



European Fish Ageing
Network

**Newsletter
TACADAR**
(Towards accreditation and certification of
age determination of aquatic resources)
2002 - 2005



Sponsored by:

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Homepage:
www.efan.no/tacadar/

Newsletter Editor:
E. Moksness

Objectives
To stimulate the achievement of a higher
level of quality within and integration
between the member institutions of
TACADAR, concerning fish age
determination.

**European
Commission**
Concerted Action
(Q5CA-2002-01891)

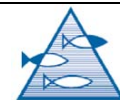
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TACADAR
Institute of Marine Research
Department of Coastal Zone
Flødevigen Marine Research Station
N-4817 His, Norway

Phone: +47 37 05 90 00
Fax: +47 37 05 90 01
Email: bente.lundin@imr.no
Email: moksness@imr.no



2. Report from the Ancona meeting, 9-12 September 2004

Thursday 9 September

2000: TACADAR Steering Group meeting (At Hotel Jolly)

Friday 10 September - Meeting location: Hotel Jolly

1000: Welcome. Short presentation of the participants

1015: Erlend Moksness: TACADAR: where are we going and how

1040: Audrey Geffen: Is it an art ?

1100: Coffee break

1130: W. J. McCurdy: Quality issues in the use of otoliths for fish age estimation

1200: Peter Wright: The nature of secondary growth structures in temperate marine fishes

1230: Ronan Fablet: outline of the new version of our software TNPC dedicated to CS imaging + statistical learning applied to age and growth analysis from otolith images

1300: Lunch

1430: Henrik Mosegaard: The effects of age, growth, species, population, and environment on fish otolith shape

1500: H  l  ne de Pontual: Continuation of the "hake story". The analysis of recaptures shows that we may largely underestimate growth and overestimate age.

1515: Arild Folkvord: Use of stable isotope analyses of cod otoliths to examine the timing of otolith macrostructure formation

1530: Working Groups

WG1: Discuss the levels of precision and accuracy to be used as qualifiers in statistical terms.

WG2: Discuss the evaluation of individual methods of age determination in cases where several methods are used to provide data input for the same stock assessment or environmental management model.

WG3: Develop guidelines for the creation and application of quality assurance and quality control mechanisms to protocols for the determination of the ages of fish from hard tissues.

WG4: Define the framework for the application of quality assurance and quality control mechanisms, to protocols for the determination of fish ages from hard tissues.

Saturday 11 September

0900: WGs continues

1100: Coffee break

1130: summing up WGs

1230: Lunch

1800: Final comments & end of meeting

2000: TACADAR dinner

List of participants, Ancona 9-12 September 2004

Navn	Country	Tacadar No	WG				WG Chairman	Email
			1	2	3	4		
Erlend Moksness	Norway	0				X	moksness@imr.no	
Tor Birkeland	Norway	0					tor.birkeland@imr.no	
Cornelius Hammer	Germany	1				X	chammer@ior.bfa-fisch.de	
Nuno Formigo	Portugal	3	X				X	neformig@fc.up.pt
Ana Moreno	Portugal	3			X		amoreno@ipimar.pt	
Enrico Arneri	Italy	4		X			e.arneri@ismar.cnr.it	
Gianfranco Giannetti	Italy	4			X		g.giannetti@ismar.cnr.it	
Jari Raitaniemi	Finland	5				X	jari.raitaniemi@rktl.fi	
Jose Pedro Andrade	Portugal	6	X				jandrade@ualg.pt	
Paulino Lucio	Spain	7			X		plucio@suk.azti.es	
Birgitta Krischansson	Sweden	8		X			birgitta.krischansson@fiskeriverket.se	
Yvonne Walters	Sweden	8			X		Yvonne.Walter@fiskeriverket.se	
Magnus Appelberg	Sweden	9				X	Magnus.Appelberg@fiskeriverket.se	
Carin Ångström	Sweden	9		X			carin.angstrom@fiskeriverket.se	
Anne Odelström	Sweden	9			X		Anne.Odelstrom@fiskeriverket.se	
Helene de Pontual	France	10	X				pontual@ifremer.fr	
Ronan Fablet	France	10	X				Ronan.Fablet@ifremer.fr	
Peter Wright	UK	11	X				P.J.Wright@marlab.ac.uk	
Jane Mills	UK	11		X			J.Mills@marlab.ac.uk	
William James Mc Curdy	UK	12		X			X	Willie.McCurdy@dardni.gov.uk
Henrik Mosegaard	Denmark	13	X				hm@dfu.min.dk	
Lotte A. Worsøe Clausen	Denmark	13				X	law@dfu.min.dk	
Beatriz Morales-Nin	Spain	14			X		X	ieabmn@clust.uib.es
Javier Tomás	Spain	14				X	javier.tomas@uib.es	
Michael Easey	UK	15			X		M.W.Easey@cefes.co.uk	
Carmen Piñeiro Alvarez	Spain	16			X		carmen.pineiro@vi.ieo.es	
Groa Petursdottir	Iceland	17			X		groa@hafro.is	
Paola Belcari	Italy	18		X			belcari@discat.unipi.it	
Claudio Viva	Italy	18		X			viva@discat.unipi.it	
Jacques Panfili	France	19		X			panfili@ird.fr	
Anastasopoulou Aikaterini	Greece	20		X			kanast@ncmr.gr	
Arild Folkvord	Norway	21				X	arild.folkvord@bio.uib.no	
Audrey Geffen	Norway	21				X	X	audrey.geffen@bio.uib.no
Jose Eduardo Rebelo	Portugal	25					erebelo@bio.ua.pt	
Peter Lengyel	Hungary	26		X			lengyelp@haki.hu	
Olga Bukovskaya	Hungary	27		X			silence@mail.mata.v.hu	
Kari Nyberg	Finland	28				X	kari.nyberg@helsinki.fi	
Helen McCormick	Ireland	Not member			X		helen.mccormick@marine.ie	
Eva Bergstrand	Sweden	Not member			X		eva.bergstrand@fiskeriverket.se	
Magnus Kokkin	Sweden	Not member			X		magnus.kokkin@fiskeriverket.se	

