

1 Annex 4 Updated guidelines for the ICES benchmark data evaluation process

Based on the PGDATA 2015 report, Annex 4, including feedback from WGBFAS & WKIRISH2

a) Stock structure

Explain the basis for existing assumptions on stock structure and mixing rates between stock areas, or proposed new assumptions which form the basis for spatial aggregation of fishery and survey data and/or adjustments to data sets to account for stock mixing.

If no changes are to be made to stock boundaries, or to any procedures to separate fishery or survey catches into stocks within a stock mixing area, provide a brief summary of the current definition in a document for the data evaluation workshop report. This should include a map showing the existing stock boundaries along with brief text explaining the basis for the stock assumption and any methods to quantify stock mixing rates. Provide links to the Stock Annex, previous benchmark data evaluation reports or any other documentation explaining the basis for these assumptions and methods.

If the assessment expert group (EG) has evidence from genetics, tagging or spatial patterns in biological parameters to suggest that the current stock areas or mixing rates may need revision, it should consider involving experts from the ICES Stock Identification Methods Working Group (SIMWG; ICES 2015b and earlier) and the ICES Working Group on Biological Parameters (WGBIOP; ICES 2015c) to help evaluating the evidence.

Prior to any data compilation and evaluation for new stock areas, it must first be determined if the evidence is sufficiently robust and the work to create new data sets and parameters is feasible. Carry out the following tasks, in liaison with the other expert groups being consulted:

- Conduct an initial review and summarise this in a Working Document containing: i) a full explanation of the reasons for reviewing the stock structure or mixing rates; ii) an evaluation of the robustness of the evidence – e.g. the quality and comparability of data on growth, maturity, recruitment patterns, genetic structure, tagging results, morphometrics and meristics or other population characteristics used as evidence for stock structure; and iii) an evaluation of the feasibility of aggregating or disaggregating catch and survey data and revise biological parameters to reflect the new stock definitions in time for the proposed benchmark data evaluation meeting. Which evidence is needed? What to be proven? Is the null hypothesis that only one stock exists?
- If the evidence is not sufficient to warrant a revision of stock structure, or if it is not possible to develop data sets for revised stock definitions in time for the benchmark assessment, the assessment EG should consult with the ICES Benchmark Steering Group to decide if the benchmark should continue using the existing stock definitions or be postponed until the required information is available.
- If it is decided to revise the stock boundaries and it is possible to complete such work in time for the benchmark data evaluation meeting, provide revised historical landings, catch composition data, abundance indices and biological parameters required according to the new stock boundaries. If the assessment EG intends to account for mixing rates between stocks by adjusting input data (e.g. plaice stocks in VIII d & e), thoroughly review the evidence for mixing rates and provide a plausible range of uncertainty to allow the sensitivity of the assessment and forecast to this to be evaluated. This is also required if mixing rates are to be estimated within a multi-stock statistical assessment model, to help develop prior distributions of input values.

- If the data can be compiled in time, provide the disaggregated or aggregated data sets for the revised stock definitions together with an evaluation of quality of the data sets. Depending on sampling and survey coverage, expanding or splitting the stock area could lead to truncation of the time series and changes in the data quality at the stock level depending on the quality of data from the different sampling areas included in the range of the stock.
- In the event of a change in assumed stock structure or methods for quantifying stock mixing, the resultant change in quality of assessment data will also be covered in subsequent sections of the data evaluation report, and the revised input data for the new stock boundaries will be tabulated as an output of the data evaluation meeting.

b) Life-history parameters

Life-history parameters (e.g. growth parameters, maturity ogives, fecundity, natural mortality), for use in the assessments should be analysed. Where applicable, provide appropriate models to describe growth, maturation, and fecundity by age, sex, or length.

