**Presentation afternoon 31/01: Sclerochronology Laboratory – Stephen W.**

**Pattern recognition**

Count the number of rings? Not so simple.

Example from the Sablefish, Rhougheye rockfish, and Pacific Hake, which are complicated to age due to the presence of lots of microstructure.

Presentation of the maximum age of the most commonly aged non-research species.

Presentation of the different species aged by the laboratory (70% of the ageing work is done on Atlantic Salmon).

**Bias in fish age estimation**

15% of otoliths are re-aged, because the presence of ager bias.

2 aspects of ageing error: precision and accuracy

Precision is inherent to the nature of the structure, the protocols used, etc.

Accuracy: relationship between the postulated age and the true age of the fish. True age is determined via age-validation studies (costly). Unfortunately not all species can be validated

**How do we know we aged them correctly?**

Secondary Ion Mass Spectroscopy (SIMS) – using a mass spectrometer to determine the isotopic composition.

Example of usage of SIMS to validate the age of Rocky Mountain Ridged Mussel (*Gonidea angulata*).

Bomb Radiocarbon Validation (14C) – based on the temporal signal in increase of ocenanic radiocarbon due to testing of atomic weapons in the 1950s-1960s

Climate change, the effects on ageing fish

Climate change will cause variations in growth patterns and metabolic condition.

Example on Salmon (Chinook, Coho, Sockeye): increasing difficulty in estimating the number of freshwater winter events, and thus the absolute age.

Warmer temperatures = faster growth but smaller adult size

Fish are driven towards the poles, thus new species will enter our waters.

**The SCL meeting the challenge of Climate Change**

SCL provides more access to new calibration technologies, support for validation studies

(1) Direct Data Entry (DDE) (i.e. computerized workstations) has many goals:

-Increase work throughout

- Eliminate paper usage / transcription errors

- Add real-time age determination statistical analyses

- Eliminate client key punching.

(2) Otolith weights are studied at the SCL (since the otoliths continue to growth throughout the whole life of the individuals).

(3) Otolith images are also analyzed at SCL: Otolith Shape Analysis (OSA) can help distinguish different species (for instance some within the Redfish complex).

(4) Fournier Transfer-Near Infrared (FT-NIR): Recent development to automatize fish ageing. This approach has been used successfully with Bering Sea Walleye Pollock. This is a secondary method of age estimation, a primary calibration is required by traditional methods. However, there are several benefits to this methods including the reduction in time, costs and subjectivity associated with age estimation.

**Questions**:

Aaron A.: Asking how broadly the FT-NIR can be used for different species. Answer: FT-NIR is very specific, for instance if you don’t have an expert reader you will have errors input into the model. So samples would have to be collected in the same area, you would have to break it up between regions, to make sure a good quality of the data coming in. It is possible to use it for different species but it needs to be properly conducted by an expert reader as it is sensitive to small geographic or biological variations.

Allan Debertin: Could we use FT-NIR on otoliths conserved in glycerin? Answer: Tests are currently being conducted to determine whether different storage methods have a significant impact on age estimation using this technique. One of the problem is that glycerin is not standardized.

Daniel Ricard: Do we know the molecular process by which glycerin enhances the annuli? Answer: Glycerin interacts with the sugar molecules in the otolith. Special care should be given to the proper mixing of glycerin.

Daniel Ricard: How will climate change modify our approach in age estimation? Answer: No definite answer, but we are definitely seeing more noise (ex. In Pacific Hake) with climate change so this should be taken into consideration.

Julie OD: Comment on the effect of edge type, shape and weight on age estimation.

Aaron A: When using length and weight to calibrate the ages, should we always use the same length-weight curves or these should be updated? Answer: No definite answer.

Daniel R and Stephen W: Discussions on the best way to annotate the otoliths, via Smartdots, Photoshop, etc.

Tania D.: Does the FT-NIR would be as efficient on longer-lived species? Answer: No data on that point at the moment, more data needed.

**Daniel Ricard: Age validation, ager calibration presentation**

Introducing the Standard Operating Procedures document

Age validation: The paper from Campana (2001) is a must-read.

Example of age validation for American Plaice in 4T.

Otolith reference collection: Series of otoliths of known ages to determine whether an ager provides accurate and unbiased ages. The reference collection recently went from a physical to a digital collection. Acts as a safety net.

Ager calibration: Shown using examples from White Hake and American Plaice. Outputs a RMarkdown document showing different plots that portray the accuracy of the measurements of a sampler when measuring the otoliths from the reference collection. Fixed threshold that determine whether an ager’s measurements are accurate or not. The RMarkdown also identifies the outliers that were not included in the 95% confidence interval. It is also possible to exchange otoliths with other regions (and countries) to verify our measurement with external partners.