1.1. Report from WG 1

WG 1 aim:

Discuss the levels of precision and accuracy to be used as qualifiers in statistical terms.

WG 1 Chairman: Nuno Formigo, Portugal

During the year of 2004 the group members had the task of looking in the literature available in their areas of work for relevant information concerning accuracy and precision of estimations of fish age.

Also they were supposed to prepare a contribution to present in the yearly meeting, in Italy, that would help define this working group contribution to the overall project of TACADAR.

During the yearly meeting, in Ancona, Italy, that took place between 10 and 12 of September 2004, the group members had two meetings where they decided on objectives of the group and the strategy to adopt concerning the work within the TACADAR project and on the schedule to achieve the objectives they had defined.

Concerning the objectives of the group, the following assumptions were accepted as a framework for the future and some recommendations are made:

- The group work relates mainly to quality control procedures
- Quality control in age estimation can only be done thoroughly knowing true age and understanding the related structures.
 - For example, in the case of hake, growth may be underestimated by a factor of 2, due to ageing problems, in spite of good percentage agreement in group age readings. This highlights the difference between accuracy and precision
- This requires more effort and investment into validation work
- Also related to quality control is the issue of different sources of error and their contribution to the final error in the model estimates. As such, this group will strongly recommend that sensitivity analysis are run on the models, from different areas of application (stock assessment, growth models, etc)
- Concerning quality control itself, recommendations will be made on what kind of procedures to use, on how to compare them and, if possible, on the type of precision level to obtain in relation to its cost
- These recommendations will include individual results, comparisons between readers, laboratories or methods
- Most of the work done until now is based on comparing age estimates and not the interpretation of the structures.
- An increase in the traceability and comparability of the interpretation process is needed and image processing systems make this feasible.

Planning of the work for the next year, until 2005 yearly meeting in Belfast:

- Exchange of information concerning the previous issues until the end of October 2004 between the members of the group, and a call for contributions on this subject will be made to all TACADAR members
- Writing of a draft version of the quality control part of the manual to be produced by TACADAR (detailed index and explanatory text, glossary and, eventually, examples) until the end of December 2004
- Circulation of the draft text within the group members for correction and improvement until the end of May 2005
- Presentation of the final document in N. Ireland in June 2005

1.2. Report from WG 2

WG 2 aim:

Discuss the evaluation of individual methods of age determination in cases where several methods are used to provide data input for the same stock assessment or environmental management model.

WG 2 Chairman: William James Mc Curdy, UK

At the Budapest TACADAR meeting in May 2003, WG2 concluded that the first step in the evaluation of multiple methods should be the evolution of a protocol for evaluating individual methods. Work began on an initial inspection to examine the robustness of the ‘quality’ of each stage of the age determination process, by asking a series of ‘quality questions’ using Guidelines for the Quality Assurance of Fish Age Determination (EFAN Report 5-2000) as a framework, but there is also a need for a more comparative approach to the evaluation of individual methods. The quality inspection approach is more suited the certification of individual methods and this task will be completed before the next TACADAR meeting.

Detailed advice on the selection of appropriate methods of age determination is provided in the Manual of Fish Sclerochronology, (Panfili *et al*, 2002). The process of determining the age of an otolith or other calcified structure can be broadly divided into three parts; preparation, observation and interpretation of the age reading material. In response to the need for a more comparative approach, WG2 formed three temporary sub-groups to consider the evaluation of the preparation, observation and interpretation of the age reading materials, where several methods are used. The processes of sample collection and data storage were not included at this stage. The flow charts in this report were developed from these discussions and are intended to provide guidance on the suitability of an individual method, in cases where more than one method is used.

The group discussions produced a brief overview of the evaluation process. It was noted that it is very difficult to evaluate observation methods without visual assess to this part of the age determination process. While visits to the relevant laboratories would be preferred, video evidence may be acceptable in some cases. It is also difficult to fully

define an evaluation process from a QA/QC perspective without knowing the degree of assurance required. This raises certain key questions:

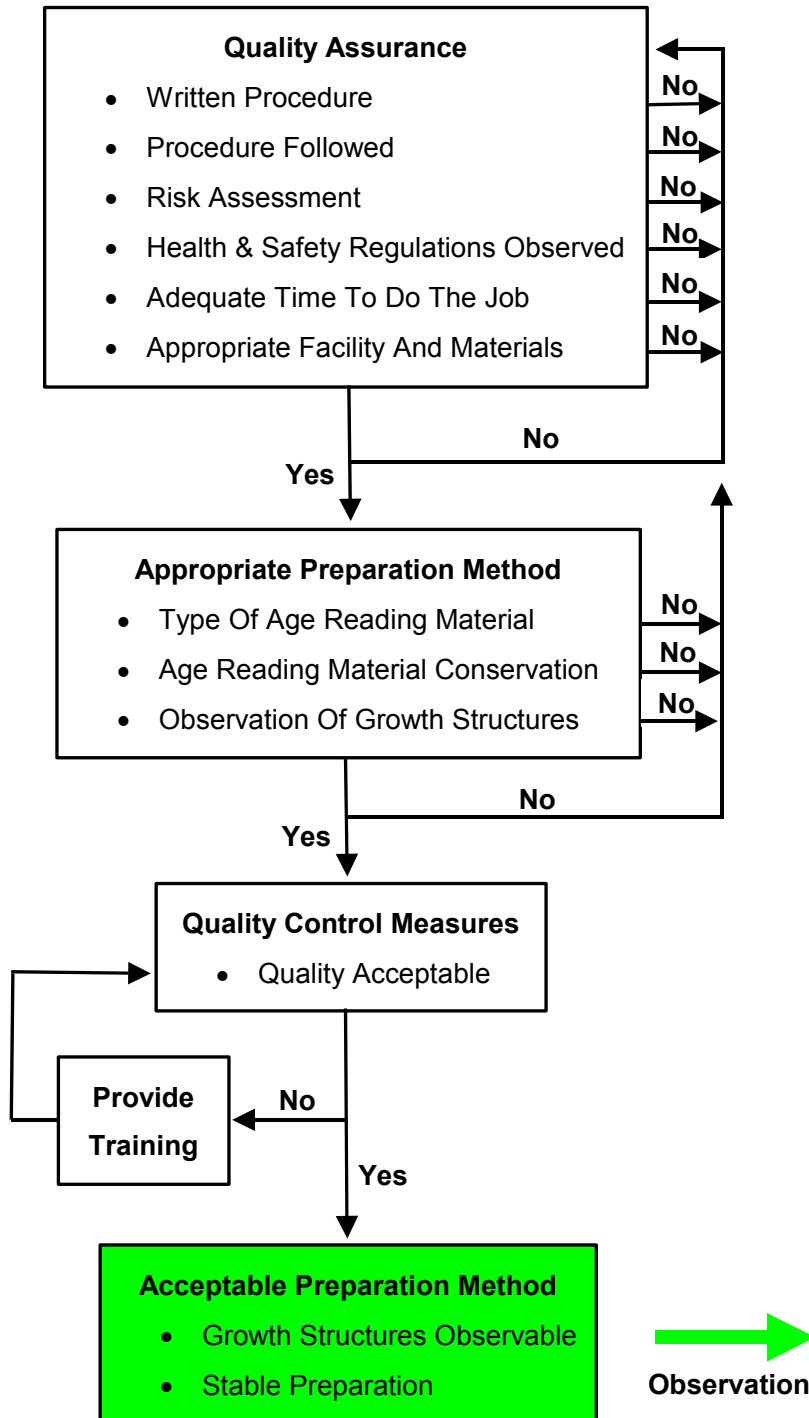
- What precisely does the customer want?
- How much will the customer pay for this service?
- Who should carry out the evaluations?

There are advantages in conserving images of the otoliths or scales etc., in addition to the actual age reading material itself for future precision checks (Fablet, R. TACADAR Ancona Meeting Presentation 2004) and this must also be considered when choosing a particular method of age determination. A training programme for the age readers must support each age determination method and providing evidence of this training should be a part of the QC process for the method. The experience of the age readers must also be taken into account.

Some age determination methods require complex preparation of the age reading material, but given appropriate QC measures and effective training, tried and tested simple preparation methods can also consistently produce equally precise results. Each preparation method has advantages, disadvantages and constraints, and these must all be considered when choosing a particular preparation method. There are subtle variations in the methods of viewing or observing age reading material for most methods of age determination, but each observation process must be appropriate for the intended output. The chosen method of observation must produce an image of good quality and there must be evidence that a written procedure is followed correctly.