Growth, maturity and fecundity; mean weight-at-age, length-at-age

The data evaluation process will address the life-history parameters and specific issues identified by the parent assessment EG for the benchmark data evaluation process. Summarise the findings in a Working Document. If previous benchmark data evaluations of these parameters remain valid, provide references and links together with a summary of the parameter values and their precision if calculated. If a full evaluation is required, document the following aspects of design, interpretation and analysis:

- The sources of the samples (e.g. which trawl surveys or fishery sampling schemes), and the laboratories involved in data collection over time.
- Selectivity characteristics of gears providing samples, where these may lead to biases caused by skewed distributions of size at age.
- Coverage of the sampling in terms of geographic areas and seasons, relative to the known distribution of the population at different life stages, and an evaluation of possible effects of any spatio-temporal mismatch with the stock biology.
- Numbers of independent primary sampling units such as survey trawl hauls or commercial fishing trips with samples for the species, and total numbers of individuals sampled, by year. Gaps in sampling coverage that will affect quality of estimates should be identified.
- How the sampling units were selected (e.g. opportunistic or using a design-based random sampling scheme).
- Methods and criteria for identifying mature fish in samples, with reference to maturity keys, sampling protocols and calibration workshops or studies.
- Results of age validation studies, calibration studies and exchanges to document bias and precision of age estimates, highlighting any persistent differences between laboratories and changes in interpretation of age material over time.
- Description of fecundity estimation methods, if applicable.
- Description of analysis methods including use of statistical models to estimate growth, maturity and fecundity parameters by age, length or sex as appropriate.

- Derived parameter estimates, with diagnostics and evaluation of quality and evidence for stability or trends in parameter values over time.
- Recommended parameters for use in assessments. For statistical age- and length-based assessment models, specific statistics such as standard deviation of length-at-age, CV of ageing errors or age-error matrices, may be required and should be requested by the assessment working group.

c) Natural mortality

Within ICES, decisions on appropriate values for M generally rely on: i) results of multispecies models such as the Stochastic Multispecies Model SMS for the North Sea updated at intervals by the ICES Working Group on Multispecies Assessment Methods (WGSAM), or integrating single-species models with other forms of multispecies or ecosystem models; ii) methods that predict average or age-based natural mortality from life history parameters such as growth and maturity parameters and maximum observed age; iii) an assumption such as 0.2 used in the absence of other information, or by comparison with similar species. For some data-rich stocks assessed using statistical models, it may be possible to derive some inference on plausible rates of natural mortality based on likelihood profiles over a range of M, or from tagging results included in the model. Are there any places where you can find this literature

Depending on information available, carry out the following tasks:

- Check changes in the ecosystem that can have affected the natural mortality over time (predators such as seal population, predator fish ect.). Evaluate how to use the information to adjust natural mortality by age/ length accordingly.
- If an estimator such as SMS, or another approach using multispecies models, is used by the assessment EG and it is intended to continue with this approach, or if it is proposed to start using M estimates from such a model, provide a reference and link to the latest model update and the values of M by age and year for the stock. Summarize information on the quality of the estimates given in the multispecies assessment report. It is important to consult the expert group providing the multispecies model estimates when preparing the data evaluation, to ensure the correct information is provided for the benchmark stock assessment.
- If life history methods to infer M are to be proposed, provide the results of a range of plausible models from the literature, proposing a baseline method together with alternatives that could be used for sensitivity testing.
- If estimates of M have previously been derived from an assessment model including tagging, or inferences have been made from likelihood profiles or other modelling approaches, summarise the findings of the relevant EG report including any information provided by the EG on the quality of the estimates or inferences.
- If there is no existing information, derive a range of plausible values for M for species with generally similar life histories and give supporting arguments.

d) History of fishery management

Describe the history of fishery management regulations and actions that are expected to have caused changes in the quality of fishery catch data or the selectivity patterns of fisheries that are of relevance for the scientific assessment of the stocks and provision of advice.

If there is an existing Stock Annex, this should already provide a history of management measures relevant for the assessment and advice. If this is not sufficiently complete and adequate, it must be reviewed and updated. Carry out the following tasks where appropriate (much of this will be generic to many stocks within a region. See PGDATA (Annex 1 of ICES 2015a) for further information:

