CHALLENGES IN THE ‘ART” OF AGEING: A BRIEF HISTORY OF 20 YEARS WORKING ON AGE ESTIMATION STUDIES, WITH A FOCUS ON THE DIFFICULTIES ENCOUNTERED IN RECENT AGEING OF BIGEYE FROM THE EPO AND WCPO USING ANNUAL INCREMENT COUNTS IN OTOLITHS

Kyne Krusic-Golub - Fish Ageing Services
Background

Started down the path of the otolith back in 1996
- fork in the road moment really
  - do a project on age and growth or landscape gardening!

In that 22 years:

>250 different species - annual ageing
>60 different species – daily ageing
well over 250,000 individual reads

Over that time I’ve made some observations:
6 main observations

1. Counting assumed annuli on sectioned otoliths have been proven and continues to be proven to be the most valuable tool for age estimation.
3 examples of structure comparison


6 main observations

1. Counting assumed annuli on sectioned otoliths have been proven and continues to be proven to be the most valuable tool for age estimation.

2. Interpretation of annuli can be difficult.

   > 80% of the species we have dealt with would be classified as medium or hard. Unfortunately there are very few really good ones.
3 examples:

- easy
- medium
- hard
6 main observations

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3. Growth can be very different between individuals of a species.
Difference in growth

Pink Snapper - *Chrysophrys auratus*

Fork Length - 124 cm
Otolith weight – 0.833 g
Zone count - 6

WCPO Bigeye Tuna

Fork Length - 124 cm
Otolith weight – 0.620 g
Zone count - 3
We also see this on a daily level

**Australian freshwater fish - Golden Perch (Macquaria ambigua)**

44 mm TL  
DOC 8/12/18  
Age – 48 days

19mm TL  
DOC 9/11/18  
Age – 35 days

Same system, different growth. Likely from different flow event.
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3. Growth can be very different between individuals of a species.

4. Tropical vs Temperate…… real observation or myth?

5. The next 6 main observations:

AGE IN YEARS FROM OTOLITHS OF ADULT TROPICAL FISH A.J. FOWLER South Australian Research and Development Institute
Latitudinal effect

• Distribution further away from the equator = easier to read/longer lived-slower growing

• Closer to the equator = difficult to read/shorter lived-faster growing

Q/ If there is a latitudinal gradient effect is there also a longitudinal effect? I know some researchers have looked at growth of the same species located in different parts of the world, but what about across the one ocean?
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5. Daily ageing is a very useful tool in the process of developing an annual ageing methodology.
Daily ageing

- The main uncertainty with the utility of microincrement counts is the question of whether the daily zones are laid down continuously throughout the year.
  
  Note: B Morales-Nin (1988).

*Acanthopagrus butcheri* - 129 assumed daily zones from hatch mark to first check, 120 days from first check to edge. 10-12 microincrement counted in first opaque check mark. Total daily zones = 261

Annual age 1.785 yrs (651 days).

Difference = 390 days
• Daily zone can still be detected on larger (presumably older) fish in some parts of the outer otolith structure
  – Yellowfin with a annual zone count of between 5-6.

  – Southern Bluefin Tuna estimated at 23 yrs showed an average of 30 clear daily like zones within the translucent zones in the outer few annuli of the otolith.
    • These zones were similar in width and structure to those in the internal part of the otolith.
For Bigeye Tuna transverse sections

Position where I see the first interruption of the classic daily pattern
6 main observations

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6. There is still so much that we don’t know about otoliths, the formation of zones, interruptions to growth, somatic vs otolith growth etc.
Bigeye Tuna Ageing

Clear example showing internal growth zones and clear outer zones. Edge type also clear (New opaque)
Challenges

– First 3 opaque and translucent zones are often lacking in definition.
Often older samples can seem to have clearer internal structure.

But when we remove the outer clear zones?
## Tag-mark and recapture

<table>
<thead>
<tr>
<th>Fish number</th>
<th>FL at tagging (cm)</th>
<th>FL at recapture (cm)</th>
<th>Time at liberty after tagging (days)</th>
<th>Number of increments after Sr mark</th>
<th>Age estimate (this study)</th>
<th>Age at tagging **</th>
<th>Age at recapture **</th>
<th>Month of recapture</th>
<th>distance from Sr mark to margin (cm)</th>
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* Estimated by counting annual increments on sectioned sagittal otoliths

** Estimated using results from a study of otolith microincrements and tagging data (Hampton et al. 1998).
Counting microincrements to verify 1\textsuperscript{st} and 2\textsuperscript{nd} annuli

Figure 8.3.9. Histograms of otolith measurements from the first inflection point to the first, second, and third opaque growth zones. All otoliths with measurements were included. Grey stripes represent the 25\textsuperscript{th}/75\textsuperscript{th} percentile of the median distance to 365\textsuperscript{th} increment (age 1; Y1) and the 730\textsuperscript{th} increment (age 2; Y2) from microincrement analysis.

Challenges

– First 3 opaque and translucent zones are often lacking in definition.
– Presence fine structure around the 2nd inflection.
  • Trying to interpret what is annual and what is not
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– Edge type can be difficult to assign in young fish
  • Alternatively, measurements of marginal increment could be as useful.
Edge type assignment

- Some examples.
- Younger can be difficult, older better.

Both EPO samples supplied by IATTC
But for EPO?

- I have aged approx. 70 samples from IATTC which ranged between a zone count of 0 to 6. All less than 149 cm – difficult size range to age.

- However the otoliths look reasonably consistent between eastern and western. Discussion point?
I have aged another 70 samples of EPO caught fish from NRIFSF

155 cm EPO – 6+  
177 cm EPO – 13+
“And see this ring right here, Jimmy? ... That's another time when the old fellow miraculously survived some big forest fire.”

• Thank you