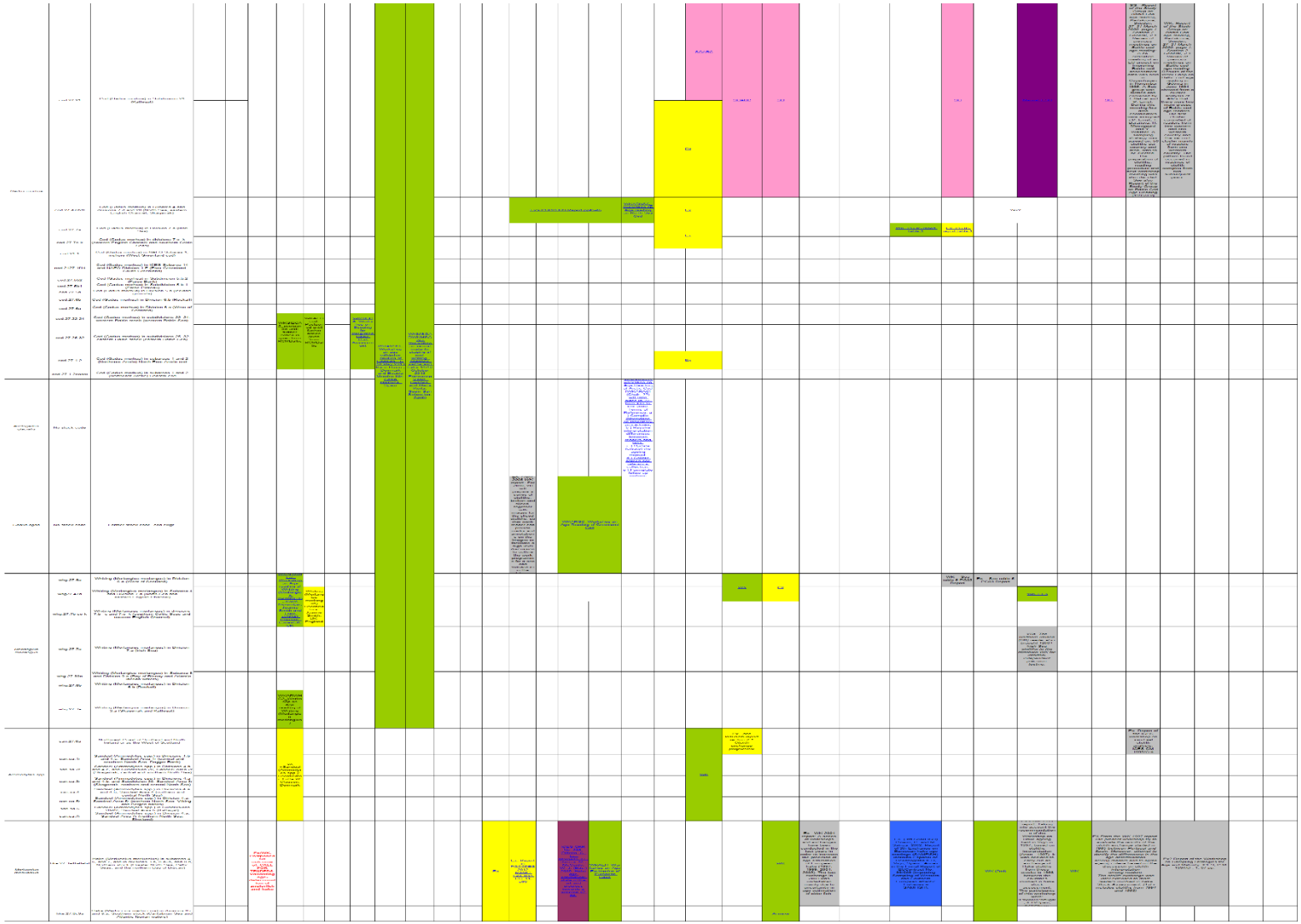
Sardine (Sardina pilchardus) in divisions 8.a-b and 8.d (Bay of Biscay)

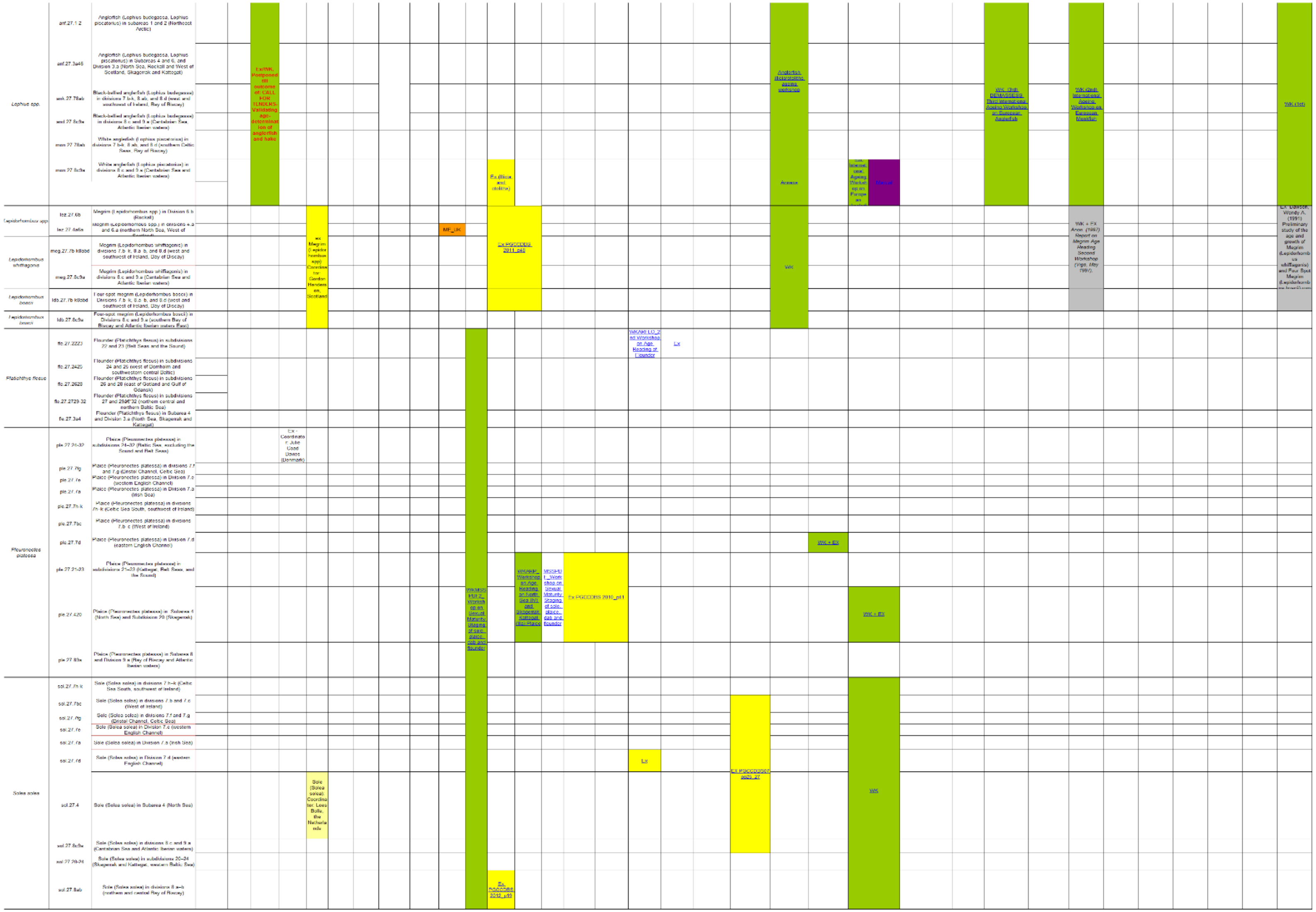
Sardine (Sardina pilchardus) in Subarea 7 (Southern Celtic Seas, and the English Channel)

Sardine (Sardina pilchardus) in divisions 8.a-b and 8.d and in Subarea 7 (Bay of Biscay, southern Celtic Seas, and the English Channel)

Scomber scombrus	mac.27.nea	Mackerel (Scomber scombrus) in subareas 1-8 and 14 and division 9.a (the Northeast Atlantic and adjacent waters)	WKARMAC2 Workshop on Age estimation of Mackerel (Scomber scombrus), 5-9 January, Jens Ulleweit (Germany) & Maria Nieto Nieto, Navarra (Spain), 22-26 Oct. San Sebastian, Spain.	WKARMAC2, 5-9 January, Mark Fitterton, San Sebastian, Spain Postponed					Mackerel - Small scale exchange Jens Ulleweit, Germany						WKARMAC Workshop on Age Reading Mackerel		Ex PGCCDBS 2009_p41							Ex. In WKARMAC report 2010. The first reported workshop on mackerel ageing was held in Lowestoft in 1987 and following that only one workshop has been held (in 1995 in Spain) and one additional exchange in 2002							WK, report of the Workshop on Mackerel otolith reading	Ex			
Micromesistius poutassou	whb.27.1-91214	Blue whiting (Micromesistius poutassou) in subareas 1-9, 12, and 14 (Northeast Atlantic and adjacent waters)		WKABLUE 2010 Workshop on Age Reading of Blue Whiting		Exchange Coordinators: Pereira Gonçalves (Portugal) and Jens Godiksen (Norway)				WKABLUE Workshop on the Age Reading of Blue Whiting				Ex PGCCDBS 2012_pp35-36	Ex PGCCDBS 2011_pp45_47					WG	Svetlanovsson S., Tangen, Ø., Vaina, R. 2004a. Report of the Nordic Blue Whiting Network Meeting, Reykjavik, 3-5.11.2003. Working document to the Northern Pelagic and Blue Whiting Fisheries Working Group, Copenhagen, Denmark, 27 April-4 May 2004. 17 pp. See also: Power, G.R., Kelly, C.J., King, P.A. & McGrath, D. 2004. in http://www.ices.dk/products/CMdocs/2004/W_G-2004.pdf												
Reinhardtius hippoglossoides	ghl.27.5614	Greenland halibut (Reinhardtius hippoglossoides) in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North of Azores, East of Greenland)				WKARGH 2 Workshop on Age Reading of Greenland Halibut (Reinhardtius hippoglossoides) 29-31 August, Kaare Erlver and Birta Thorsteinsdottir, Reykjavik, Iceland							WKARGH_Workshop on Age Reading of Greenland halibut	Ex. In WKARGH 2011 p 13				WKARGH Treble, M. A. and K. S. Dwyer. 2008. Report of the Greenland halibut (Reinhardtius hippoglossoides) Age Determination Workshop. NAFO Sci. Coun. Studies. 41: 1-96.		NAFO SCR Doc 06/49	Ex. In WKARGH 2011 p 13							Iceland halibut		1996 WK Repor				
	ghl.27.1-2	Greenland halibut (Reinhardtius hippoglossoides) in subareas 1 and 2 (Northeast Arctic)																																	
Sebastes norvegicus (previously S. mentella)	reg.27.1-2	Golden redfish (Sebastes norvegicus) in subareas 1 and 2 (Northeast Arctic)			Exchange 77																			Exchange 2003-2004					WG		WK				WK Anon. 1991. Report of Workshop on Age Determination of redfish ICES CM 1991/G:79 Reference in 1995 WK report
	reg.27.5614	Golden redfish (Sebastes norvegicus) in subareas 5, 6, 12, and 14 (Iceland and Faroes grounds, West of Scotland, North of Azores, East of Greenland)																																	
Sebastes mentella	reb.27.1-2	Beaked redfish (Sebastes mentella) in subareas 1 and 2 (Northeast Arctic)												Ex. PGCCDBS 2012_p21					WKADR_Workshop on Age Determination of Redfish	Ex's 2006-2008 - see WKADR REPORT 2008 pp 4-32	WKADR_Workshop on Age Determination of Redfish	EX - see WKADR REPORT 2006 section 2												
	reb.27.5a14	Beaked redfish (Sebastes mentella) in Subarea 14 and Division 5.a, Icelandic slope stock (East of Greenland, Iceland grounds)																																	
	reb.2127.dp	Beaked redfish (Sebastes mentella) in ICES subareas 5, 12, and 14 (Iceland and Faroe grounds, North of Azores, East of Greenland) and NAFO subareas 1 and 2 (deep pelagic stock > 500 m)																																	
	reb.27.14b	Beaked redfish (Sebastes mentella) in Division 14.b, demersal (Southeast Greenland)																																	
	reb.2127.sp	Beaked redfish (Sebastes mentella) in ICES subareas 5, 12, and 14 (Iceland and Faroe grounds, North of Azores, East of Greenland) and NAFO subareas 1 and 2 (shallow pelagic stock < 500 m)																																	