- Provide a chronological description of management regulations and actions applied to fleets (rather than those specific to stocks), and the known or expected impacts on data quality and fishery selectivity in general. Include information such as: spatio-temporal closures; gear regulations (mesh size, selective devices, length of nets); direct regulation of fishing effort; decommissioning schemes (including how much of the targeted fleets are removed and the impact on overall fleet capacity) and any other measures having a significant impact on the amount of fishing and selectivity of fishing fleets.
- Provide a chronological description of management regulations both national and international and actions that are specific to the stock being benchmarked. This could include: TACs; individual boat limits; minimum conservation reference size (MCRS); implementation of the landing obligation, etc.
- Provide a chronological description of management regulations or actions that affect the compliance with management measures and the completeness and quality of fishery data supplied to assessment working groups. This may include changes in catch reporting systems such as national Buyers and Sellers regulations, and in vessel monitoring and control.
- For stocks where an understanding of changes in fishery selectivity is needed for the assessment model, document any management regulations or actions that are expected to cause a change in selectivity for the stock being benchmarked, and evaluate the known or likely outcomes.
- For stocks where fishery CPUE or LPUE is to be evaluated for providing abundance indices, identify management regulations or actions that are expected to cause a change in catchability or selectivity of the relevant fleets for the stock being benchmarked.
- Where possible, make use of graphical or tabulated summaries to give a clearer overview of changes over time. Some examples are given in Annex 1 of PGDATA (ICES 2015a).

e) Catch estimates

Develop time-series of commercial and recreational fishery catch estimates, including both retained and discarded catch, with associated measures or indicators of bias and precision.

The guidelines in this section relate to total retained or discarded fishery catch for all types of fishing. Separate data evaluations are needed for catches that are recorded exhaustively (e.g. landings logbooks), and for those estimated through sampling schemes (e.g. discards and recreational catches).

For exhaustively collected data:

- Provide full documentation of the derivation of the catch figures for the time series available for assessment, and any adjustments made to official statistics. Such adjustments might have been made to allocate landings to the correct fishing ground, adjust for stock mixing, to disaggregate mixed-species landings records using sample data, or make other corrections for misreporting or under-reporting. Explain how the adjustments are made.
- Document and explain differences between the landings figures recommended by the data evaluation team and the official statistics

- Evaluate the reliability of catch estimates in terms of historical biases and trends in bias, where evidence for such biases exist.
- Propose catch data series which are appropriate for use in a stock assessment. If there are historic data of poor quality, for example due to known or suspected inaccuracies in reporting, provide (if possible) different plausible catch histories that could be used for sensitivity analyses in the benchmark assessment. Consult with stakeholders in drawing up such scenarios.

For data collected non-exhaustively through sampling schemes, the description of the surveys and evaluation of data quality can be complex, requiring detailed examination of survey design and sampling achievement down to the level of sampling strata. Seek assistance from ICES Expert Groups dealing with such surveys well in advance of the data meeting (e.g. ICES Working group on Recreational Fishery Surveys - WGRFS; ICES Working Group on Commercial Catches - WGCATCH) unless members of these groups are part of the benchmark data evaluation team. If necessary, contact the ICES secretariat and the chairs of these EGs to determine a process by which the sampling survey experts may contribute to the documentation and evaluation of catch data from surveys of recreational fisheries or commercial discards and landings. This may require ToRs to be added to the next meeting of these EGs so this needs to be considered well in advance of the benchmark. The following data evaluation tasks will be required:

- Provide an overview of the survey methods adopted, with links or references to detailed scheme descriptions. This covers the design of the schemes, including: definition of the population being sampled; sampling frames and their coverage; primary and lower level sampling units and how they are selected; stratification of the sampling units and reasons for this; other relevant data collected such as recording of non-responses or refusals; and how the data are analysed to provide estimates of total catches.
- Document historical changes in sampling schemes that may indicate changes in data quality (bias and precision) over time. Some examples of how this could be presented are given in Annex 2 of ICES PGDATA (ICES, 2015a), though other formats are possible and full use should be made of information in the ICES Regional Database or other databases to explore data quality.
- Evaluate the reliability of catch estimates in terms of historical biases and trends in bias, and in terms of precision. Where standard errors or CVs of estimates are provided, document these. Also provide simpler quality indicators such as numbers of primary sampling units sampled. See additional notes in Annex 1 of PGDATA (ICES 2015a) for further details.
- Propose catch data series which are appropriate for use in a stock assessment together with data quality indicators to help the stock assessment team to decide which data to use, to weight different data series if necessary, and to interpret the diagnostics of assessment models.