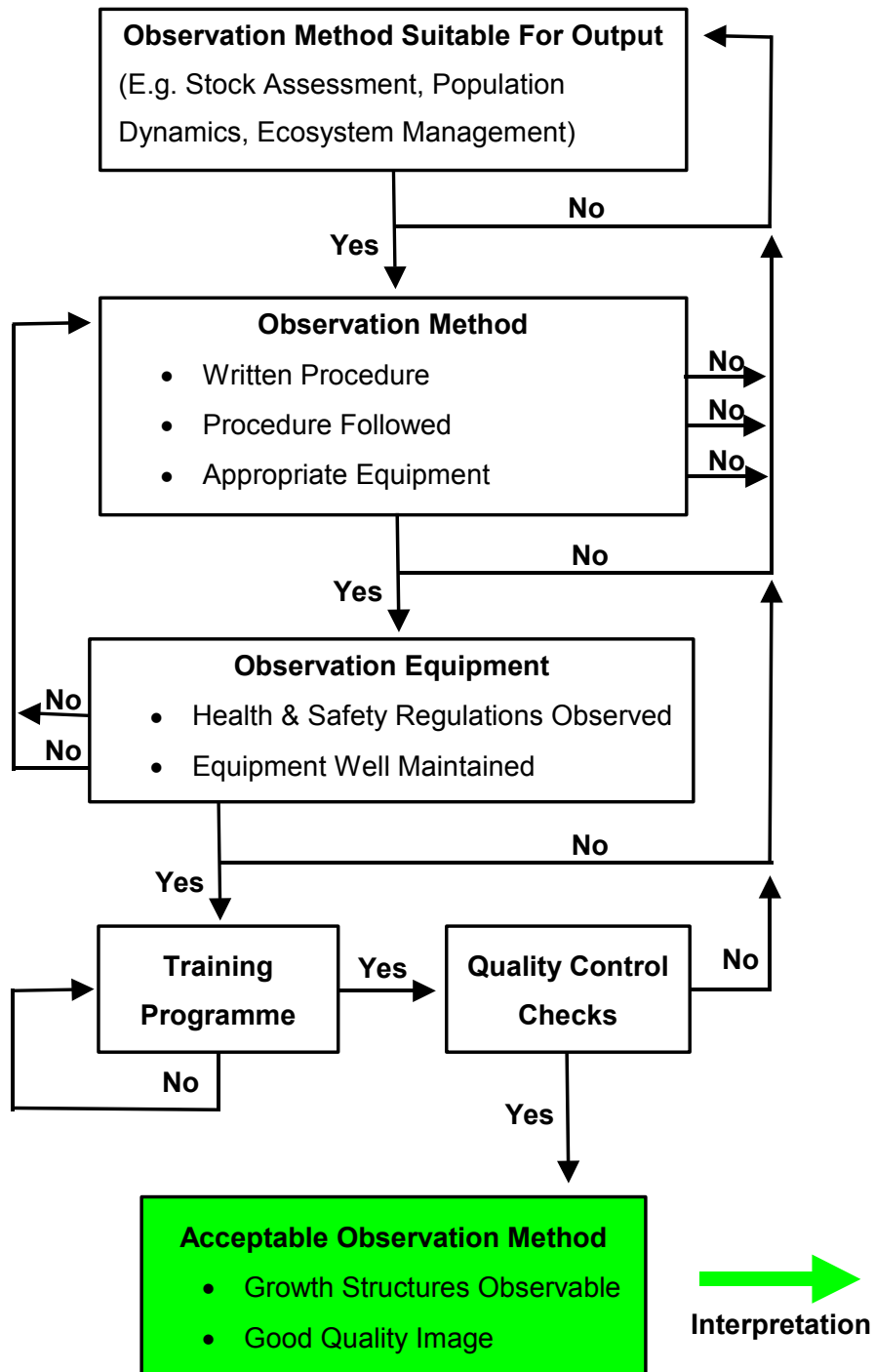
Evaluation Of Age Determination Methods

1. Preparation of Age Reading Material



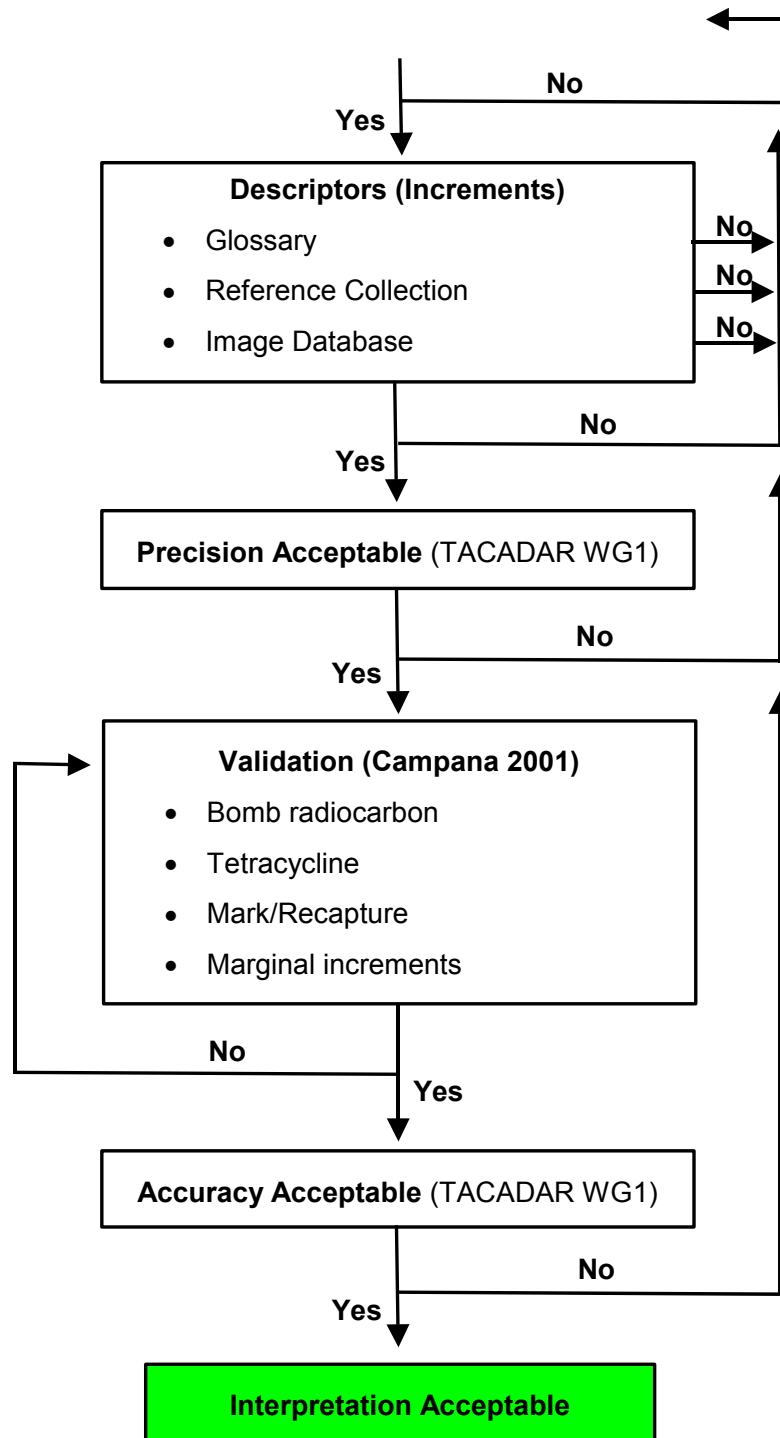
Evaluation Of Age Determination Methods

2. Observation of Age Reading Material



Evaluation Of Age Determination Methods

3. Interpretation of Age Reading Material



1.3. Report from WG 3

WG 3 aim:

Develop guidelines for the creation and application of quality assurance and quality control mechanisms to protocols for the determination of the ages of fish from hard tissues

WG 3 Chairman: Beatriz Morales-Nin, Spain

The working group met at Ancona the 10 and 11 September 2004. The participants were: Beatriz Morales-Nin (coordinator), Ana Moreno, Paulino Lucio, Birgitta Krischansson, Yvonne Walters, Ronan Fablet, Lotte Worsoe Clausen, Carmen Pinero, Groa Peturdottir, Helen McCormick, Eva Bergstrand, Maja Reizenstein, Javier Tomás.

The work was scheduled following the terms of reference (TOR) of the working group and based on the previous year recommendations and tasks carried out in the inter-meeting period.

TOR 1 Define the Species

From a list of species that were selected by the available information on age and growth, cod, sardine and perch (operculum and otolith) were selected to be used as examples. These were selected on the basis of their Geographical variety, i.e. a freshwater species, a Mediterranean species and an Atlantic species, as well as for their relevance and because of the availability of reading control protocols for those species.

Future development: Carmen Piñeiro is to contact the people involved to get technical documents associated with the processing and ageing of these species. These documents will be circulated and used as examples.

TOR 2 Produce an Index

An index based on the guidelines of other quality manuals was produced and distributed before the meeting. This index was discussed and some modifications were made, these were amended on the day and the revised version is included in Annex 1. It is important to notice that we only included in the index management and quality control processes, because the technical processes should be in an appendix, as was suggested in the meeting. An example of a possible index to be discussed by all TACADAR members was produced (Annex 2).

The group discussed the problem that some labs may not want to make the quality control compulsory, because it requires more personnel and funds that might not be provided.