Gadus morhua	cod.27.21	Cod (*Gadus morhua*) in Subdivision 21 (Kattegat)																																	
	cod.27.47d20	Cod (*Gadus morhua*) in Subarea 4 and divisions 7.d and 20 (North Sea, eastern English Channel, Skagerrak)																																	
	cod.27.7a	Cod (*Gadus morhua*) in Division 7.a (Irish Sea)																																	
	cod.27.7e-k	Cod (*Gadus morhua*) in divisions 7.e-k (eastern English Channel and southern Celtic Seas)																																	
	cod.21.1	Cod (*Gadus morhua*) in NAFO Subarea 1, Inshore (West Greenland cod)																																	
	cod.2127.1f14	Cod (*Gadus morhua*) in ICES Subarea 14 and NAFO Division 1.F (East Greenland, South Greenland)																																	
	cod.27.5b1	Cod (*Gadus morhua*) in Subdivision 5.b.2 (Faroe Bank)																																	
	cod.27.5b1	Cod (*Gadus morhua*) in Subdivision 5.b.1 (Faroe Islands)																																	
	cod.27.5a	Cod (*Gadus morhua*) in Division 5.a (Iceland grounds)																																	
	cod.27.6b	Cod (*Gadus morhua*) in Division 6.b (Rockall)																																	
	cod.27.6a	Cod (*Gadus morhua*) in Division 6.a (West of Scotland)																																	
	cod.27.22-24	Cod (*Gadus morhua*) in subdivisions 22-24, western Baltic stock (western Baltic Sea)																																	
	cod.27.25-32	Cod (*Gadus morhua*) in subdivisions 25-32, eastern Baltic stock (eastern Baltic Sea)																																	
	cod.27.1-2	Cod (*Gadus morhua*) in subareas 1 and 2 (Northeast Arctic) North East Arctic cod																																	
	cod.27.1-2coast	Cod (*Gadus morhua*) in subareas 1 and 2 (Northeast Arctic) Coastal cod																																	
Aristostomias grimaldii	No stock code																																		
Gadus ogac	No stock code	Former stock code "cod-ogac"																																	





Lophius spp.	anf.27.1 2	Anglerfish (Lophius budegassa, Lophius piscatorius) in subareas 1 and 2 (Northeast Arctic)	Ex/WK, Postponed till outcome of: CALL FOR TENDERS- Validating age-determination of anglerfish and hake												Anglerfish illicia/otoliths ageing workshop				WK (3rd) DEMASSESS Third International Ageing Workshop on European Anglerfish	WK (2nd) International Ageing Workshop on European Monkfish	WK (1st)
	anf.27.3a46	Anglerfish (Lophius budegassa, Lophius piscatorius) in Subareas 4 and 6, and Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)																			
	ank.27.78ab	Black-bellied anglerfish (Lophius budegassa) in divisions 7.b-k, 8.ab, and 8.d (west and southwest of Ireland, Bay of Biscay)																			
	ank.27.8c9a	Black-bellied anglerfish (Lophius budegassa) in divisions 8.c and 9.a (Cantabrian Sea, Atlantic Iberian waters)																			
	mon.27.78ab	White anglerfish (Lophius piscatorius) in divisions 7.b-k, 8.ab, and 8.d (southern Celtic Seas, Bay of Biscay)																			
	mon.27.8c9a	White anglerfish (Lophius piscatorius) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)						Ex (Illicia and otoliths)							Annexe		International Ageing Workshop on European	Manual			
Lepidorhombus spp.	lez.27.6b	Megrim (Lepidorhombus spp.) in Division 6.b (Rockall)			ex Megrim (Lepidorhombus spp): Coordinator: Gordon Henderson, Scotland			Ex PGCCDBS 2011_p48							WK					WK + EX Anon. (1997) *Report on Megrim Age Reading Second Workshop (Vigo, May 1997).*	Ex Dawson, Wendy A. (1991) Preliminary study of the age and growth of Megrim (Lepidorhombus whiffiagonis) and Four Spot Megrim (Lepidorhombus boscii)
	lez.27.4a6a	Megrim (Lepidorhombus spp.) in divisions 4.a and 6.a (northern North Sea, West of Scotland)				MF_UK															
Lepidorhombus whiffiagonis	meg.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)																			
	meg.27.8c9a	Megrim (Lepidorhombus whiffiagonis) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)																			
Lepidorhombus boscii	ldb.27.7b-k8abd	Four-spot megrim (Lepidorhombus boscii) in Divisions 7.b–k, 8.a–b, and 8.d (west and southwest of Ireland, Bay of Biscay)																			
Lepidorhombus boscii	ldb.27.8c9a	Four-spot megrim (Lepidorhombus boscii) in Divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters East)																			
Platichthys flesus	fle.27.2223	Flounder (Platichthys flesus) in subdivisions 22 and 23 (Belt Seas and the Sound)					WKMSSPLE2_ Workshop on Sexual Maturity Staging of sole, plaice, dab and flounder					WKAREFLO_2nd Workshop on Age Reading of Flounder	Ex								
	fle.27.2425	Flounder (Platichthys flesus) in subdivisions 24 and 25 (west of Bornholm and southwestern central Baltic)																			
	fle.27.2628	Flounder (Platichthys flesus) in subdivisions 26 and 28 (east of Gotland and Gulf of Gdansk)																			
	fle.27.2729-32	Flounder (Platichthys flesus) in subdivisions 27 and 29â€"32 (northern central and northern Baltic Sea)																			
	fle.27.3a4	Flounder (Platichthys flesus) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)																			
Pleuronectes platessa	ple.27.24-32	Plaice (Pleuronectes platessa) in subdivisions 24–32 (Baltic Sea, excluding the Sound and Belt Seas)		Ex - Coordinator: Julie Coad Davies (Denmark)																	
	ple.27.7fg	Plaice (Pleuronectes platessa) in divisions 7.f and 7.g (Bristol Channel, Celtic Sea)																			
	ple.27.7e	Plaice (Pleuronectes platessa) in Division 7.e (western English Channel)																			
	ple.27.7a	Plaice (Pleuronectes platessa) in Division 7.a (Irish Sea)																			
	ple.27.7h-k	Plaice (Pleuronectes platessa) in divisions 7.h–k (Celtic Sea South, southwest of Ireland)																			
	ple.27.7bc	Plaice (Pleuronectes platessa) in divisions 7.b–c (West of Ireland)																			
	ple.27.7d	Plaice (Pleuronectes platessa) in Division 7.d (eastern English Channel)														WK + EX					
	ple.27.21-23	Plaice (Pleuronectes platessa) in subdivisions 21–23 (Kattegat, Belt Seas, and the Sound)							WKARP_ Workshop on Age Reading on North Sea (IV) and Skagerrak-Kattegat (IIIa) Plaice	MSSPDF_Workshop on Sexual Maturity Staging of sole, plaice, dab and flounder	Ex PGCCDBS 2010_p41										
	ple.27.420	Plaice (Pleuronectes platessa) in Subarea 4 (North Sea) and Subdivision 20 (Skagerrak)															WK + EX				
	ple.27.89a	Plaice (Pleuronectes platessa) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)																			
Solea solea	sol.27.7h-k	Sole (Solea solea) in divisions 7.h–k (Celtic Sea South, southwest of Ireland)															WK				
	sol.27.7bc	Sole (Solea solea) in divisions 7.b and 7.c (West of Ireland)												EX PGCCDBS07 pp25_27							
	sol.27.7fg	Sole (Solea solea) in divisions 7.f and 7.g (Bristol Channel, Celtic Sea)																			
	sol.27.7e	Sole (Solea solea) in Division 7.e (western English Channel)																			
	sol.27.7a	Sole (Solea solea) in Division 7.a (Irish Sea)																			
	sol.27.7d	Sole (Solea solea) in Division 7.d (eastern English Channel)									Ex										
	sol.27.4	Sole (Solea solea) in Subarea 4 (North Sea)			Sole (Solea solea): Coordinator: Loes Bolle, the Netherlands																
	sol.27.8c9a	Sole (Solea solea) in divisions 8.c and 9.a (Cantabrian Sea and Atlantic Iberian waters)																			
	sol.27.20-24	Sole (Solea solea) in subdivisions 20–24 (Skagerrak and Kattegat, western Baltic Sea)																			
	sol.27.8ab	Sole (Solea solea) in divisions 8.a–b (northern and central Bay of Biscay)						Ex PGCCDBS 2012_p19													

Scophthalmus maximus (former Psetta maxima)	tur.27.3a	Turbot (Scophthalmus maximus) in Division 3.a (Skagerrak and Kattegat)				Ex. Brill and Turbot (Scophthalmus maximus and Psetta maxima). Coordinator: Loes Bolla, Netherlands							WKBRIT Workshop on Brill and Turbot age reading (Brill and Turbot age reading)		?no?				WKART_Workshop on Age Reading of Turbot	Yes PGCCDBS 2 report, pp78_79 The exchange task plans for the data were not analysed yet. The presentation of the results was postponed to 2007																
	tur.27.4	Turbot (Scophthalmus maximus) in Subarea 4 (North Sea)																																							
	tur.27.22-32	Turbot (Scophthalmus maximus) in subdivisions 22-32 (Baltic Sea)																																							
Psetta maxima maotica	No stock code																																								
Scophthalmus rhombus	bll.27.3a47de	Brill (Scophthalmus rhombus) in Subarea 4 and divisions 3.a and 7.d-e (North Sea, Skagerrak and Kattegat, English Channel)				Ex. Brill and Turbot (Scophthalmus rhombus and Psetta maxima). Coordinator: Loes Bolla, Netherlands															PGCCDBS 2 report, pp78_79 The exchange task plans for the data were not analysed yet. The presentation of the results was postponed to 2007																
	bll.27.22-32	Brill (Scophthalmus rhombus) in subdivisions 22-32 (Baltic Sea)																																							
Anguilla anguilla (and Anguilla rostrata)	ele.2737.nea	European eel (Anguilla anguilla) throughout its natural range			new Workshop ???									WKAREA2 Workshop on Age Reading of European and American Eel	Ex. PGCCDBS 2011_p46			WKAREA Workshop on Age Reading of European and American Eel																						WG Fontenelle, G. (1991). Age et croissance des anguilles (Anguilla anguilla) en Europe: une revue critique. EIFAC, Eel Working Group, Dublin, 1991.
														Manual																											
Engraulis encrasicolus	anc.27.8	Anchovy (Engraulis encrasicolus) in Subarea 8 (Bay of Biscay)		Postponed to 2018 Dates TBC		Workshop on Age reading of European anchovy (Engraulis encrasicolus) in subdiv. 29 (Mediterranean)			Ex.	Ex. Workshop on Mean increment daily growth in Mediterranean Anchovy and Sardine							WKARA Workshop on Age Reading of European Anchovy			WK	Ex.			WK	Ex.			Ex. Garcia Santamaría, I., 1998. Anchovy (Engraulis encrasicolus L.) otolith exchange. EFAN Report 4 - 98		WK	Ex.							
	ane.27.9a	Anchovy (Engraulis encrasicolus) in Division 9.a (Atlantic Iberian waters)																																							
Pollachius virens	pok.27.1-2	Saithe (Pollachius virens) in subareas 1 and 2 (Northeast Arctic)		WKAVG 02			WKARF Workshop on Age Reading of Saithe (Pollachius virens)			Ex.										Ex. PGCCDBS 2008 pp92_93																			
	pok.27.5b	Saithe (Pollachius virens) in Division 5.b (Faroes grounds)																																							
	pok.27.5a	Saithe (Pollachius virens) in Division 5.a (Iceland grounds)																																							
	pok.27.3a46	Saithe (Pollachius virens) in Subareas 4, 6 and Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)																																							
Pagellus bogaraveo	No stock code																			Proposal recommended by PGCCDBS 2007_p108 (WKARRP Workshop on Age Reading of Red Porgies) A workshop on Age Reading of Red Pandora (WKARRP Chair: ??) will take place in ??, Greece, from xxx to xxx 2008. Terms of Reference: a) Compile information on laboratory procedures; b) Assess interpretation differences between readers and																					
Dicentrarchus labrax	dla.27.nea	Atlantic seabass (Dicentrarchus labrax) in subareas 4, 6 and 7 (Northeast Atlantic and adjacent waters)																																							