With regard to the integrity of the historical discard series, it is necessary to take into account the recent changes in the European fisheries legislation in relation to the Landing Obligation. Since 2015, it has been sequentially applied the obligation to land all catches of certain species. The volume of this non-commercial but compulsory landed catch must be recorded by fishermen in the logbooks, so that it can now be known without having to be estimated. This change can produce bias in the historical series that must be perfectly documented and analyzed; especially in those stocks whose assessment includes discards time series.

f) Length and age structure

Estimate the length and age distributions of fishery landings and discards if feasible, with associated measures or indicators of bias and precision.

As with estimation of catches by surveys, the description and evaluation of additional sampling surveys to estimate length and age composition, and evaluation of data quality, can be complex. Include this aspect of data collection with catch estimation when seeking assistance from ICES Expert Groups dealing with such surveys. Assistance from the ICES Working Group on Biological Parameters (WGBIOP) should if needed be sought in relation to quality of age estimates (see guidelines for biological parameters).

With input from the relevant EGs as described above, where appropriate, document the derivation and quality of existing length and age composition data for fisheries, and of any new data sets that have been made available, as follows:

- Using ICES reports on age validation and calibration studies for the stock (see Data Quality Assurance Repository), or any other documentation on precision and bias in age readings: (i) evaluate if age readings are reliable enough for use in an assessment – i.e. sufficiently low bias, and (ii) provide metrics of precision such as CV or an age error matrix that can be incorporated into a statistical stock assessment model. Identify any systematic differences in interpretation of otoliths, scales or other material between laboratories, and any drift over time in age interpretation by national laboratories, where information is available. Seek guidance from the stock assessors on the metrics of bias or precision needed for incorporation in assessment models (see Annex 1 of PGDATA – ICES 2015a - for more information).
- Provide a summary of the historical design of national shore-based and at-sea sampling schemes or any other schemes to estimate length and age compositions, and the methods of raising data to give compositions at the national scale. Describe how total catches at age are derived from combination of length and age sampling, or from age sampling on its own.
- Tabulate achieved annual sampling rates in terms of numbers of fishing trips sampled for length and age, with supporting information on numbers of fish measured or aged. This should ideally be done by country and sampling stratum in each year together with the estimated annual landings or discards for each stratum. Use these data to identify deficiencies and gaps in sampling.
- Describe how length and age compositions are raised and aggregated within and across countries to give international estimates (e.g. by métier or métier group through InterCatch). Identify if the methods are statistically sound and the sample sizes are sufficient in each stratum to support the degree of resolution being applied, or if there is a substantial amount of subjective “borrowing” of estimates from other countries and métiers especially if done without reference to the quality of borrowed data. Consult with experts from the ICES Working Group on Mixed Fisheries Advice (WGMIXFISH) on their information needs. If necessary, rework the raising and aggregation using more statistically robust methods for comparison with InterCatch results.
- Describe how individual live weights are derived (e.g. direct measurement or from length-weight relationships) and evaluate known or potential errors introduced by this.
- Provide a recommended data set of length and age compositions for landings, discards (and recreational catches where appropriate), and associated weights at age. If possible, provide estimates of precision (e.g. relative standard error or CV) for the raised international landings and discards at age, and the total discards. Consult the stock assessment team on whether numbers or weights at age should be sums-of-products (SOP) corrected so that the sum of numbers at age and weights at age is equivalent to the total catch weight figure input to the assessment.
- Use the information on sampling design, sampling achievements, precision over time and ageing errors to provide advice to the stock assessment team on changes in overall data quality (bias and precision)

that will allow an objective decision to be made on whether the data can be used for all or some years, or weighted in an assessment model.

- Evaluate the internal consistency of proposed catch-at-age data sets in terms of consistent tracking of year classes, and identify the most likely sources of poor year class tracking based on the data quality information available. This will help identify further research or additional sampling needed to improve data quality. Unless otherwise instructed, provide age compositions out to the oldest true age to allow flexibility in setting a plus group. Information on numbers of fish sampled at age each year can be useful statistics to help determine the most appropriate plus group for the assessment.

g) Selectivity

Develop recommendations for addressing fishery selectivity (pattern of catchability at length or age) in the assessment model.

