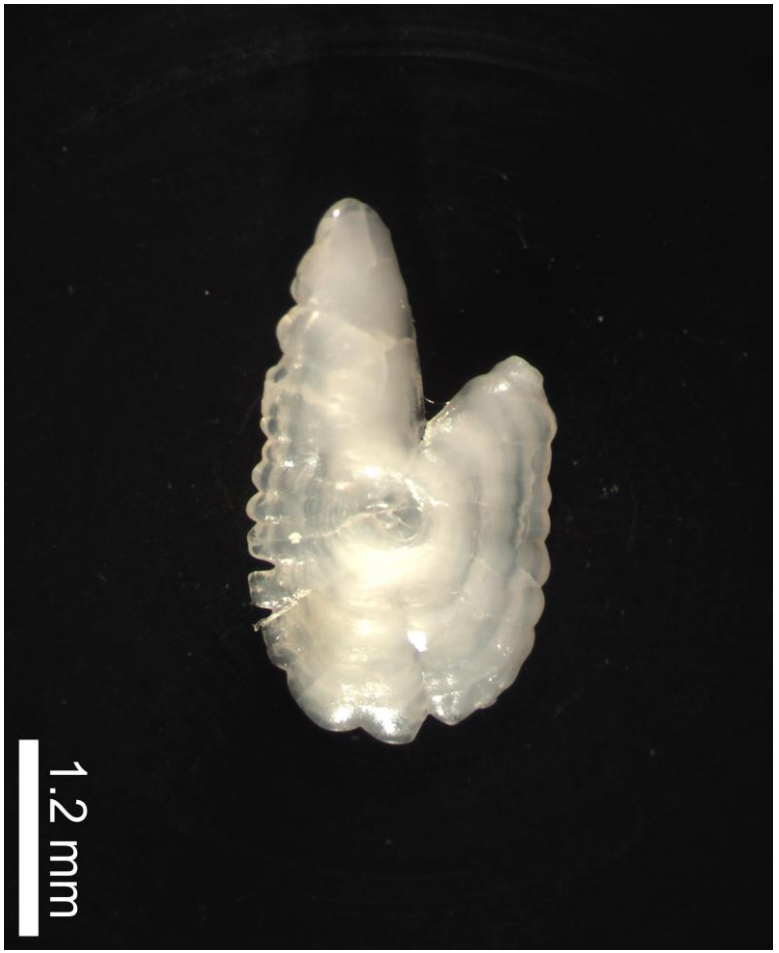
# Age determination in herring (*Clupea harengus*)

## Using otoliths in the Quebec region

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# Plan of the presentation

- Preparation of otoliths
- Reading otoliths
- Challenges
- Future projects
- Conclusion

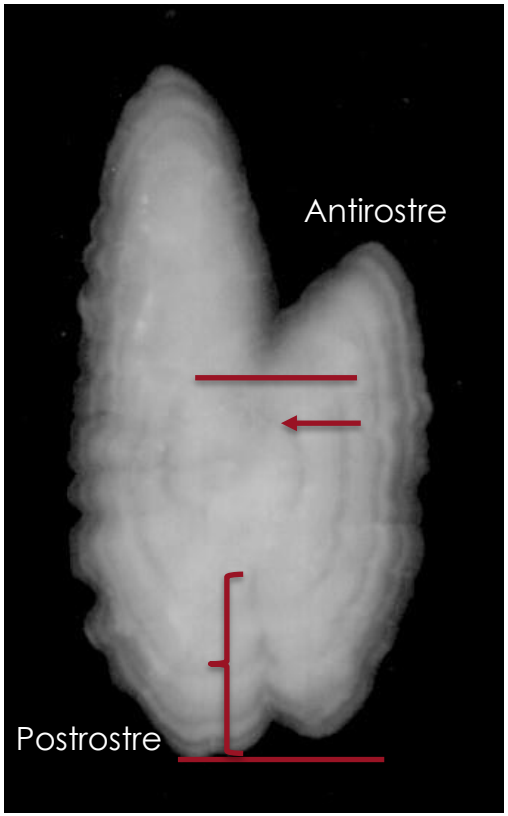
# Preparation of otoliths



- Extraction of sagittea
- Cleaning, placing on plate and drying in the oven (24hrs at 55°C)
- Bonding with resin composed of 80% Cytoseal™ 60 and 20% toluene
- Drying for 24 hours under a hood and in an oven (24 hours at 55°C) to remove fumes

# Reading of otoliths
# Determination of the spawning group

- Spring




- **According to the shape of the first ring**
- **Pararost and Postrostrum**
- **Excisure**
- **Concave or convex core**
- **General shape (narrow or wide)**
- **Serrated edge**