Conger conger	No stock code																																		
Dicentrarchus labrax	bas.27.4bc7ad-h bas.27.6a7bj bas.27.6ah bas.27.8c9a	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) Seabass (Dicentrarchus labrax) in divisions 6.a, 7.b, and 7.j (West of Scotland, West of Ireland, eastern part of southwest of Ireland) Seabass (Dicentrarchus labrax) in divisions 6.ah7b (northern and central Bay of Biscay) Seabass (Dicentrarchus labrax) in divisions 8.c and 9.a (southern Bay of Biscay and Atlantic Iberian waters)					WGBAS: 1. Work up on age reading of sea bass			Ex				ex (scales and otoliths)																			
Gobiidae spp.	No stock code																																		
Pagellus bogaraveo	ple.27.10	Blackspot seabream (Pagellus bogaraveo) in Subarea 10 (Azores grounds)																																	
	ple.27.6-8	Blackspot seabream (Pagellus bogaraveo) in subareas 6&7&8 (Celtic Seas, the English Channel, and Bay of Biscay)																																	
	ple.27.9	Blackspot seabream (Pagellus bogaraveo) in Subarea 9 (Atlantic Iberian waters)												FQ_11 email ex																					
Glyptocephalus cynoglossus	wit.27.3a47d	Witch (Glyptocephalus cynoglossus) in Subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)													Study Proposal - see Protocol entry for details																				
Hippoglossoides platessoides	No stock code																																		
Microstomus kitt	lem.27.3a47d	Lemon sole (Microstomus kitt) in Subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)			Lemon sole (Microstomus kitt) Coordinator: Joanna Smith (UK) and Lucy Insole (the Netherlands)										Study Proposal - see Protocol entry for details																				
Limanda limanda	dab.27.22-32	Dab (Limanda limanda) in subdivisions 22-32 (Baltic Sea)					WGARE: Add Workup on age reading of dab (Limanda limanda) 22-25 Rescomb c 2015: Luke Nolte (Netherlands) and Holger Hoffab (German y German y)			Ex			WGARE: Define Stakeholders Report Stakeholders of dab status, data and issues																							
	dab.27.3a4	Dab (Limanda limanda) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)													WKLIMAN 1: Workup on age reading of dab			Ex EGCCSBS 2017, ecoQO 19																	
Salmo trutta	tre.27.22-32	Sea trout (Salmo trutta) in subdivisions 22-32 (Baltic Sea)																																	
Scomber colias	No stock code		WKMSMAC 2: HMS			Exchange Coordinator to be assigned	Ex 1: WKMSMAC: Workup on age reading of chub mackerel (Scomber colias), jack mackerel (Trachurus trachurus), Mediterranean horse mackerel (Trachurus mediterraneus) (Scomber colias) and horse mackerel (Trachurus trachurus) (Lisbon, Portugal)	WKMSMAC2: Workshop on Maturity Staging of mackerel (December scombrid) and horse mackerel (Trachurus trachurus) 25 September - 1 October Study on Damna: The Netherlands Partners: Carbonara Italy, Lisbon Portugal		ex																										
Scomber japonicus	No stock code														FQ_11 email ex																				
Trisopterus esmarki	nop.27.3a4	Norway pout (Trisopterus esmarki) in Subarea 4 and Division 3.a, October advice (North Sea, Skagerrak and Kattegat)																																	
	nop.27.6a	Norway pout (Trisopterus esmarki) in Division 6.a				Exchange: Coordinator: Mark Fraser (UK)																													
Trisopterus luscus	No stock code					Informal Exchange between Spain and Portugal: Coordinator: Sandra Farias (Portugal)																													

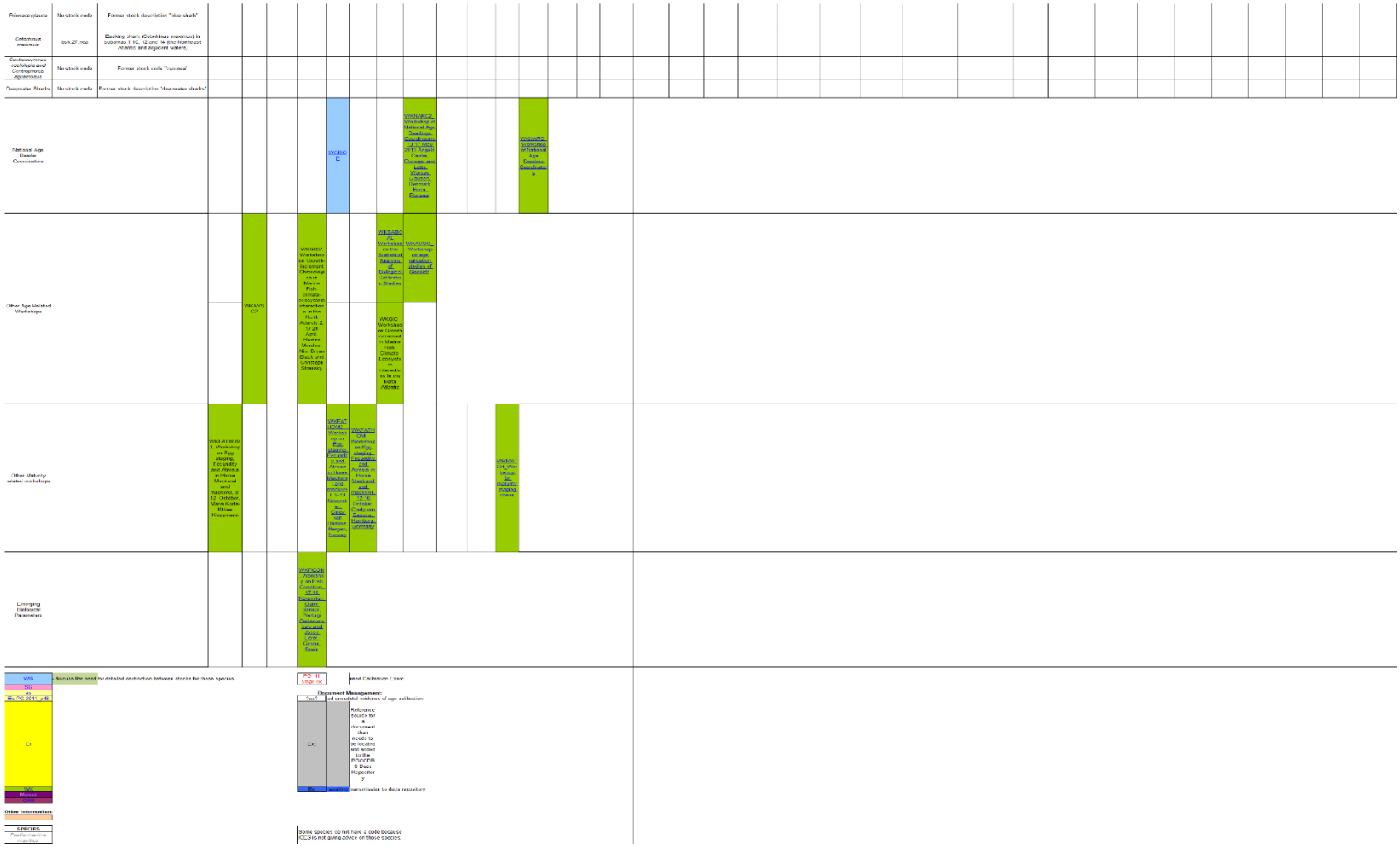
Mullus surmuletus	mur.27.3a47d	Striped red mullet (Mullus surmuletus) in Subarea 4 and divisions 7.d and 3.a (North Sea, eastern English Channel, Skagerrak and Kattegat)				Exchange between Spain and France (Coordinator: Pablo Abaunz (France))																																	
	mus.27.67a-ce-inbs	Striped red mullet (Mullus surmuletus) in subareas 6 and 7, and in divisions 7.a.c, 7.e.k, and 8.a (North Sea, Bay of Biscay, southern Celtic Seas, and Atlantic Iberian waters)	(Exchange data Pablo Abaunz Portugal Carlos Carlos & Chover Mystaiaou		WKMSA 2015 Workshop on Age Reading Gulf of Cadiz (Mullus surmuletus) Sara Maria Santos Carvalho & Chover Mystaiaou								WKACUM2 Workshop on Age Reading Gulf of Cadiz (Mullus surmuletus) and Striped red mullet (Mullus surmuletus)		Ex Doc Lisbon 20-12_pdf	Unpublished 2010		WKACUM_Workshop on Age Reading of Red mullet Mullus barbatus and Striped mullet Mullus surmuletus																			
Mullus barbatus	No stock code																																						
Aspitrigla cuculus	No stock code																																						
Eutrigla gurnardus	gug.27.3a47d	Grey gurnard (Eutrigla gurnardus) in Subarea 4 and divisions 7.d and 3.a (North Sea, eastern English Channel, Skagerrak and Kattegat)																																					
Chelidonichthys lucernus	No stock code																																						
Trisopterus pollachius	pol.27.3a4	Pollack (Pollachius pollachius) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)				Exchange between Spain and France (Coordinator: Pablo Abaunz (France))																																	
	pol.27.6a	Pollack (Pollachius pollachius) in Subarea 6 and Division 5.a (Bay of Biscay and Atlantic Iberian waters)																																					
	pol.27.6b7	Pollack (Pollachius pollachius) in subareas 6+7 (Celtic Seas and the English Channel)																																					

Trachurus mediterraneus	No stock code														Study Proposal - see Pollack entry for details																				
Trachurus trachurus	hom.27.3a4bc7d	Horse mackerel (Trachurus trachurus) in divisions 3.a, 4.b-c, and 7.d (Skagerrak and Kattegat, southern and central North Sea, eastern English Channel)	WKAPHOME Kolig Maria, Pierluigi Carbonara & Alba Jurado-Ruzafa 7-11 May 2018 Livorno, Italy		OExchange MACHERE LS: Kolig Maria, Pierluigi Carbonara & Alba Jurado-Ruzafa		Stock Assessment Group (SAG) of stocks in Age, meeting of Horse Mackerel in Blocksberg, Jesper Horse Mackerel Lead: Blocksberg, Jesper Horse mackerel (Trachurus trachurus) in Division 9.a and in Subareas 4 and 7 (Atlantic Iberian waters) Lead: Ibaibarriaga, Leire	WKPELAGIC Workshop on Mapping Stocks of mackerel, (Scomber scombrus) and horse mackerel (Trachurus trachurus) 26 September - 1 October 2018, Lisbon, Portugal Lead: Cindy van Damme, The Netherlands Ex. Pierluigi Carbonara, Italy	Ex. Reported in WGBIOP 2016's Annex 4 section 2.2.3.1				WKAHMS - M																												
Trachurus trachurus	hom.27.9a	Horse mackerel (Trachurus trachurus) in Division 9.a (Atlantic Iberian waters)																																	
Trachurus trachurus	hom.27.2a4a5b6a7a-ce-k8	Horse mackerel (Trachurus trachurus) in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a-c, e-k (the Northeast Atlantic)																																	
Trachurus picturatus	jaa.27.10a2	Blue jack mackerel (Trachurus picturatus) in Subdivision 10.a.2 (Azores grounds)					Ex. 26-28 October 2016																												
Zeus faber															Study Proposal - see Pollack entry for details																				
Labrus bergylta															Study Proposal - see Pollack entry for details																				
Capros aper	boc.27.6-8	Boarfish (Capros aper) in subareas 6–8 (Celtic Seas, English Channel, and Bay of Biscay)													Study Proposal - see Pollack entry for details																				
Mallotus villosus	cap.27.1-2	Capelin (Mallotus villosus) in subareas 1 and 2 (Northeast Arctic), excluding Division 2.a west of 5°W (Barents Sea capelin)													Ex. Norway, Russia, Canada, Iceland. Not IBCE. Contact: brian.nakashima@dfo-mpo.gc.ca			WK (Norway, Russia, Canada, Iceland. Not ICES)																		
Mallotus villosus	cap.27.2a514	Capelin (Mallotus villosus) in subareas 5 and 14 and Division 2.a west of 5°W (Iceland and Faroes grounds, East Greenland, Jan Mayen area)								Study proposal (PSCCEES 2017 Report P23) Small scale exchange. Hansen/Ieland																									
Anarhichas lupus	No stock code																																		
Squalus acanthias	dgs.27.nea	Spurdog (Squalus acanthias) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)											WKSHARK Workshop on Recent Marine Surveys of Elasmobranchs																						
Squalus blainville	No stock code																																		
Scyliorhinus canicula	No stock code																																		
Lamna nasus	por.27.nea	Porbeagle (Lamna nasus) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	
Dalatias licha	sck.27.nea	Kitefin shark (Dalatias licha) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	
Isurus oxyrinchus	No stock code																																		
Demersal elasmobranchs	No stock code	Former stock code "skx-34/4"																																	
	No stock code	Former stock code "skx-47-d"																																	
	No stock code	Former stock code "skx-89a"																																	
	No stock code	Former stock description "demersal elasmobranchs arctic"																																	
	No stock code	Former stock description "demersal elasmobranchs barents sea"																																	
	No stock code	Former stock description "demersal elasmobranchs iceland"																																	
	No stock code	Former stock description "demersal elasmobranchs norwegian sea"																																	
Galeorhinus galeus	gag.27.nea	Tope (Galeorhinus galeus) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	