Most age-based or length-based stock assessment models require some assumptions about selectivity, i.e. how catchability varies with size or age in fisheries. Selectivity in this context is a combination of the selectivity properties of fishing gears of different design, and factors influencing the probability of fishing operations encountering fish of different sizes and ages, for example related to distribution of fishing or behaviour patterns of the fish.

Statistical assessment models may involve fitting selectivity patterns of varying complexity (e.g. asymptotic or various types of domed curves) separately to individual fleets or groups of fleets. To help the assessment team decide on appropriate selectivity patterns and any changes over time, carry out the following tasks:

- Examine the spatio-temporal distribution of fisheries relative to the known distribution of fish of different sizes or ages, for example from trawl surveys.
- Review any available information on how the behaviour of different sizes of fish affect their likelihood of interacting with fishing gear at any location.
- Review existing information on selectivity characteristics of the main types of fishing gears used for the assessed stock, based on gear selectivity studies or other published studies.
- Refer to the guidelines for documenting changes in management regulations (Section 3 above) to identify expected changes in selectivity, and consider how changes over time in the contribution of catches by fleets with different selectivity characteristics may have altered the overall selectivity pattern for the combined fisheries.
- A comparison of the fleet-raised length and age compositions for separate fleets can provide information directly on the relative selectivity of the fleets and any historical changes.
- If an assessment is to be explored in which domed selectivity is to be assumed for some fleets, it can be helpful to have one fleet for which selectivity is most likely to be asymptotic and where the catches and input length or age data are sufficient to allow a good fit. If all of the fleets are expected to have domed selectivity, it may be necessary to fix the parameters of the descending limb for a fleet that is likely to have the least pronounced dome, and explore sensitivity of the assessment to different fixed parameters. Advise on which fleets (national or international), are most likely to be asymptotic or have the least pronounced dome, based on the tasks given above.

h) Discard mortality and survival rates

Recommend values for discard mortality rates, where appropriate, and indicate the range of uncertainty in values.

ICES assessment EGs have, for most assessed stocks, assumed that all discards die. The potential for dispensations from the EU landings obligation for species with high discard survival has resulted in a range of studies on the mortality rates of fish and shellfish discarded or released alive from fishing operations. Many recreationally-caught fish are also released alive after capture and have variable survival rate depending on a range of factors such as deep hooking, bleeding and water temperature. There are numerous published studies on post-release survival of marine species, though relatively few are from Europe. Increasingly, ICES assessment EGs will need estimates or inferences of mortality of discarded or live-released fish caused by the fishing operation.

Carry out the following tasks to provide information on estimated or potential discard mortality:

- Review existing information on discard mortality for the assessed stock, or for similar species in similar fisheries and conditions, following the guidelines provided by the ICES Workshop on Methods for Estimating Discard Survival (WKMEDS: ICES 2015d and previous).
- Where supported by data or comparisons with similar stocks studied elsewhere, recommend discard mortality rates and range of uncertainty. Include thorough rationale for recommended discard mortality rates.
- Provided justification for any recommendations that deviate from the range of discard mortality provided in available research and published literature.

i) Abundance estimates

Review all available and relevant fishery independent and dependent data sources on fish abundance, and recommend which series are considered adequate and reliable for use in stock assessments

8.1 Fishery independent data

Assessment EGs make extensive use of research surveys to provide absolute estimates of abundance, or more commonly, relative abundance indices, for tuning length or age based stock assessments. In many data-limited assessments, surveys provide the main source of information on stock trends. Survey data may be used as size/age-aggregated indices or as length or age based indices. Some assessment models require the parameters of the selectivity pattern of a survey at length or age to be fixed or estimated, and for indicators of data quality such as CVs or effective sample sizes to be input to the model separately for the total abundance indices and the length or age compositions.

As with survey estimates of fishery catches and catch compositions, the evaluation of fishery independent survey data can be complex and will require support from expert groups dealing with design and implementation (e.g. International Bottom Trawl Survey Working Group, IBTSWG) and those dealing with interpretation and end-use of survey data (e.g. Working Group on Improving Use of Survey Data in Assessments and Advice, WGISDAA). The appropriate survey EGs must be consulted at the initial stages of

the benchmark process (See Fig. 1) to identify tasks for providing advice or carrying out the evaluation work needed for the benchmark.