- Fall


Ref: Messieh, S.N. et al. 1989

# Otolith reading
# Age determination

- Herring harvested in spring (April-June)
  - Count the dark hyaline areas and add the last opaque growth area (if present)

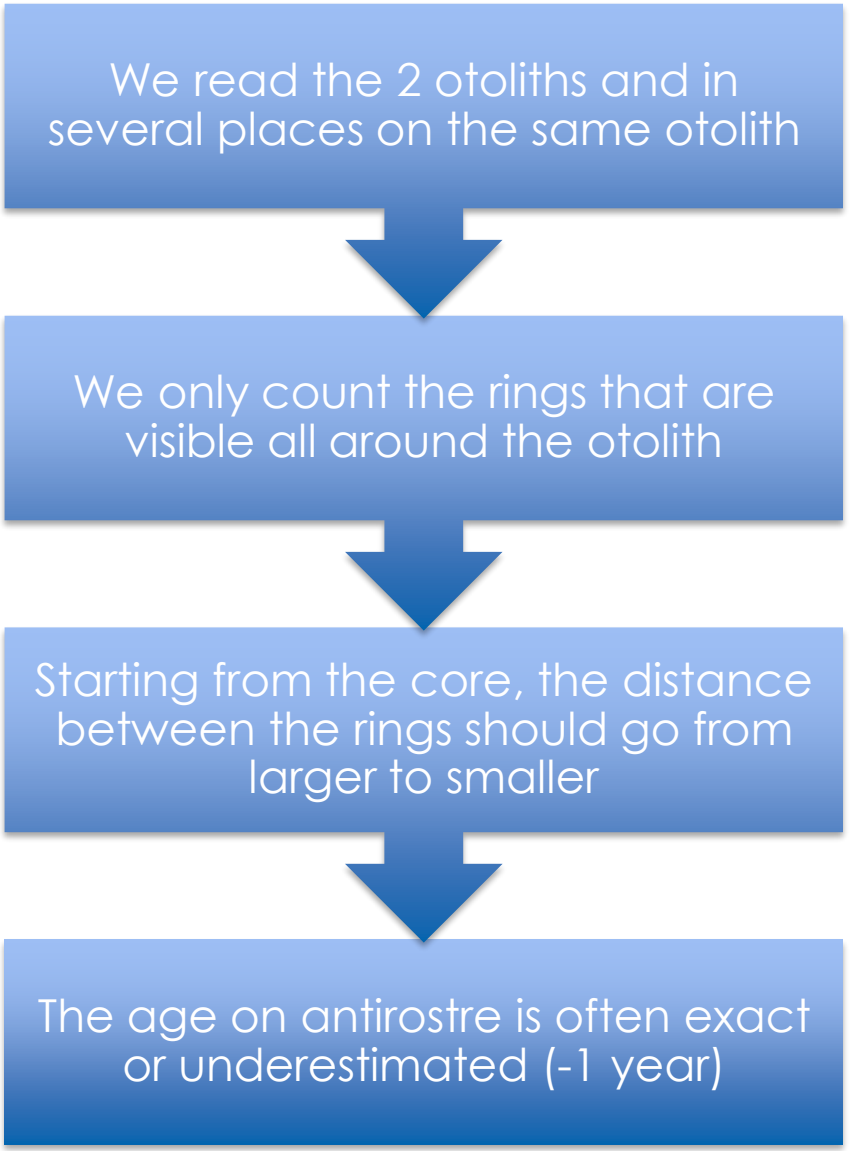
For herring harvested in July, the addition or not of the opaque growth zone is at the discretion of the reader.

- Herring harvested in the fall (August-December)
  - Count dark hyaline areas

# Otolith reading

We read the otoliths blind that is to say that we do not know the length or the stage of maturity of the fish

Ref: Penttila, J. and L.M. Dery 1988.

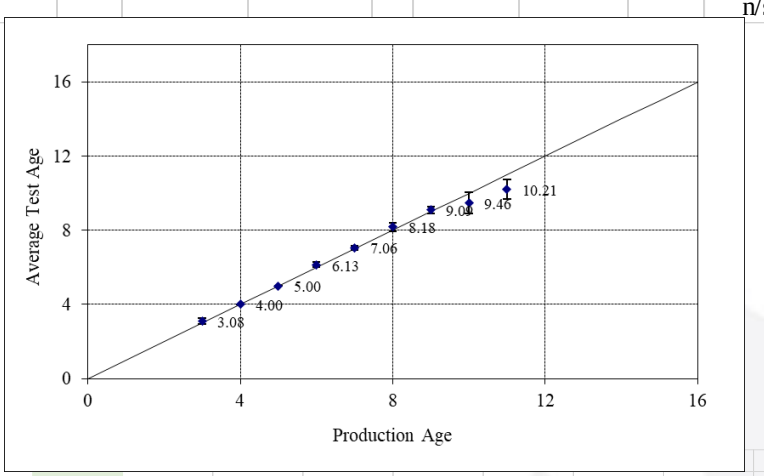


# Otolith reading Validation

Ref: Campana, S.E. et al. 1995. Appendix 3b. 1997.