Trachurus mediterraneus	No stock code																																		
Trachurus trachurus	hom.27.3a4bc7d	Horse mackerel (Trachurus trachurus) in divisions 3.a, 4.b-c, and 7.d (Skagerrak and Kattegat, southern and central North Sea, eastern English Channel)																																	
Trachurus trachurus	hom.27.9a	Horse mackerel (Trachurus trachurus) in Division 9.a (Atlantic Iberian waters)																																	
Trachurus trachurus	hom.27.2a4a5b6a7a-ce-k8	Horse mackerel (Trachurus trachurus) in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a-c, e-k (the Northeast Atlantic)																																	
Trachurus picturatus	jaa.27.10a2	Blue jack mackerel (Trachurus picturatus) in Subdivision 10.a.2 (Azores grounds)																																	
Zeus faber																																			
Labrus bergylta																																			
Capros aper	boc.27.6-8	Boarfish (Capros aper) in subareas 6–8 (Celtic Seas, English Channel, and Bay of Biscay)																																	
Mallotus villosus	cap.27.1-2	Capelin (Mallotus villosus) in subareas 1 and 2 (Northeast Arctic), excluding Division 2.a west of 5°W (Barents Sea capelin)																																	
Mallotus villosus	cap.27.2a514	Capelin (Mallotus villosus) in subareas 5 and 14 and Division 2.a west of 5°W (Iceland and Faroes grounds, East Greenland, Jan Mayen area)																																	
Anarhichas lupus	No stock code																																		
Squalus acanthias	dgs.27.nea	Spurdog (Squalus acanthias) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	
Squalus blainville	No stock code																																		
Scyliorhinus canicula	No stock code																																		
Lamna nasus	por.27.nea	Porbeagle (Lamna nasus) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	
Dalatias licha	sck.27.nea	Kitefin shark (Dalatias licha) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	
Isurus oxyrinchus	No stock code																																		
Demersal elasmobranchs	No stock code	Former stock code "skx-34/4"																																	
	No stock code	Former stock code "skx-47-d"																																	
	No stock code	Former stock code "skx-89a"																																	
	No stock code	Former stock description "demersal elasmobranchs arctic"																																	
	No stock code	Former stock description "demersal elasmobranchs barents sea"																																	
	No stock code	Former stock description "demersal elasmobranchs iceland"																																	
	No stock code	Former stock description "demersal elasmobranchs norwegian sea"																																	
Galeorhinus galeus	gag.27.nea	Tope (Galeorhinus galeus) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)																																	

Deep Water Species		Former stock code "ids comb"																																		
Brosme brosme	usk.27.1-2	Tusk (Brosme brosme) in subareas 1 and 2 (Northeast Arctic)	WKAMPIT (R2, 12-21 Sep 2016 Nantes Albert Jean Cal Valdez Kathe	WKAMDI Nov 14, 1-10/11-12 Nov		Exchange Coordinator (Jon Elson, Fisheries Scotland) and Fabg Marie (France)				WKAMPIT (R_WKAMDI) ex Age Transition Methods of Deep Water Species																										
	usk.27.5a14	Tusk (Brosme brosme) in Subarea 14 and Division 5.a (East Greenland, and Iceland grounds)																																		
	usk.27.12ec	Tusk (Brosme brosme) in Subarea 12, excluding Division 12.b (southern Mid-Atlantic Ridge)																																		
	usk.27.3a4bc6-9/12b	Tusk (Brosme brosme) in subareas 4 and 7, 8, and in divisions 3.a, 5.b, 6.a, and 12.b (Northeast Atlantic)																																		
	usk.27.5b	Tusk (Brosme brosme) in Division 5.b (Faroe)																																		
Molva molva	lin.27.1-2	Ling (Molva molva) in subareas 1 and 2 (Northeast Arctic)																																		
	lin.27.3a4a6-9/12/14	Ling (Molva molva) in Subareas 6, 9, 12, and 14, and Divisions 3.a and 4.a (Northeast Atlantic and Arctic Ocean)																																		
	lin.27.5a	Ling (Molva molva) in Division 5.a (Iceland grounds)																																		
	lin.27.5b	Ling (Molva molva) in Division 5.b (Faroe grounds)																																		
Molva dypterygia	bli.27.5a14	Blue ling (Molva dypterygia) in Subarea 14 and Division 5.a (East Greenland and Iceland grounds)																																		
	bli.27.5b67	Blue ling (Molva dypterygia) in subareas 6–7 and Division 5.b (Celtic Seas, English Channel, and Faroes grounds)																																		
	bli.27.nea	Blue ling (Molva dypterygia) in Subareas 1, 2, 8, 9, and 12, and Divisions 3.a and 4.a (other areas)																																		
Coryphaenoides rupestris	rng.27.1paa9/14 ab	Roundnose grenadier (Coryphaenoides rupestris) in subareas 1, 2, 4, 9, and 14, Division 14.a, and in waters/areas 14.b.2 and 5.a.2 (Northeast Atlantic and Arctic Ocean)																																		
	rng.27.3a	Roundnose grenadier (Coryphaenoides rupestris) in Division 3.a (Skagerrak and Kattegat)																																		
	rng.27.5a10b12ac14b	Roundnose grenadier (Coryphaenoides rupestris) in Divisions 10.b and 12.c, and Subdivisions 12.a.1, 14.b.1, and 5.a.1 (Oceans: Northeast Atlantic and northern Reykjanes Ridge)																																		
	rng.27.6b6712b	Roundnose grenadier (Coryphaenoides rupestris) in subareas 6 7, and in Divisions 6.b and 12.b (Celtic Seas and the English Channel, Faroes grounds, and western Hatton Bank)																																		
Argentina silus	are.27.1/2bd	Greater silver smelt (Argentina silus) in subareas 1, 2, and 4, and in Division 3.a (Northeast Arctic, North Sea, Skagerrak and Kattegat)																																		
	are.27.5a14	Greater silver smelt (Argentina silus) in Subarea 14 and Division 5.a (East Greenland and Iceland grounds)																																		
	are.27.5b6a	Greater silver smelt (Argentina silus) in divisions 6.a and 5.b (Faroes grounds and west of Scotland)																																		
	are.27.6b7-10/12	Greater silver smelt (Argentina silus) in Subareas 7–10 and 12, and Division 6.b (other areas)																																		
Aphanopus carbo	bsf.27.nea	Black scabbardfish (Aphanopus carbo) in subareas 1, 2, 4, 6–8, 10, and 14, and in divisions 3.a, 5.a–b, 9.a, and 12.a (Northeast Atlantic and Arctic Oceans)																																		
Pagellus bogaraveo	sbr.27.10	Blackspot seabream (Pagellus bogaraveo) in Subarea 10 (Azores grounds)																																		
	sbr.27.6-8	Blackspot seabream (Pagellus bogaraveo) in subareas 6–8 (Celtic Seas, the English Channel, and Bay of Biscay)																																		
	sbr.27.9	Blackspot seabream (Pagellus bogaraveo) in Subarea 9 (Atlantic Iberian waters)																																		
Trisopterus minutus capelanus	No stock code	Former stock code "ptb comb"																																		
Hoplostethus atlanticus	ory.27.nea	Orange roughy (Hoplostethus atlanticus) in subareas 1–10, 12, and 14 (the Northeast Atlantic and adjacent waters)																																		

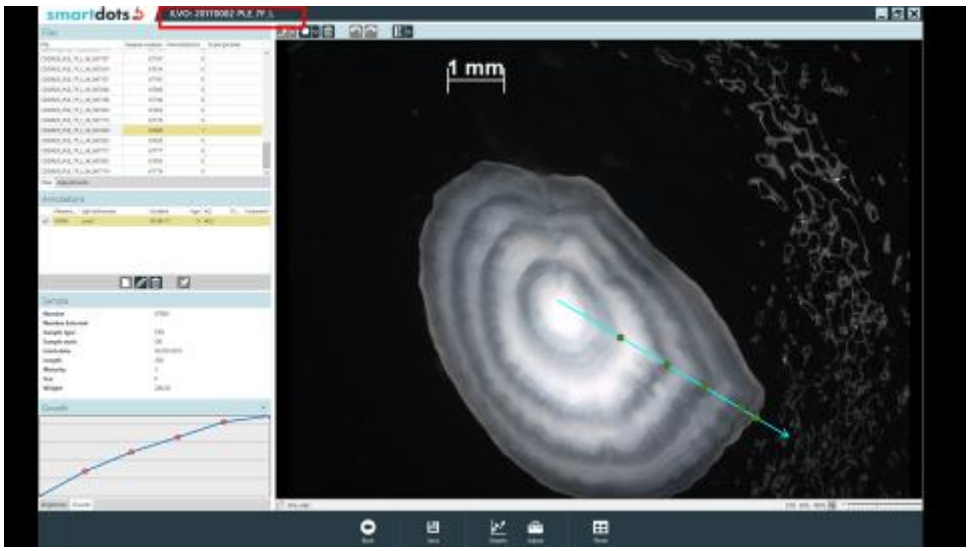
Prionace glauca	No stock code	Former stock description "blue shark"
Cetorhinus maximus	bsk.27.nea	Basking shark (Cetorhinus maximus) in subareas 1 10, 12 and 14 (the Northeast Atlantic and adjacent waters)
Dentiraxinus coelolepis and Centrophorus squamosus	No stock code	Former stock code "cyo-nea"
Deepwater Sharks	No stock code	Former stock description "deepwater sharks"



Annex 8: SmartDots software, webapp and Reporting Modules

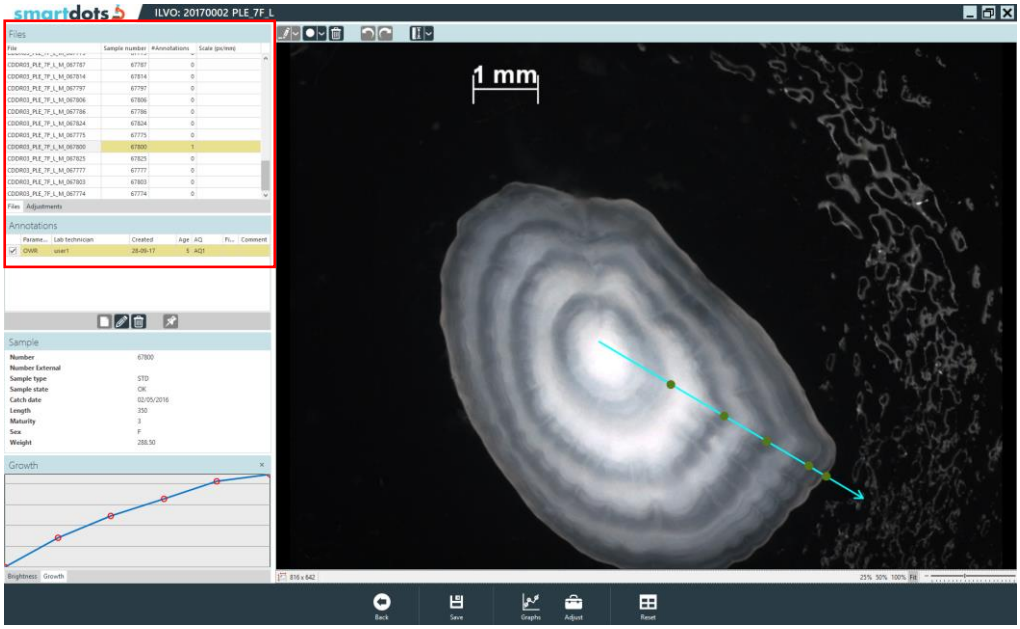
Some features

1) Selection of activity i.e. workshop, exchange, etc.