ICES data quality insurance repository: link to ICES website.

Questions:

Stephen W.: Just because we have a validation, we still have to match the microstructure with that age.

Aaron A.: Comment on the conservation of otoliths in resin.

Daniel R and others.: Comments on the importance to renew the reference collection once in a while and discussions on the maximum age of a reference collection. The danger is if the growth patterns change over time, and the collection has not been renewed.

Allan D.: Comment on the removal of otoliths from resin.

**Presentation: Age determination in Herring (Clupea harengus) in Quebec – Helene Dionne**

**Preparation of otoliths:**

- Extraction of sagittea

- Cleaning and drying 24h at 55C

- Bonding with resin (80% Cytoseal 60 and 20% toluene)

- Drying for 24h

**Reading otoliths**

(1) Determination of the spawning group (according to the shape of the first ring)

(2) Age determination (\* one year added for the fall spawners). The reading is done without any knowledge of the length and the weight of the fish.

(3) Validation: to validate intra-reader accuracy between years, and to validate inter-reader accuracy (20% of otoliths are read by two different readers).

**Challenges**

(1) Determining the spawning group of the juvenile herring, a lot of subjectivity.

(2) New readers need to be trained, but inter-reader accuracy is a significant challenge.

(3) The date of July (1st) is set as the separation between spring and fall spawners but it is arbitrary.

**Future projects**

(1) Otolith microstructure

(2) Shape analysis

**Conclusion**: Lots of uncertainty but measurements are reliable since we are able to follow different cohorts.

**Question:**

Kelly S and Andrew Smith.: Comment on the Bowker’s, Evans and Hoenig tests for bias. One should look at the results from all the tests as they all provide different insights.

Julie OD: Comment on the challenges associated with the ageing of herring (several sympatric stocks, more than 10 detected).

**Age determination of Atlantic Herring… - Sylvie Robichaud**

**What we have in the Gulf:**

- Collection of otoliths dates from 1965.

- Approx. 3500 otoliths per year.

- Whole otoliths embed in acrylic plates.

**Spring vs. Fall spawners**: mostly based on the first ring (very robust indicator). Other characteristics can be used but most of the time only the shape of the first year is used.

**Picture**: A picture is taken from the acrylic tray, and otolith reading is done from the picture.

**Presentation of *Herman***, a data entry system where all the biological information about the herring samples from the Gulf can be found.

**Question**:

Kari U.: Comment on the use of a “cheat sheet” (age-length data), that needs to be updated over time.

Allan D.: Comment on the type of formatting input that *Herman* could accommodate.

Jacob B.: Comment on apparent changes on size-at-age data over time. Important to take this into consideration.

Tracey: Wondering if Dmapps is a tool that could be used by several regions, how customable it is, and whether the developer would be willing to accommodate formats from different regions. Answer (Daniel R.): Yes there is some room for collaboration to share Dmapp, and enable its use for different regions. However, possible availability issues with the developper’s time.

Question: How to handle the spring and fall spawning for the ones that are spawning in July? Answer (from the Quebec region): All the ones spawning after July 1st are considered fall spawners. Allan D.: Comment on the fact that fall spawning can be as early as late June.

**Presentation: Reconciling dreams, expectations and reality in a production ageing environment- Tina Davignon-Burton**

Personal presentation of Tania DB.

**Introduction**: Why do we need so many otolith ages? Tania mentions that in her opinion, the number of fish that need to be aged are not well thought-of, without considerations of sex, location, maturity, etc.

Age estimation is not just “counting rings”, it needs a specific skill set.

Importance of “knowing yourself”, and to know whether you will be influenced or not if you learn information about a fish prior to age estimation.

**Question:**

Stephen W.: Comment on the cut of budget, lack of agers, and high expectations from stakeholders concerning the number of otoliths that should be aged.

Tracey: Comment on the importance of highlighting the outlier otoliths, to reuse them as training afterwards.

Julie OD: A lot of agers are retiring, but incorporating technological tools in the job (computer, etc.) can help to recruit new/younger employees.

Lingbo L: Comments on the existence of maturity-age patterns from otoliths.

Peter C.: Comment on the importance of “knowing when you have a bad day” as agers.

**Presentation Daniel Ricard: Stepping stones in community building**

Presentation of different community building ideas, for example:

- Community of Age Reading Experts (CARE)

- Smartdots to conduct otolith exchanges between regions

- Proceedings from this meeting

Presentation of the schedule for tomorrow.

End of the meeting – 16h40