Future development: The group considered that we have finished this TOR and that the draft Index should be discussed in the TACADAR plenary group in order to have a final version of the Index.

TOR 3 List of flow charts outlining procedures

DIFRES flowcharts were used as an example of future developments.

Future development: A list of the technical flowcharts will be compiled and submit at next meeting.

TOR4 Excel Spreadsheets for levels of data collection and TOR 5 Basic Spread sheet for Statistical Analysis

Nothing was presented, however further discussions suggested the level of data required. The spreadsheet designed by Guus Elting will be used. This can be down loaded from www.efan.no. It was also considered that TOR4 and 5 can be merged and elaborated together.

Future development: Paulino Lucio will lead the collection of available spreadsheets with the help of the other group members and will present them at next meeting.

TOR 6 Guidelines for Image acquisition and annotation and TOR 7 Guidelines on minimum hardware requirements for image requisition

The group felt that TOR 6 and 7 should be merged. The guidelines were presented and discussed. This TOR is finished and the results are included in Annex 3 to be discussed in the TACADAR community.

Final remarks

The group has finished TOR 6 and 7 and almost has finished TOR 2, needing the input of the TACADAR group to review and finish these contributions. The flowchart of the index will be produced once the index has been revised and approved by the extended group.

We request that the TACADAR Community review the Annexes and before the next meeting send to the coordinator (beatriz.morales@uib.es) their improvements in order to have time to amend the document and discuss them at the plenary meeting. The group also recommend to meet for a half day next TACADAR meeting.

Annex 1.

Proposed index for the Elaboration of the Otolith age determination Quality Manual (QM)

WG3-TACADAR

Index

Introduction

1. Field of application (kind of laboratories who should follow this guide and possible clients)
2. Quality objectives
3. Quality policy and references

Chapter 1 – Structure and management of the QM

- 1.1. Aims (of the QM)
- 1.2. Structure (description of the general structure of the QM and related documents/manuals)
- 1.3. Owners and Distribution (n° copies of the QM)
- 1.4. Revisions and Updates (who, periodicity, how, etc.)
- 1.5. Authorised signatures
- 1.6. References
- 1.7. Glossary of quality terms
- 1.8. Acronyms and Abbreviations
- 1.9. QM promulgation (declaration by the administration on the approval of the QM and applicability commitment)