- Validation of intra-reader accuracy with a sub-sample (50-100) each year
- Draw of 20% of otoliths made for validation by a second reader (inter-reader)
- Verification of agreement with CV (≤ 5%) and % agreement (≥80%)
- Discussion between readers and correction (if agreed)

| | | | | | |
|---|---|---|---|---|---|
| **Sample Type/year** | | Species | | Hareng | |
| Aged 2X by ___ | | Date | | 1-4-21 | |
| | | Age Reader | | Hélène Dionne +Geneviève Perrin | |
| | | | | Bowker's test | |
| N Aged | 120 | Total CV | 2.59% | Chi-sq | 19.00 |
| N Agreed | 101 | | | d.f. | 11 |
| Disagreed | 19 | %Agreement | 84.2% | P-value | 0.06 |
| | | | | | n/s |




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2022** | **69589** | 9 | C9 | P | 5 | P | 5 | | |
| | | 23 | D11 | A | 5 | A | 5 | | |
| | | 27 | E3 | A | 5 | A | 5 | | |
| | | 29 | E5 | P | 5 | P | 5 | | |
| | | 31 | E7 | P | 5 | P? | 5 | | |
| | | 38 | F2 | P | 5 | P | 5 | | |
| | | 42 | F6 | A | 4 | A | 4 | | |
| | | 45 | F9 | A | 5 | A? | 5 | | |
| | | 46 | F10 | P? | 5 | P | 5 | | |
| | | 47 | F11 | A | 4 | P? | 5 | A | 5 |
| | | 48 | F12 | A | 6 | A? | 5 | | 5 |
| | | 49 | G1 | P | 5 | P | 5 | | |
| | | 52 | G4 | P | 6 | P | 6 | | |
| | | 57 | G9 | P | 5 | P | 5 | | |
| | | 59 | G11 | P | 3 | P? | 4 | A | 3 |

# Challenges

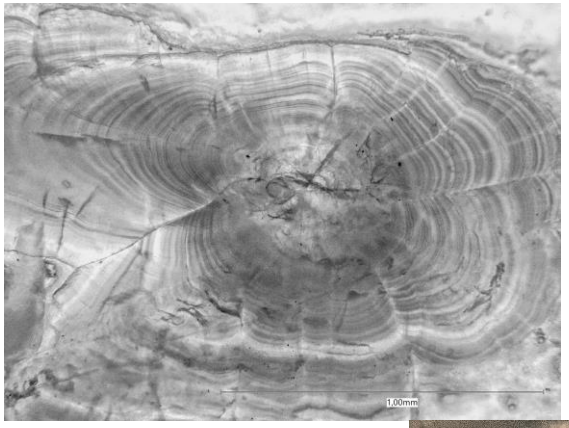
- Determining the spawning group of juvenile herring is rather difficult.
  - The characteristics of the otoliths discussed earlier are not always very obvious.
  - Sometimes the characteristics contradict each other (with angle but first ring shorter than the antirostrum, etc.)
  - There is always a certain subjectivity depending on the reader (visual acuity, contrast detection, etc.)

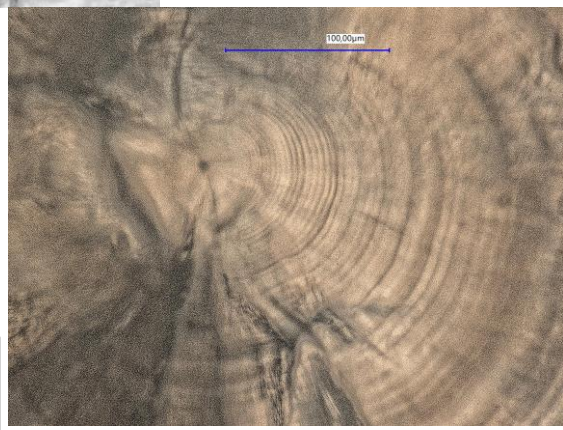
# Challenges

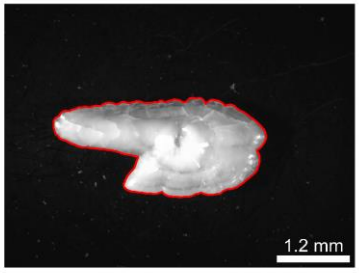
- New readers
  - Training with a reference collection
  - Intra and inter reader accuracy
- The last ring on the outer border is not present on the whole otolith. A doubt remains whether the latter should be added or not.
- The date of July 1 to separate the spawning groups