In collaboration with the survey EGs where required, carry out the following tasks to evaluate each fishery independent data series:

- Document main objectives, timing, frequency, spatial coverage, survey sampling design including definition of sampling units, sampling gear, sampling intensity, stratification and methods for allocation of sampling effort to strata, subsampling procedures, and other relevant characteristics. Provide maps of survey coverage in relation to expected species/stock area of occupancy.
- Evaluate the suitability of the survey for providing abundance indices for the species/stocks being assessed given known aspects of fish behavior, habitat preferences and vertical- horizontal distribution.
- Document changes in survey design, coverage, vessels and gears over time. Evaluate the potential for bias caused by systematic or step-changes in catchability over time due to such changes. Document any calibration factors applied following vessel or gear changes, and any estimates of uncertainty around these.
- Refer to guidelines for biological parameters to evaluate if age or maturity readings are of sufficient quality to derive abundance indices by age and maturity, including any changes in age interpretation or maturity criteria that would compromise integrity of time series (liaise with WGBIOP where required).
- Describe the analytical methods used for deriving indices of abundance including any disaggregation by sex, maturity, length or age class. Describe any selection methods used in the analysis of the survey data to provider assessment inputs – for example restricting the analysis to spatial subareas (domains) or time of day of observations, or use of any modelling approaches such as GLMs or GAMs.
- For age-based CPUE/LPUE indices, evaluate the internal consistency of age compositions and if more surveys are used the external consistency between surveys.
- Describe the methods for deriving estimates of precision and provide the estimates for each year over the time series – see Annex 1 of PGDATA 2015a for further details and caveats.
- Review any evidence that may help identify the shape of the selectivity pattern by length or age for the survey, if needed for the assessment. This is a complex function of gear selectivity, distribution of fish of different sizes relative to the survey coverage, and aspects of fish behaviour at a trawl station that affect the probability of fish of different sizes or ages interacting with the gear.
- Tabulate the recommended survey indices and quality indicators for use by the assessment EG.
- Tabulate all other survey data provided and evaluated, but not considered suitable for the assessment.

8.2 Fishery dependent data (CPUE/LPUE)

Fishery dependent abundance indices continue to be used for some species, with or without fishery independent data, and may be the only information available on stock trends for some data-limited stocks. Assessment and advisory groups need to understand the limits imposed by the quality and resolution of

such data. See Annex 1 of PGDATA 2015a for more details on the limitations of such data. The ICES Working Group on Fishing Technology and Fish Behaviour (WGFTFB) may be able to provide good advice on the suitability of a fleet for providing abundance indices and on issues such as technology creep, and should be consulted where required.

If fishery-dependent data are to be evaluated, consult the background documents listed in Annex 1 of PGDATA 2015a and carry out the following tasks, collaborating where needed with ICES WGFTFB:

- Document all fishery CPUE/LPUE series, addressing target species, fleet sectors, fishing gears, coverage, and regulatory measures affecting fleet behaviour. Evaluate the suitability of each CPUE/LPUE fleet for the species being assessed, in terms of known aspects of the fisheries and fish behaviour in relation to gear design and fleet coverage.
- If developing a CPUE index including discards, evaluate the quality of the discards data for each year in the series, following the approaches outlined above for developing time series of fishery discards and landings.
- Define and describe the available effort metrics (e.g. hours, days, trips, number of hooks or nets, horsepower, soaking time, search time or any combinations of these), and evaluate which, if any, of the metrics are appropriate, and why.
- Describe the methods for data selection (e.g. sub-setting of fishery trips according to vessel size, time, area, and gear or species composition). Provide maps of coverage of the selected vessels in relation to the entire selected fishery (e.g., VMS).
- Develop fishery CPUE/LPUE indices by appropriate strata (e.g., area, and fishery) and include measures of precision and assessment of bias; rank indices with regard to their suitability for use in assessment modelling. Describe methods of analysis of CPUE/LPUE data including any statistical modelling carried out.
- Evaluate the potential for changes in catchability over time due to changes in vessels, fishing gear and methods, or spatiotemporal activities. Document the methods and rationale for any factors used to correct for changes in fishing efficiency and feasible ranges for time-trends in efficiency.
- For age-based CPUE/LPUE indices, evaluate the internal consistency of age compositions and correlations between fishery dependent CPUE/LPUE series and surveys. Indicate if CPUE/LPUE fleets with age compositions provide a large fraction of the total international catches.
- Where needed for exploring assessment models, evaluate the length or age selectivity of the CPUE/LPUE fleet as described above for fishery length and age compositions. Indicate the extent to which components of the age composition are mainly observed in the fishery dependent CPUE/LPUE and not in the scientific surveys.
- Recommend and tabulate fishery dependent data sets that are appropriate for use in the assessment, together with any quality indicators such as precision estimates or plausible alternative scenarios for catchability trends.