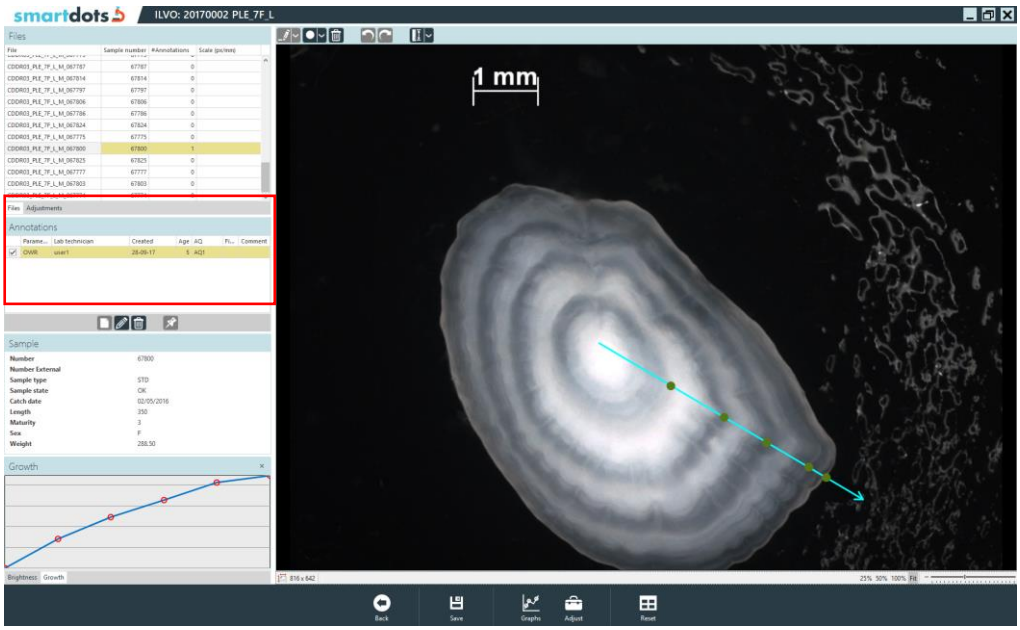
2) Selection of Files with the images:

- Read-only view
- Filename
- Sample number (linked)
- Sample number (linked)
- Scale info
- "IsReadOnly": Hidden file property and annotating is disabled



3) Making Annotations:

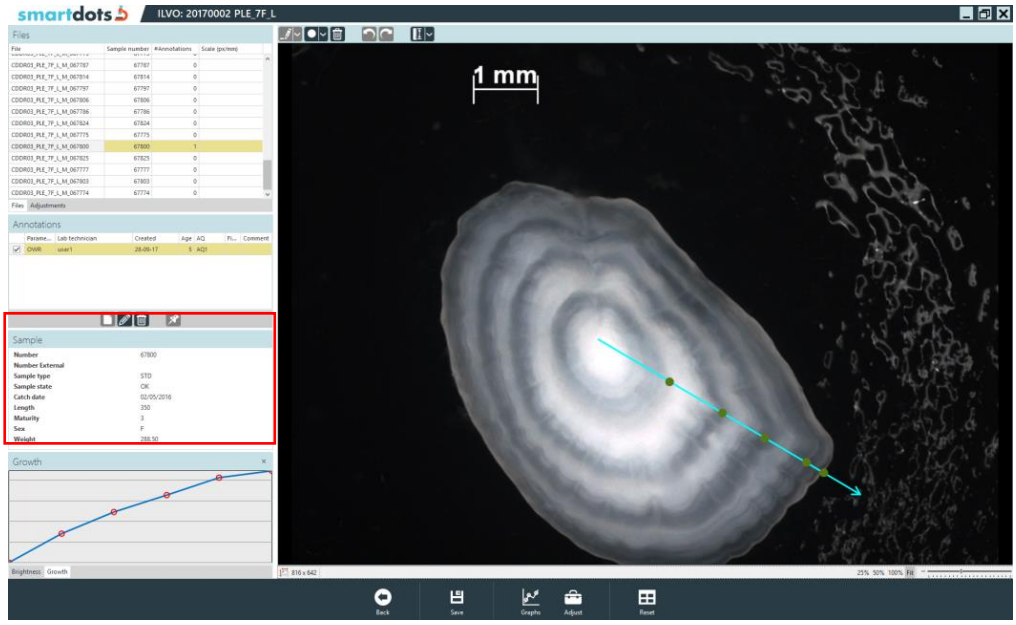
- The inclusion of annotations depends on the role the user is allocated. For example this is different dependant if this a workshop coordinator, or a reader. View all annotations (admin) or View only own annotations
- Select / deselect the kind of annotation (symbol)
- CRUD: New; Edit: set AQ code and comment and Delete
- Color row depending on AQ code
- Create fixed reading line
- Setting via activity property: CanPin



4) Sample details

A sample is an image. The images with their annotations can be set as 'read only'. This to avoid that a reader changes the annotations.

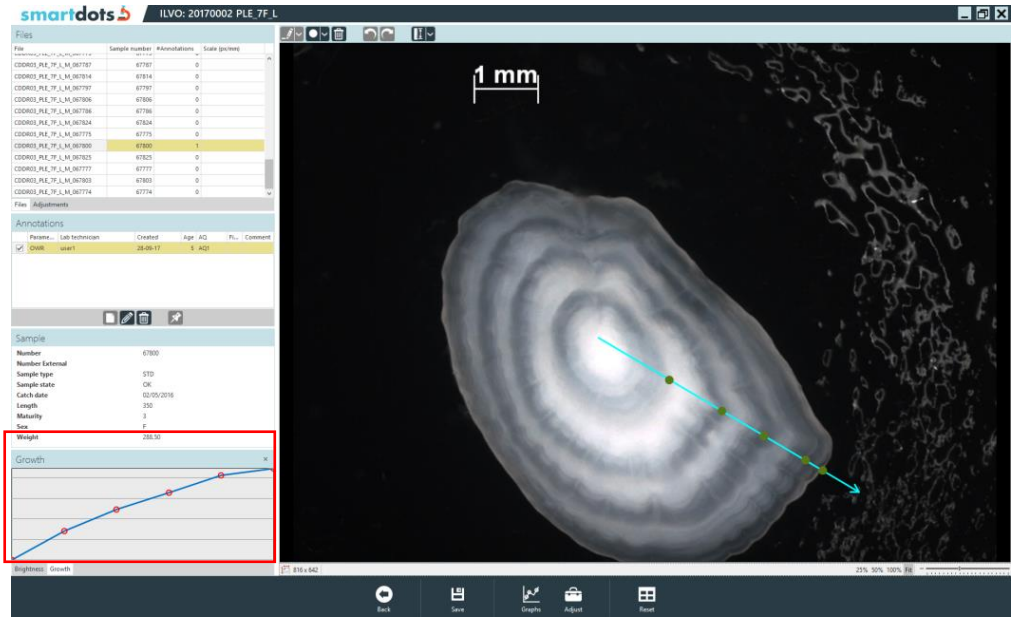
However, there are dynamic properties present: type of annotation to be changed, colour of the line, colour of the annotation, size of the annotation, etc.



5) Graphs

Two type of graphs are possible:

- Brightness: as the dot moves on the annotation (on the line), the dot on the graph moves
- Growth: these curves illustrates the distance between the dots made on the line, reflecting the growth distance between the dots (rings).



6) Image – features specifically linked to the images

General:

- Zoom in/out is possible, the zooming factor is available and can be saved for next image
- Adjustments: Brightness and Contrast of the image can be adjusted

Draw line and annotations

Draw line(s) on the image

- Single click (left, no hold) => move the mouse => click (left) again
- Stop drawing line by right-click
- Settings: colour, thickness of the line, direction of the line

Set dots on the line, according to the age to be determined:

- Settings: type of dot, colour of dot, size of dot.

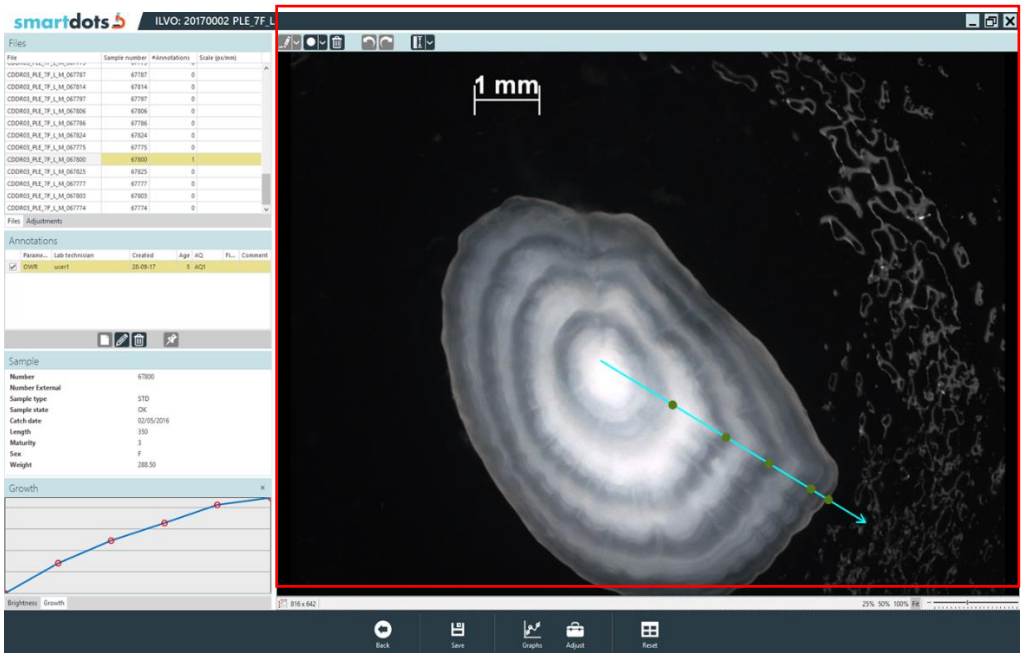
Possibility to Delete:

- Single dot: dot by dot can be removed, line can be deleted as well
- Line (and dots): combination of line and dots to be deleted

Possibility to Undo, Re-do: these functions allow undoing the last performed action, or re-doing the deleted last action.

Set scale:

- Can be done automatically:
  - Searching for white horizontal line
  - Unit detection via machine learning (µm, mm, cm)
  - Unit must be above line
- Can be done manually as well.



7) Commando bar beneath image

The following instructions (= commando's) can be done with shortcut symbols:

- Back: go to the previous window
- Save => auto save
- Show / hide graphs panel
- Show / hide picture adjust panel
- Reset lay-out (factory settings)

A subgroup of WGBIOP is currently working on finalizing the contents of the report output.

SmartDots webapp

The SmartDots webapp was developed by ICES to facilitate the setup of Exchanges, Workshops and Training of events. This system was envisage and developed by ICES, ILVO, DTU and IMR. WGBIOP has its main future user will help in its final details by testing the system and ensuring that the system covers the needs of the community.

The main aims of the SmartDots web app is to allow the community to store and update age readers expertise, organize events and of course store and allow images to be read into SmartDots (software). In reality, the Web App is a database developed in Microsoft SQL server accessed via an interface. This interface allows operations such managing the age reader expertise, create and manage events and upload of samples and images.

The web interface currently has three areas:

- the **front page** that is public but is currently only a static page with the explanation of what is the system
- The **manage area** where a user to login has to have permissions.
- The **administrative area** where very few users have access and allows defining an age reader has national coordinator.