Chapter 2 - Requirements of the quality management system

- 2.1. Quality management system
 - 2.1.1. Laboratory activity field (include procedures list)
 - 2.1.2. Quality policy
- 2.2. Organization and Management
 - 2.2.1. Legal identification and Laboratory address
 - 2.2.2. Property rights and confidential information
 - 2.2.3. Organization (including a flowchart)
 - 2.2.4. Delegation of Authority
- 2.3. Document and Information control
 - 2.3.1. Description, update and document control (eg. QM, procedures M, reports, data records, personnel files, etc.)
 - 2.3.2. Localization of the documents (archiving type, location, safety conditions and confidentiality)
- 2.4. Analysis of the Order, Proposal or Contract (rules for work requests)
- 2.5. Procedure sub-contracts
 - 2.5.1. Sub-contracted tests (list of procedures that require sub-contract)
 - 2.5.2. External equipment (list, requirements and conditions)
 - 2.5.3. Utilization of external facilities (why, criteria to follow and technical requirements)
- 2.6. Rendering of services to the customer
 - 2.6.1. Client co-operation
 - 2.6.2. Reclaims
 - 2.6.3. Client satisfaction assessment
- 2.7. Procedure non-conformity control (way to non-conformity report)
- 2.8. Corrective actions

- 2.8.1. Analyse of non-conformity reasons
- 2.8.2. Implementation and control of corrective actions
- 2.8.3. Special audits (in result of reclaims or non-conformity reports)
- 2.9. Preventive actions (eg. Audits, non-conformity observations, etc.)
- 2.10. Records (define which actions need to have a record, e.g. data and test results, meetings, training actions, etc.)
- 2.11. Internal Audits
 - 2.11.1. Internal audits plan
 - 2.11.2. Qualification of the internal auditors
 - 2.11.3. Audit preparation
 - 2.11.4. Responsibilities and execution
 - 2.11.5. Audit reports
 - 2.11.6. Audit frequency
 - 2.11.7. Following audit (to verify implementation of actions stated in the internal audit report)
- 2.12. Co-ordinator Review
- 2.13. Quality system improvement
 - 2.13.1. Development and review of procedures
 - 2.13.2. Identification and application of new technologies and approaches
 - 2.13.3. Communication between laboratories

Chapter 3 – Technical requirements of the laboratory

- 3.1. General issues
- 3.2. Personnel
 - 3.2.1. Responsibilities attribution and description
 - 3.2.2. Personal file
 - 3.2.3. Training
 - 3.2.4. Contracts
- 3.3. Facilities and physical environment
 - 3.3.1. Facilities admission
 - 3.3.2. Hygiene and safety
 - 3.3.3. Physical environment
 - 3.3.4. Archives preserving
- 3.4. Laboratory reagents, equipment and instrumentation
 - 3.4.1. Reagents list
 - 3.4.2. Equipment list and maintenance
 - 3.4.3. Equipment instructions and calibration
 - 3.4.4. Instrumentation list and maintenance
- 3.5. Ageing structures reference collections
 - 3.5.1. List and description
 - 3.5.2. Maintenance and improvement

Chapter 4 – Quality Control and Quality Assurance

- 4.1. Quality control of readings or precision (eg. Repeated readings)
 - 4.1.1. Analytical methodology
 - 4.1.2. Standartization
 - 4.1.3. Post-reading analysis
 - 4.1.4. Applicability
- 4.2. Quality Assurance of Results or accuracy
 - 4.2.2. Reader performance assessment
 - 4.2.3. Validation of methods

- 4.2.4. Validation and verification of ageing
- 4.2.5. Validation of results (eg. Correlation analysis, data review by statistical sampling, etc.)
- 4.2.6. Validation plan
- 4.3. Internal verification and the use of standard protocols
 - 4.3.1. Electronic data logging (rules to be sure that data are safe and protected)
 - 4.3.2. Traceability of data
 - 4.3.3. General issues
 - 4.3.4. Specific requirements
 - 4.3.5. Reference collections
- 4.4. Reports
 - 4.4.1. General
 - 4.4.2. Technical reports
 - 4.4.3. Results of validation/tests done by external experts (exchange programs)
 - 4.4.4. Electronic transmission of results
 - 4.4.5. Model for Certificates and Reports
 - 4.4.6. Corrections to Certificates and Reports
- 4.5. Logs (define which records have to be kept and how)
- 4.6. Relations with the accreditation bodies

Annexes (documents too big to incorporate in the manual, docs that need frequent change, technical aspects)

- 1-Procedures flowcharts
- 2-Procedures list
- 3-Examples on:
 - Basic excel spreadsheets for levels of data collection
 - Basic excel spreadsheets for statistical analysis
- 4-Guidelines on minimum hardware requirements for image acquisition and processing
- 5-Index of a technical annex on procedures
- 6-Examples of available information (sardine, cod, perch)

Annex 2

Index of a technical annex on procedures

1. Ageing structure extraction and analysis
 - 1.1. Time planning
 - 1.2. Sampling methods
 - 1.2.1. Biological sampling and measurements
 - 1.2.2. Ageing structure selection and extraction
 - 1.2.3. Ageing structure preservation and traceability
 - 1.3. Methods of ageing structure preparation
 - 1.3.1. Method selection and description
 - 1.3.2. Criteria for acceptance/rejection of ageing structure
 - 1.3.3. Estimation of uncertainty in ageing structure preparation (degrees of error at preparing the structure)
 - 1.3.4. Preparation preservation and traceability
 - 1.4. Ageing structure observation
 - 1.4.1. Equipment, image acquisition and storage
 - 1.4.2. Reading equipment set up (magnification, light intensity, etc)
 - 1.4.3. Image quality requirements
 - 1.4.4. Image analysis and interpretation
 - 1.4.5. Interpretation criteria
 - 1.4.6. Age attribution