j) Environmental impacts

Longer term or episodic/transient changes in environmental drivers known to influence distribution, growth, recruitment, natural mortality or other aspects of productivity and which are relevant for assessments and forecasts.

There are potential circumstances where the data inputs to an assessment model, or the assumptions in the model, need to take into account environmental drivers. These may be episodic or transient phenomena such

as mortality or changes in fish distribution caused by low-oxygen water or lethal temperature events, or longer term trends in environmental conditions. The data evaluation team should source and review existing information and make recommendations on how this information should be used by the assessment team, as described below.

9.1 Long-term environmental drivers

Regional integrated ecosystem assessment groups, ecosystem overviews or scoping workshops may have identified environmental time series that are relevant for an assessment or forecast – for example trends in environmental variables that affect recruitment and could be included as covariates in an assessment or used to modify decisions on recruitment for short-term or medium-term forecasts. Environmental variables may also be related to changes in growth and distribution, or catchability in surveys. Compile any such data sets supplied by regional integrated ecosystem assessment groups etc. and make available to the assessment team together with any specific comments on quality of those data (taking advice from ICES Data Information Group where needed)

9.2 Episodic / transient events

Identify any episodic / transient environmental events that have been shown to affect abundance or population dynamics of the stock being assessed, where these need to be accounted for in the assessment model and any associated predictions and advice. Data that could be used by the assessment team for this purpose should be developed if not already supplied by other expert groups (e.g. low oxygen or salinity events, exceptional warm or cold periods)

k) Research status

Review progress on existing recommendations for research to develop and improve the input data and parameters for assessments, and develop and prioritise new proposals.

Provide a review of existing recommendations for research to develop and improve the input data for the assessment, and what has been achieved. If work is still ongoing, describe progress, problems encountered, how these will be resolved and expected finalization of the work. If this cannot be progressed, consider a recommendation that the work should be stopped.

During the data evaluation workshop, proposals for changes to data collection or needs for new data or studies may be identified. The workshop must identify the relative priorities of the recommendations and expected impact on the quality of the assessment, and take into account feasibility.

l) Data quality indicators

Develop a spreadsheet of assessment model input data that reflects the decisions and recommendations of the Data Workshop.

Use a spreadsheet of assessment model input data and parameters that reflects the decisions and recommendations of the data evaluation workshop, covering all aspects of data and parameter estimates covered in 1 – 9 above. This will include quality indicators such as age-error matrices and time series of CVs or sample sizes that are needed for input to the assessment model, in addition to plausible ranges of

parameters such as M, and alternative catch histories where needed. Also document any data that were evaluated by the data evaluation team but not recommended for use.

This is a key output of the data evaluation process. The benchmark assessment workshop will use this table to indicate which data were used, and explain why any of the data are not used or are modified.

m) Workshop report

Prepare the data evaluation/compilation workshop report providing complete documentation of workshop actions, decisions, list of working documents, other information used by the workshop, and a list of any additional tasks to be completed following the workshop with dates and responsibilities for completion.

Finalise and agree the report of the data evaluation workshop, and the spreadsheet of recommended assessment input data, within two weeks of the end of the workshop. This is to allow the stock assessment team time to evaluate the recommendations, seek any clarification from the data evaluation team, or conduct any of their own analyses if they disagree with the findings of the data evaluation workshop.

The data evaluation workshop report and Excel tables of recommended inputs should stand as separate documents alongside the assessment workshop report with both being available from the same ICES web page.