The draft diagram of entity and relationship (ER) of the database is:

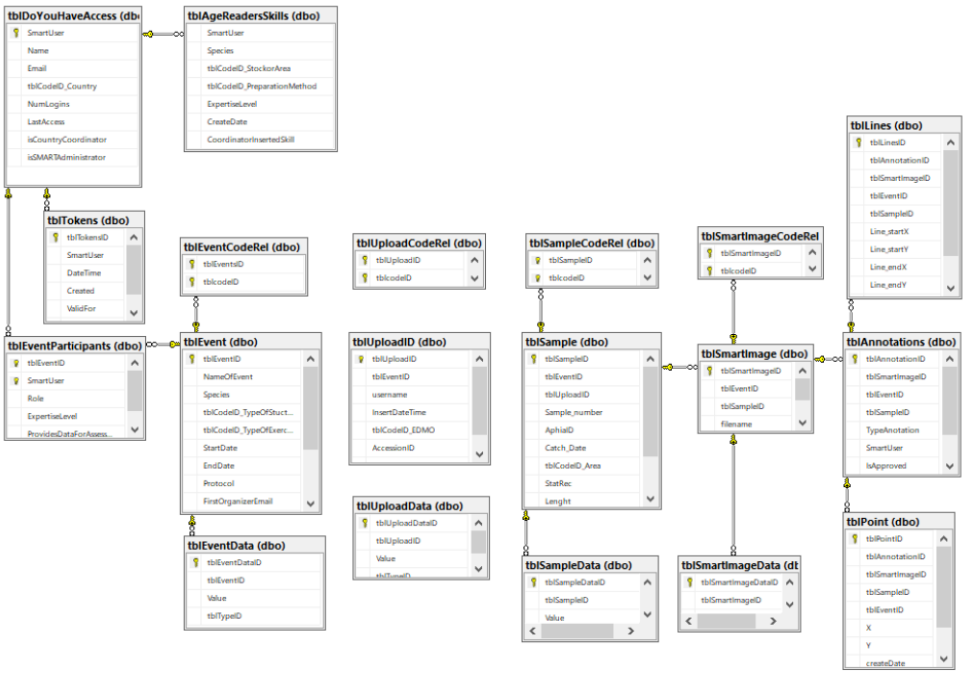


Figure 1 – Entity–relationship model of the SmartDots database.

To access the manage area (http://smartdots.ices.dk/manage) it is required that the users have an ICES login, an ICES login can be requested by sending an e-mail to: advice@ices.dk.

In the manage area there are two types of users:

a) National coordinators

b) Age readers

Table 1: Permission options by role

PERMISSIONS	AGE READERS	NATIONAL COORDINATORS
List of age readers expertise	✓	✓
List of events	✓	✓
Verify if a sample file is according to the format	✓	✓
Add new users		✓
Set up users expertise		✓
List of age readers expertise		✓
Manage current events		✓
Propose a new event		✓
List of events		✓
Verify if a sample file is according to the format		✓

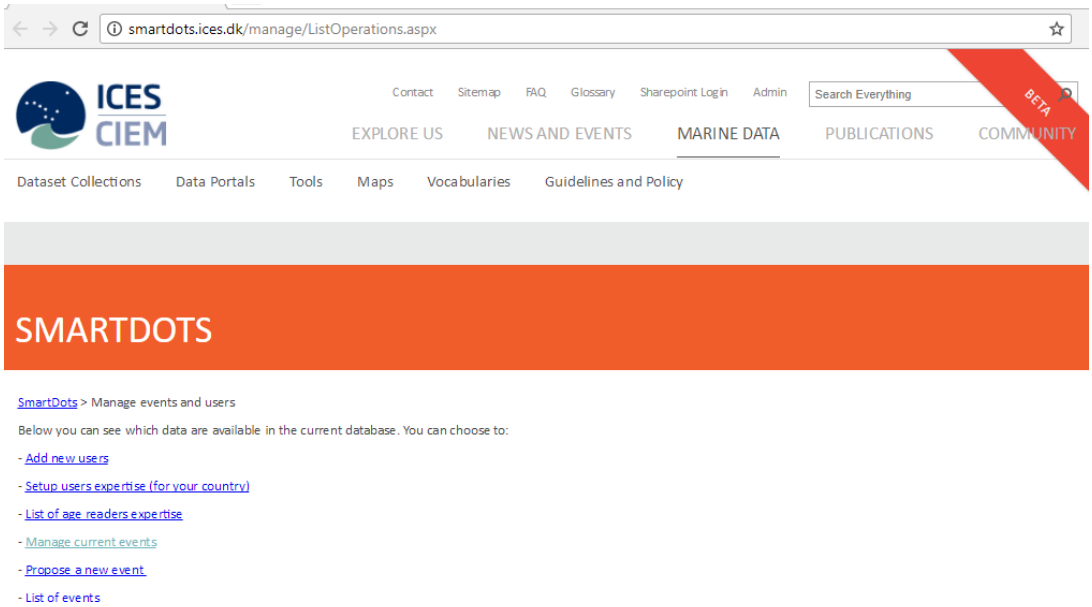


Figure 2: Print screen of the list of operations in the page "manage event and users" (login as a national coordinator)

Description of each of the pages

Add new users

This page allows the national coordinators to insert, edit or delete users in the system (only for their country).

The page shows a table with the list of all the age readers for the country of the "national coordinator". In the bottom of the page there is a textbox where the national coordinator can insert the e-mails of the users he wants to give access to in the system (multiple e-mails need to be split by comas). Once the national coordinator has inserted all the e-mails he can push the button to add the users. For each users that have to be added to the system the national coordinator will have an information line that can be one of the following:

a) If the e-mail was found in the ICES users directory and it was not listed has a SmartDots user then the system will retrieve the message "the user was xxxx has now access to the system"

b) If the e-mail was found in the ICES users directory and it is already listed has a SmartDots user then then system will retrieve the message: "the user was already part of the SmartDots application"

c) If the e-mail was not found in the ICES users directory then the system give the message "the e-mail was not found in the system, please contact advice@ices.dk to add this e-mail to the system"

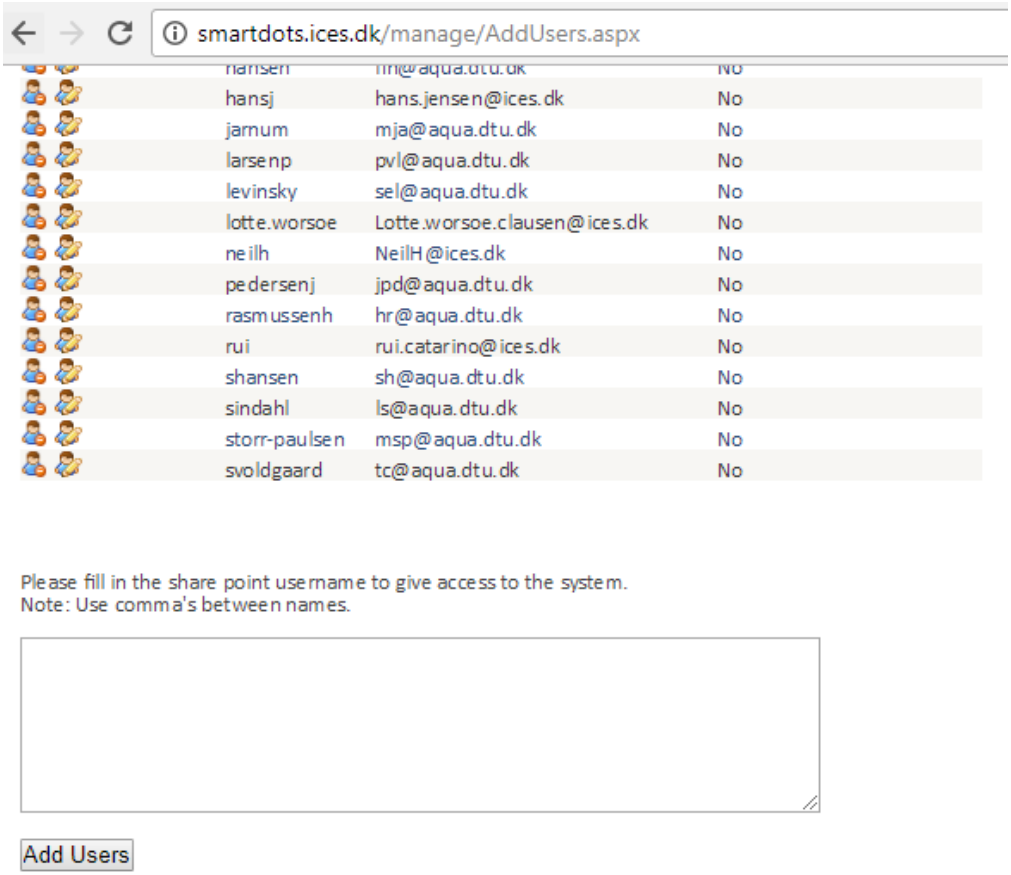


Figure 3: Print screen of the add users into the SmartDots web application.

Set up users expertise

This page allows the national coordinators to manage age reader's expertise. National coordinators can only setup age reader's expertise from their own country.

In this page the national coordinators have a dropdown menu with a list of all the age readers for their country. After selecting an age reader the page will display a list of all the skills for that age reader (see figure 4)

The national coordinator has available the following operations for the selected age reader:

a) Delete skills for that age reader

b) Edit or change the expertise level for a specific species and stock

c) Add new skills to the user, to add new skills to the age reader the national coordinator will have to choose first the species, the preparation method, the expertise level and one or multiple stock(s).

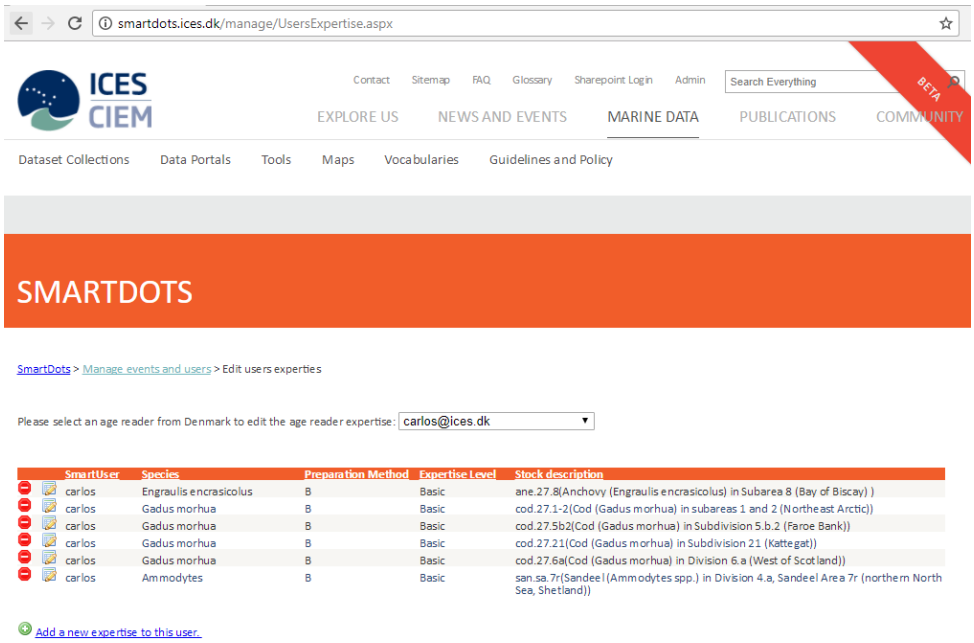
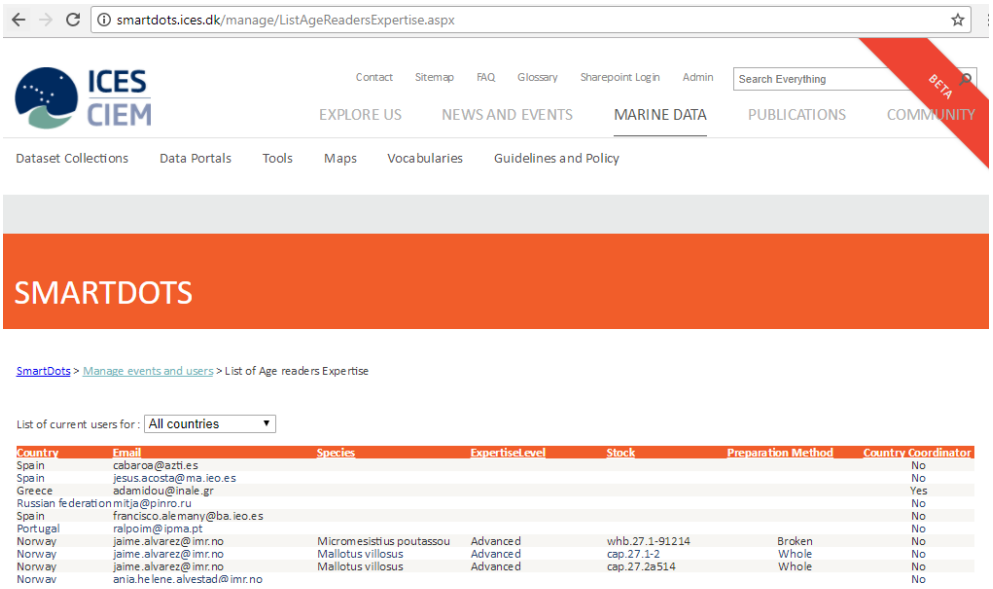


Figure 4: Page to manage the age reader expertise.