Annex 3

TOR 6 Guidelines for Image acquisition and annotation and TOR 7 Guidelines on minimum hardware requirements for image requisition

Guidelines for image acquisition and annotation

1. Acquisition of CS images
 - High resolution image of the whole otolith (at least the reading zone) (≥ 1 Mpixels)
 - Preferably non-compressed format (avoid jpg format)
 - Limited noise level (balance between exposure time and gain)
2. Acquisition of CS interpretation
 - Set markers in the image for the position of the interpreted growth rings and possible false rings or checks
 - Display the interpretation as a graphic overlay
 - Store the interpretation (file containing the graphic overlay and the ring positions)
3. Storage and management of database of interpreted CS images
 - Store the images with associated data (species, catch date, CS type,...)
 - Attach the interpretation (reader, estimated age, interpretation (ring positions))

Guidelines on hardware requirements for image acquisition and processing

1. Workstation for image analysis (recommended configuration)
 - PC 2GHz, 1Go RAM
 - Equipped with a software for computer-assisted acquisition and interpretation of CS images
2. Acquisition hardware
 - Preferably a digital camera
 - Digital camera (1Mo pixel, squared pixels, exposure time up to 1s)
 - IEEE 1394 connection
 - Controlled stage (recommended for routine ageing, work with microstructures)

1.4 Report from WG 4

WG 4 aim:

Define the framework for the application of quality assurance and quality control mechanisms, to protocols for the determination of fish ages from hard tissues

WG 3 Chairman: Audrey Geffen, Norway

Jari Raitaniemi (rapporteur)

During the 2003 meeting, this working group took on the role and responsibility: **”To define the process of applying quality assurance and quality control in age determination”**. We used this role to determine that our focus would be on process and consequences, rather than on what the form of quality standards would be. Our aim is to ensure that the application of QA and QC retains the ability to evolve, incorporating technical improvements and conceptual changes brought about by future research. We reviewed the terms of reference, and our progress during the past year:

1. **To gather information about the process of QA and QC,**
2. **To gather information about expectations both within and about the project.**
3. **To promote TACADAR and the importance of quality data widely**
4. **To help define the content of the TACADAR deliverable**

We suggested that translators for national protocols could be identified by members, at that members should also set the access levels for all their documents, including protocols. This was accomplished for a number of protocols during the past 12 months.

Despite our best efforts to contact experts in the field of QA, it was not possible to bring outside speakers to present information during the plenary sessions of the 2nd TACADAR meeting in 2004. Invitations were made to various contacts at different organisations, both those involved in determining QA policy and those with the responsibility of implementing the policy. The general impression from these contacts was that the experience of implementing QA in one discipline was not relevant to those in a different discipline. We did not agree with this opinion, and would still like to hear the experiences of other laboratories.

During our discussions at the Ancona meeting our main goals were reviewed and discussed.

These discussions considered:

1. The TACADAR deliverable

- This may be accompanied by an action plan to the commission on what should be done, depending on the final form of the TACADAR manual or a guide

- The project should include good examples of what ageing protocols could be, for guidance to those who need to develop theirs from the beginning
- How would such guidelines be promoted, accepted by the community and then implemented? It is important to have a recommendation on paper by an international organisation, at a level of international significance, both for protocols for individual species or stocks and for the importance of QA for obtaining quality data.
- How will we get the scientific world to accept the specific QA protocol? Many researchers will have their own QA procedures, and may not be able to follow the same system recommended for routine age estimation laboratories. The scientific grounds for the QA need to be presented, and that will be possible with modelling of ageing errors.

2. The achievability and desirability of accreditation

- Theoretically it is possible to accredit ageing laboratories, and one example is seen in Sweden, where benthic labs are accredited in order to bid for contract work.
- Information on the implication of accreditation and certification costs will be asked in Norway (EM), Sweden (MA) and Finland (JR & KN) and some other countries
 - + lower levels of accreditation
 - o what would they be?
 - o Extra costs?
 - o What would an accredited control system cost?
- The experiences in Sweden and in Finland showed that each step of the QA process can achieve desired results in terms of improvements in the age data.
- Accreditation implies the reliability of the results, but despite accreditation and certification things can go wrong. Regular checks and evaluation of competence are needed in any case, and the benefits and disadvantages of accreditation costs must be considered.
- It is easier to agree to the purpose of achieving quality assurance and quality control. Accreditation and certification are possibilities, but there are other good methods. These can form the Quality Management System (QMS), and this term may be more applicable to the situation of age estimation laboratories.

4. Specific needs in age estimation work

- a way to handle improvements in techniques is important
- a way to establish procedures for species in which the correct or valid way is not known
- Intercalibration internally and between laboratories, especially those working on the same stocks. In the majority of cases, training or intercalibration is against validated material.
- Training is important, and it is vital to have a system that will identify a problem and propose a solution
- Exchange visits should be recommended for students, researchers and technicians between the different laboratories and countries.