# Future projects

- Otolith microstructure
- Shape R

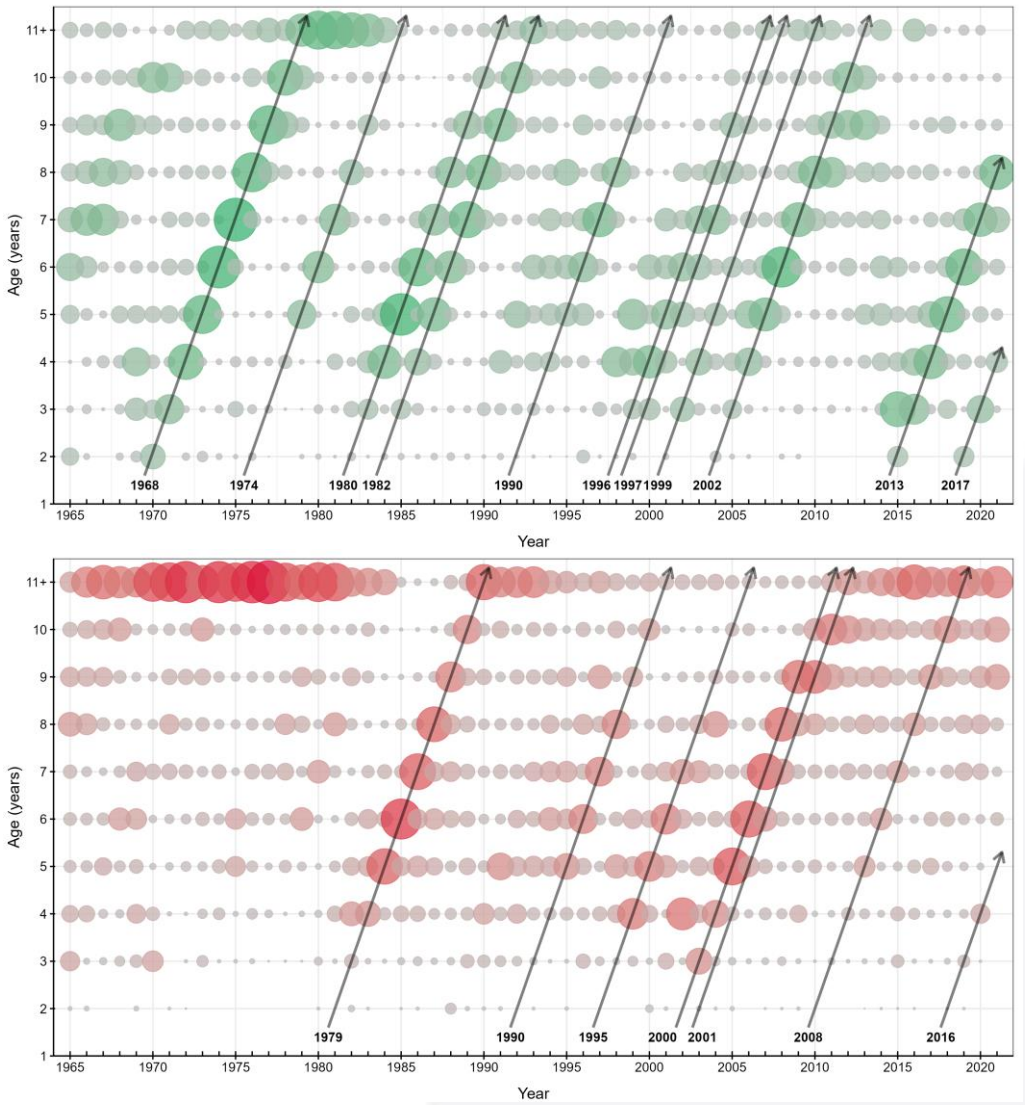







# In conclusion

- Despite the challenges encountered and discussed previously, we should not be too far from the truth because we manage to follow the cohorts!



# References

Messieh, S.N., C. MacDougal J, and R. Claytor. 1989. Separation of Atlantic herring stocks in the southern Gulf of St. Lawrence using digitized otolith morphometrics and discriminant function analysis. Can. Tech. Rep. 1647: iv + 22 p.

Penttila, J., and L. M. Dery. 1988. Age determination methods for northwest Atlantic species. NOAA Tech. Rep. NMFS-72; 135 p. [Available from: http://www.nefsc.noaa.gov/fbi/age-man.html]

Campana, S.E., M.C. Annand and J.I. McMillan. 1995. Graphical and Statistical methods for determining the consistency of age determinations. Trans. Am. Fish. Soc. 124: 131-138.

Appendix 3b. Proposed Training Outline for New Age Reader, Inter-Régional ageing workshop, June 17-18, 1997.