List of age reader expertise

This page is accessible to the age readers and to the national coordinators. In this page the system user can see a list of all the age readers and national coordinators in the system. The last column of the table will specify if it is a national coordinator or not.

The list can be filter per country and the user can sort the table by any of the specified fields.



Country	Email	Species	ExpertiseLevel	Stock	Preparation Method	Country Coordinator
Spain	cabaroa@azti.es					No
Spain	jesus.acosta@ma.ieo.es					No
Greece	adamidou@inale.gr					Yes
Russian federation	mitja@pinro.ru					No
Spain	francisco.alemany@ba.ieo.es					No
Portugal	ralpoim@ipma.pt					No
Norway	jaime.alvarez@imr.no	Micromesistius poutassou	Advanced	whb.27.1-91214	Broken	No
Norway	jaime.alvarez@imr.no	Mallotus villosus	Advanced	cap.27.1-2	Whole	No
Norway	jaime.alvarez@imr.no	Mallotus villosus	Advanced	cap.27.2a514	Whole	No
Norway	ania.helene.alvestad@imr.no					No

Figure 5: List of the age reader expertise.

Note: The age readers that have been added to the system but still don't have any expertise will also appear in this list.

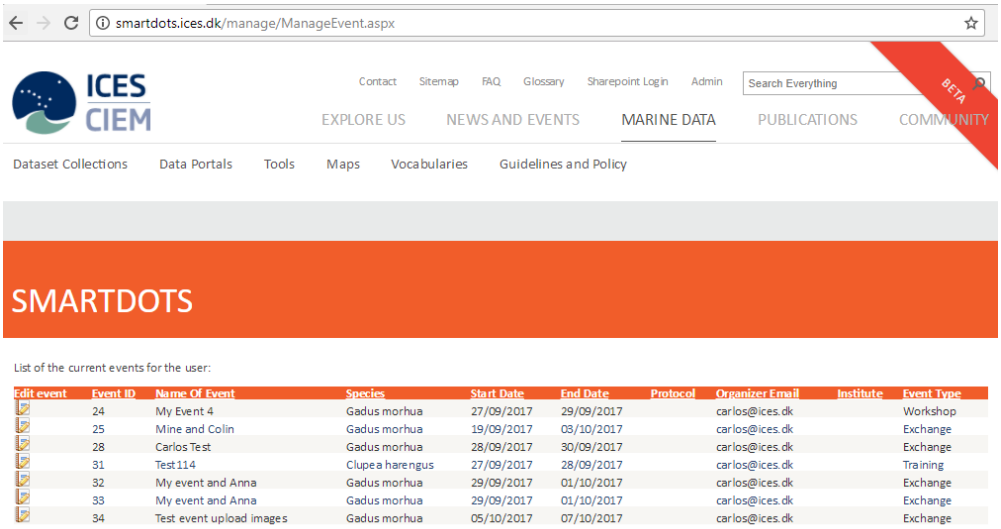
Manage current events

This page shows a list of all the events that the national coordinator has created (this page is only accessible to the national coordinators).

In this page, the event organizer can view the details of all the events and there are two possible operations:

a) Delete an event

b) Edit an event



Edit event	Event ID	Name Of Event	Species	Start Date	End Date	Protocol	Organizer Email	Institute	Event Type
	24	My Event 4	Gadus morhua	27/09/2017	29/09/2017		carlos@ices.dk		Workshop
	25	Mine and Colin	Gadus morhua	19/09/2017	03/10/2017		carlos@ices.dk		Exchange
	28	Carlos Test	Gadus morhua	28/09/2017	30/09/2017		carlos@ices.dk		Exchange
	31	Test114	Clupea harengus	27/09/2017	28/09/2017		carlos@ices.dk		Training
	32	My event and Anna	Gadus morhua	29/09/2017	01/10/2017		carlos@ices.dk		Exchange
	33	My event and Anna	Gadus morhua	29/09/2017	01/10/2017		carlos@ices.dk		Exchange
	34	Test event upload images	Gadus morhua	05/10/2017	07/10/2017		carlos@ices.dk		Exchange

Figure 6: Page that shows the list of events where the national coordinator is the organizer.

Propose a new event

In this page the national coordinators can propose a new event. This page is only accessible by the national coordinators.

In this page the fields for creating a new event are:

- **Type of event** (mandatory and with controlled vocabulary, the options are [Exchange, Workshop, Training]).
- **Species** (the species name in Latin, it is a controlled vocabulary and users can view the list here.
- **Event Name** (we recommend the event name to be self-explainable about what is the intention of the event, this will also facilitate in a few years when the national coordinator can have a long list of organized events).
- **E-mail address** (this value is automatically filled).
- **Start date** (this field is the start date of the event, this also means that from this date the event will also be visible to the age readers listed in the event).
- **End date** (this field is the end date of the event, and also means that from this date onwards the age readers will be able to view both samples and annotations).
- **Sample files** (this is an XML or csv file with the list of all the samples of the event), to prepare the file for upload ICES has provided an excel template to help the national coordinators to follow the specified format for the samples. The format expected for this file can be found here: http://datsu.ices.dk/data/selRep.aspx?Dataset=129

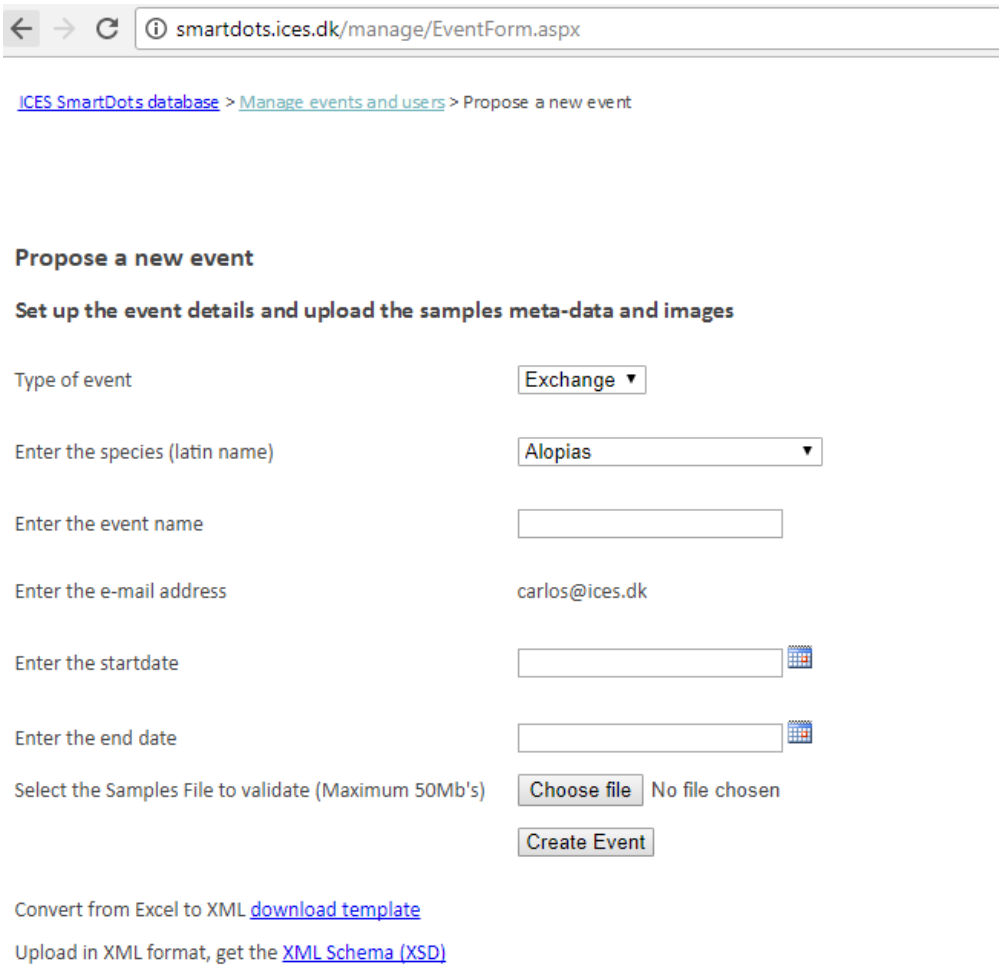


Figure 7: Page that allows the national coordinator to create a new event.

After the user has clicked the "create event" button and if all the fields have been filled-in correctly the national coordinator will be redirected automatically to the edit event page.

The **edit event** page allows the national coordinator to perform the following operations to the event:

a) **Change the details** of the event (event name, start date and end date);

b) **Upload more samples** (using the SMARTDots format, XML or csv);

c) **Associate image with the samples**, each sample will have a green or red icon next to it. When samples are uploaded all icons will be red, however the user can drag and drop the images into the drop-box area. The user can upload has many images for a single sample, the images name have to match the samples (the beginning of the image file has to be the same has the field "sampleID" of the sample) the red icon will be replace by a green icon. The green icons are also a link to all the associated images of the sample;

d) **Add/include age readers to the event**, to choose age readers for the event the national coordinator that is the organizer of the event there are two ways:

a) If an age reader has expertise in the species of the event, then the age reader will appear automatically in a summary table below. To add participants to the event, the national coordinator only has to click the icon of adding the age reader to the event. **Note:** The age reader will be removed from the summary list once it has been added to the event.

b) There is a text box bellow the list where the national coordinator can insert the e-mail(s) of the age readers that to be added to the event. The e-mails should be separated by comas. After the event organizer pushes the button to give access to the selected users, the system will retrieve some information for each of the users. For each new user added the system will return one of three messages:

i) If the e-mail was found in the ICES users directory and it was not included in the event the message "the user xxxx was added to the event" will show up.

ii) If the e-mail was found in the age readers included for the event then system will retrieve the message: "the user is already part of the event"

iii) If the e-mail was not found in the ICES users directory then the system give the message "the e-mail was not found in the system, please contact advice@ices.dk to add this e-mail to the system.

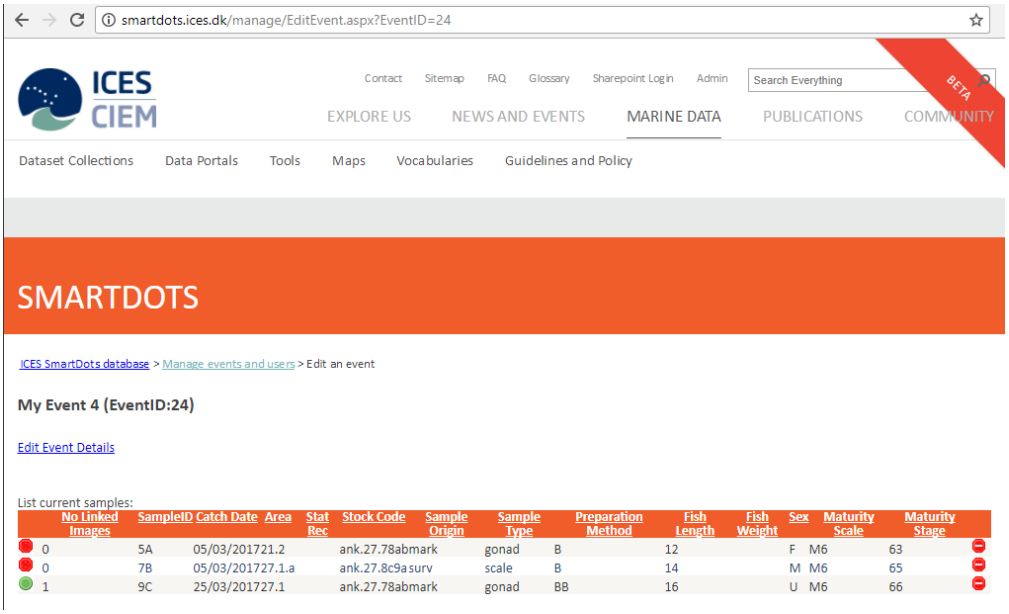


Figure 8: Edit event page, that allow the user to edit the details of the event, add more samples, associate image with the samples and choose age readers to participate in the event.