5. Identification of customers, who are they?

WFD

National science foundations

Those who pay for the advice

Governmental, regional level managers

HELCOM, governments, etc., ‘recipients of scientific advice’

Policy makers

Managers

A scientist reading a scientific paper or scientific community

We should revisit the issue of customers in open discussion at the final project meeting

6. Review of the significance of accurate ageing data:

- Ageing is one of the basics for mathematics in assessment
- as one of the possible causes of errors, it has to be dealt with, something has to be done
- we deal only with ageing errors, not other reasons for assessment errors
- the customer will determine the level of accuracy that is needed

2.5. References

EFAN Report 5-2000: Guidelines for the Quality Assurance of Fish Age Determination

Panfili, J, H. de Pontual, H. Troadec and P.J. Wright (Eds.) (2002) Manual of fish sclerochronology. Brest, France: Ifremer-IRD coedition, 464p.

Previous EFAN reports on Image Acquisition

3. Overview of procedures

Technical Protocols:

Title	Responsible	Institute/Country	Version	Last updated
Sectioning otoliths using the accutom 5 cutting machine	M W Easey	CEFAS, UK	1.1	16.11.2001
Sectioning otoliths using the “V4” superior cutting machine	M W Easey	CEFAS, UK	1.1	19.12.2001
Mounting cut sections of otoliths onto glass slides	M W Easey	CEFAS, UK	1.1	19.12.2001
Mounting otoliths in black polyester resin for sectioning	M W Easey	CEFAS, UK	1.1	15.11.2001
Mounting pelagic otoliths in resin for age determination	M W Easey	CEFAS, UK	1.1	19.12.2001
Staining cut sections of otoliths	M W Easey	CEFAS, UK	1.1	19.12.2001
The otolin system of preparing	W.Mc. Curdy	DARD, UK		

demersal otolith sections				
Larval otolith microstructure	P. Re	Guia Mar. Lab., Portugal		Web-based http://astrosurf.com/re/otolith1_bio.html
Otolith preparation: <i>Coryphaena hippurus</i>	J. Moanta & B. Morales-Nin	IMEDEA, Spain		
Age determination: Standard methodologies	P. Belcari, A. Ligas & C. Viva	Univ. of Pisa, Italy		
Larval otolith microstructure	J. Panfili	IFREMER, France		
Age determination methods for juvenile plaice <i>Pleuronectes platessa</i>	A.J. Geffen	Univ. Of Liverpool, UK		
Procedures for age determination of anchovy and sardine through the reading of the annual rings at ISMAR	G. Giannetti, F. Donato & E. Ameri	ISMAR, Italy		
Anglerfish ageing guide	Duearte et. al.	Spain, France, Portugal, Ireland		
Procedure for dissecting and preparing of age material on pelagic fish	H. Gjøsæter	IMR, Norway	1.0	Sep. 1999
Manual of analysis at the fishery resources laboratory; Preparation and reading of fish otoliths		AZTI, Spain	2	Jan 2003 Translated
Otolith age estimation of European hake from Iberian Atlantic waters in IEO (ICES Divisions VIIIc and IXa)	C. Piñeiro	Instituto Español de Oceanografía, Spain		Sep. 2003 Translated
Determination of age on the basis of otoliths at the Institut für Seefischerei	G. Gentschow, F. Beußel, S. Cumberow, C. Zimmermann	Germany		Translated
MANUAL FOR THE PREPARATION AND READING OF EUROPEAN HAKE (<i>MERLUCCIVUS MERLUCCIVUS</i>) OTOLITHS	C. Morgado, A. Marçal, M. J. Ferreira, M. de Lourdes Godinho and M. Hortense Afonso	Portugal		Translated
AGEING PROCEDURES		Finland		Translated

Ageing Procedures

Title	Responsible	Institute/Country	Version	Last updated
Procedure for ages estimation of herring (<i>Clupea harengus</i> L.)	H. Gjøsæter	IMR, Norway	1.0	Des. 1999
Procedure for ages estimation of polar cod (<i>Boreogadus saida</i> Lepechin.)	H. Gjøsæter	IMR, Norway	1.0	Des. 1999
Procedure for ages estimation of capelin (<i>Mallotus villosus</i> Muller.)	H. Gjøsæter	IMR, Norway	1.0	Sep. 1999

Quality Control Procedures

Title	Responsible	Institute/Country	Version	Last updated
Quality control of age determination	M W Easey	CEFAS, UK	1.1	01.04.2003
Procedure for quality assurance of age determination of fish	H. Gjøsæter & K. Nedreaas	IMR, Norway	1.0	June 1999

Training Procedures

Title	Responsible	Institute/Country	Version	Last updated
Training in age determination	M W Easey	CEFAS, UK	1.1	01.05.2003

Guidelines

Title	Code	Institute/Country	Version	Last updated
Quality management systems Fundamentals and vocabulary Laboratory Quality Manual	ISO 9000/2000			
Guidelines for QC in the Analytic Laboratory	NATA	Australia		Oct. 1995

Manuscripts

Title	Responsible	Institute/Country	Version	Last updated
Quality issues in the use of otoliths for fish age estimation	A. K. Morison, J. Burnett, W. J. McCurdy, and E. Moksness			July 2004

4. Future meetings

3rd TACADAR Meeting

19 – 25 July 2005

Enniskillen Agriculture College

County Fermanagh

Northern Ireland