Dataset: SmartDots sample data

Format / Checks / Species

Format

Record: SR - Sample data

Start	FieldCode	Datatype	Code List	Mandatory	Description
1	RecordType	char(2)		✓	ⓘ
2	SampleID	char(50)		✓	ⓘ
3	CatchDate	datetime(10)		✓	ⓘ
4	AreaCode	char(20)	ICES_Area	✓	ⓘ
5	StatRec	char(4)			ⓘ
6	StockCode	char(20)	ICES_StockCode		ⓘ
7	SampleOrigin	char(15)	SampleOrigin	✓	ⓘ
8	SampleType	char(15)	SampleType	✓	ⓘ
9	PreparationMethod	char(3)	PreparationMethod	✓	ⓘ
10	FishLength	int(6)		✓	ⓘ
11	FishWeight	decimal(7)			ⓘ
12	Sex	char(8)	SEXCO		ⓘ
13	MaturityScale	char(10)	MaturityScale		ⓘ
14	MaturityStage	char(6)	MaturityStage		ⓘ
15	Comments	char(500)			ⓘ

Figure 9: The format definition of SmartDots and associated checks can be found here: http://datsu.ices.dk/data/selRep.aspx?Dataset=129

Template to upload samples:

List of events

This page is accessible to all the system users and in this page gives access to a list of all the event that have passed, the list can be filtered per year.

SmartDots file format

The format can be submitted in XML or in CSV. If CSV is the format used then at the beginning of each line the type of record ("line") needs to be defined. The XML has two elements:

File information record that has the following fields:

- ContactE-mail
- Species
- SamplingInstitute

And the **Sample_Data**

- SampleID
- CatchDate
- AreaCode
- StatRec
- StockCode
- SampleOrigin
- SampleType
- PreparationMethod
- FishLength

- FishWeight
- Sex
- MaturityScale
- MaturityStage
- Comments

Verify if a SmartDots sample file is according to the format

This page is accessible to all the system users and in this page, the users can verify if the sample file is according to the format. The user can "screen" his file to verify if the file is according to the format, one the format has been checked the screening utility will also run some QC procedures that have been put by the data manager.

Result from the ICES DATa Screening Utility program for the following data:

Country:	2195
Dataset:	SmartDots sample data
FileName:	ICES_SmartDots_Reporting_Format_herring.xlsm.xml
Email:	joco@aqua.dtu.dk
Monitoring Year:	2017
Submiting date:	27/09/2017 14:14:00
Number of records in file:	
Max. Errors to return:	30000

Number of records per record type:	
record: HR	1 Row(s)
record: SR	39 Row(s)

Figure 10: Screen result when the file presents no problems and can be imported to an event.

Excel Template file (to facilitate the upload of samples)

The excel template file was done to facilitate the work of building a sample list file. In this template:

- the controlled vocabularies are in drop down box
- The mandatory fields are mark in red
- Fields have the format defined above the cell.

To produce a sample file the user has to fill in all the fields in the file information sheet.

Note: The EDMO (European directory of …) code is a controlled vocabulary and a full list of the EDMO codes here:

http://vocab.ices.dk/?ref=1398

http://www.seadatanet.org/Metadata/EDMO-Organisations

In the sample data the red fields are mandatory and the green fields are optional.

The controlled vocabularies are provided in this spreadsheet by a list box where the user can choose the description of the field and when exporting the descriptions will be converted to the code value (vocabulary).

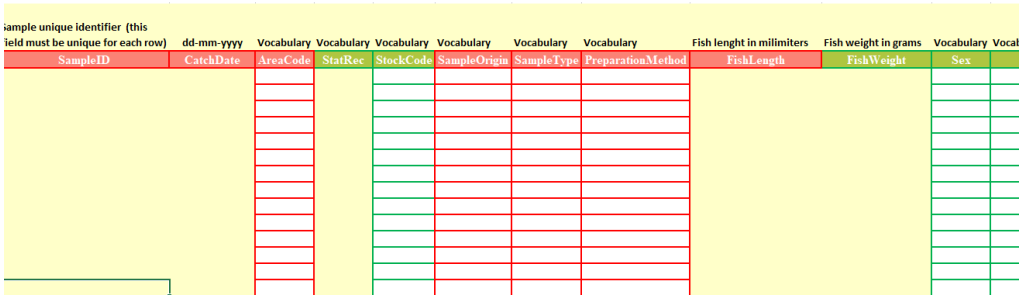


Figure 11 – The Excel template for uploading samples, the sheet when users insert the information.

When the user finishes filing the template file, he has to go to the "export data" spreadsheet when a button to export the data are available. The user can then press that button to export the data to an xml file that he can then upload to associate the samples with an event.

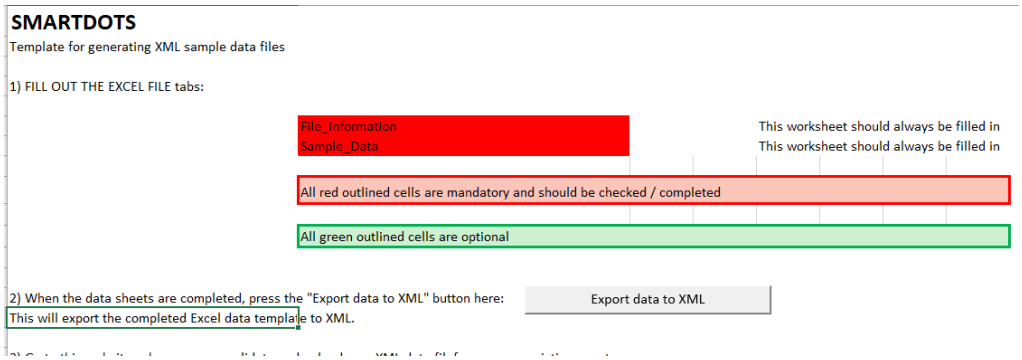


Figure 12 –Excel template for uploading sample for an event, the sheet where the users can export the file to XML.

Example of an XML File


```
<?xml version='1.0' encoding='utf-8' standalone='no'?>
<?xml-stylesheet type='text/xsl' href='SmartDots.xsl'?>
<File_information xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
xsi:noNamespaceSchemaLocation='SmartDots.xsd'>
<ContactE-mail>carlos@ices.dk</ContactEmail>
<SamplingInstitute>12 </SamplingInstitute>
<Species>Gadus morhua</Species>
    <sample_data>
        <SampleID>3 </SampleID>
        <CatchDate>25−03−2017 </CatchDate>
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Example of Report.

The following is the proposed table of contents of the exchange/workshop reporting module which will be integrated into SmartDots in the future

Otolith Exchange Analysis for XX in Area X

Table of Contents

Annex 9: List of annually updated files

WGBIOP update annually a number of files which are found on the Data Quality Assurance Repository: (http://ices.dk/community/Pages/PGCCDBS-doc-repository.aspx):

- Guideline for Exchanges and Workshops on Age Reading.
- Guidelines for Workshops on Maturity Staging.
- Material, techniques and preparation methods by species and areas for age estimation.
- Workshops, Exchanges and Study Groups Historical overview by species (Annex 7).
- Age Readers contact list.
- Maturity stagers contact list.

Annex 10: References

Adams, S. M. (1999). Ecological role of lipids in the health and success of fish populations. In Lipids in freshwater ecosystems (pp. 132–160). Springer New York.

Casini, M., Eero, M., Carlshamre, S., and Lovgren, J. (2016). Using alternative biological information in stock assessment: condition-corrected natural mortality of Eastern Baltic cod. ICES Journal of Marine Science, doi:10.1093/icesjms/fsw117.

EU (2010) Adopting a multiannual Community programme for the collection, management and use of data in the fisheries sector for the period 2011–2013. 2010/93/EU

Kell, L.K, Nash, R. D. M., Dickey-Collas, M., Mosqueira, I., Szuwalski, C. (2016). Is spawning stock biomass a robust proxy for reproductive potential? Fish and Fisheries 17 (3): 545–891.

ICES 2013. Report of the Second Workshop of National Age Reading Coordinators (WKNARC2). ICES CM 2013\ACOM: 52

ICES, 2014. Report of the Workshop on Statistical Analysis of Biological Calibration Studies (WKSABCAL). ICES CM 2014/ACOM:35

ICES, 2015. First Interim Report of the Working Group on Working Group on Biological Parameters (WGBIOP). ICES CM 2015/SSGIEOM:08.

ICES, 2016. Report of the Working Group on Biological Parameters (WGBIOP). ICES CM 2016/SSGIEOM:08.

Lloret J.,Faliex E., Shulman G. E., Raga J.-A., Sasal P., Muñoz M., Casadevall M., Ahuir-Baraja A. E., Montero F. E., Repullés-Albelda A., Cardinale V., Rätz H.-J., Vila S. & Ferrer D. (2012) Fish health and fisheries, implications for stock assessment and management: the Mediterranean example Reviews in Fisheries Science 20 (3): 165–180.

Lloret, J., Shulman, G., Love, R. M. (2014). Condition and Health indicators of Exploited Marine Fishes. Wiley – Blackwell 248 pp

Marshall, C. T., Yaragina, N. A., Lambert, Y., & Kjesbu, O. S. (1999). Total lipid energy as a proxy for total egg production by fish stocks. Nature, 402(67–59), 288290.

STECF (2005) STECF opinion on the SGRN working group report Data collection: environmental integration and move towards an ecosystem approach November, 2005. https://stecf.jrc.ec.europa.eu/documents/43805/122925/05−11_SG-RN+05−03+-+DCR+-++env+integration+towards+ecosystem+approach_SECxxx.pdf

Shephard, S., Rindorf, A., Dickey-Collas, M., Hintzen, N. T., Farnsworth, K., R (2014) Assessing the state of pelagic fish communities within an ecosystem approach and the European Marine Strategy Framework Directive. ICES Journal of Marine Science, 71(7), 1572–1585.

Scientific, Technical and Economic Committee for Fisheries (STECF) – Quality Assurance for DCF data (STECF 17−11). Publications Office of the European Union, Luxembourg, 2017, ISBN 978- 92−79−67483−9, doi:10.2760/680253, JRC107587

Spence, M. A. and Turtle, A. J. (2017). Making the most of survey data: Incorporating age uncertainty when fitting growth parameters. Ecology and Evolution, 2017:111

Thorpe, R. B., Le Quesne, W. J. F., Luxford, F., Collie, J. S. and Jennings, S. (2015) Evaluation andmanagement implications of uncertainty in a multispecies size-structured model of population and community responses to fishing. Methods in Ecology and Evolution, 6, 49–58.

Annex 11: WGBIOP Terms of Reference

The **Working Group on Biological Parameters** (WGBIOP), chaired by Pierluigi Carbonara, Italy, Cindy van Damme, The Netherlands and Julie Olivia Davies, Denmark will meet in Ghent, Belgium, 1–5 October, 2018, to:

a) Plan studies, workshops and exchange schemes or other intersessional work related to interpretation of data on stock-related biological variables and review their outcomes

b) Improve training and quality assurance of age reading and maturity staging. Identify the need for validation studies and assign priorities

c) Evaluate the quality of biological parameters: Issues and guidelines

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

e) Address requests for technical and statistical recommendations/advice related to biological parameters and indicators

f) Update and further develop tools for the exchanges and workshops (e.g. SmartDots and statistical tools.)

WGBIOP will report by DATE to the attention of the SSGIEOM, SCICOM & ACOM.

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 requirements	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: Integrated Ecosystem Observation and Monitoring (IEOM). 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 organizations	Regional Coordination Groups and PGMed

2014/MA2/SSGIEOM03 The **Working Group on Biological Parameters** (WGBIOP), chaired by Pierluigi Carbonara, Italy, Cindy van Damme, The Netherlands and Julie Olivia Coad, Denmark will meet in Ghent, Belgium, 1–5 October 2018, to 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 "XXX" 2018 to SSGIEOM, SCICOM& ACOM	
Year 2019			Interim report by "DATE"to SSGIEOM, SCICOM& ACOM	
Year 2020			Final report by "DATE" to SSGIEOM, SCICOM& ACOM	

ToR descriptors

ToR	Description	Background	Science plan topics addressed	Duration	Expected deliverables
a	Plan studies, workshops and exchange schemes or other intersessional work related to interpretation of data on stock-related biological variables	Review incoming suggestions for inter-sessional work from EGs, WKs and other ICES related groups, e.g. planned benchmarks	21, 25, 31	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	20, 21, 25, 30, 31	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.

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN TOPICS ADDRESSED	DURATION	EXPECTED DELIVERABLES
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.	25, 27	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
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.	20, 25, 30	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	25, 26, 30	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	27, 28	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

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