

AGE ESTIMATION OF SARDINE (*Sardina pilchardus*) and ROUND SARDINELLA (*Sardinella aurita*) IN NORTHWEST AFRICA

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Why fish age readings?



Different types of information structured by ages are very important for many analytical stock assessment models.

Knowing the age of fishes allows us to better understand the dynamics of fish stocks and how fish populations react to exploitation and environmental stresses, and thus can be used to analyse the effect of changes in relative exploitation patterns on the stocks and enables us to provide more precise management advice to the fisheries managers.



Sardina pilchardus



Sardinella aurita

The Northwest Africa context

The FAO Working Group for the Assessment of Small Pelagic Fish off Northwest Africa (FAO, 2003) noted inconsistencies in the catch at age matrices for sardine, sardinella and horse mackerel, and it was decided that the data were too unreliable to be used in an age-structured model.

These inconsistencies may be due to problems in age determination of the fish.

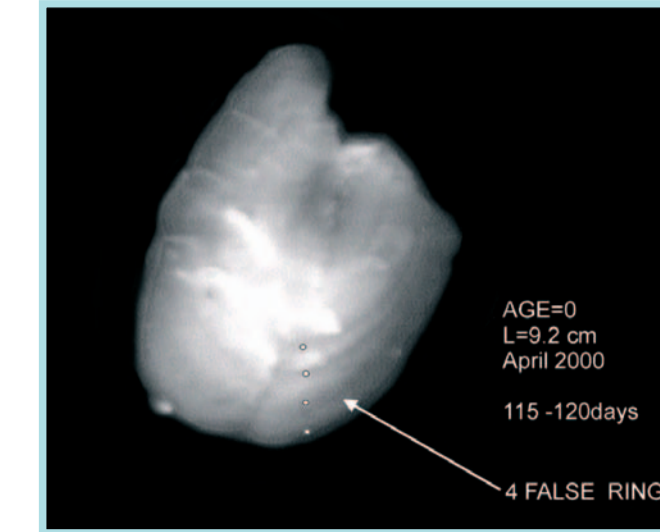
In order to increase the reliability of assessments it was recommended that emphasis should be placed on the study of age and growth of the various species in order to obtain better data for age-structured models.

The Problem

To assess the age it is necessary to analyse otoliths—calcified structures related with fish equilibrium that are present in the fish head.



Otolith of *Sardinella aurita*



Otolith of *Sardina pilchardus*



Extraction of otolith



Mounting of otoliths

The examination of otoliths shows different concentric structures, but only some are growth annual rings.

Fish ageing is exposed to subjectivity of the different readers and requires experience as well as knowledge and application of established procedures to ensure coherent results.

Errors in age determination could have an adverse effect on the quality of the stock assessment and the scientific advice based on that assessment.

Any reduction in uncertainty affecting fish-stock assessments increases the quality of scientific advice and the confidence with which policy decisions can be taken.

Guidelines

A guideline has been developed for the age estimation of sardine and sardinella to provide the readers with a common methodology.

1. Date of birth 1 January.
2. One year is equivalent to a consecutive opaque and translucent ring (= *annulus*).
3. The basic characteristic to take into account for the first annual ring is continuity around the entire otolith body.
4. Measure of first annual ring:
 - a) for *sardinella* the width of the first annual ring varies depending on the month of "birth" (date of spawning)
 - b) for *sardine* a study in Zone C showed that generally the first annual ring appears between 19 and 30 units of measurement (1 mm = 20 units at magnification 16X) depending on the month of birth.
5. Ring width decreases mainly after the first two years of life.
6. If sardine/sardinella is caught during the year with an opaque zone on the otolith edge, the age assigned is equal to the number of *annuli*.
7. If sardine/sardinella is caught in the first quarter with a translucent ring on the otolith edge, the age assigned is equal to the number of *annuli* observed.
8. If sardine/sardinella is caught in the second quarter with a translucent ring on the otolith edge two situations can occur:
 - a) big translucent increment that started settling the previous year. In this case the age assigned is equal to the number of *annuli* observed.
 - b) if translucent ring at edge is very narrow, it means that the formation of this ring started that year and should not be considered. This is best observed in the first two years.
9. If sardine/sardinella is caught in the third and fourth quarters with a translucent ring on the otolith edge, the age assigned will be equal to the number of *annuli* observed minus 1.



Reading of otoliths



Activities



Senegal, 2003



Morocco, 2006

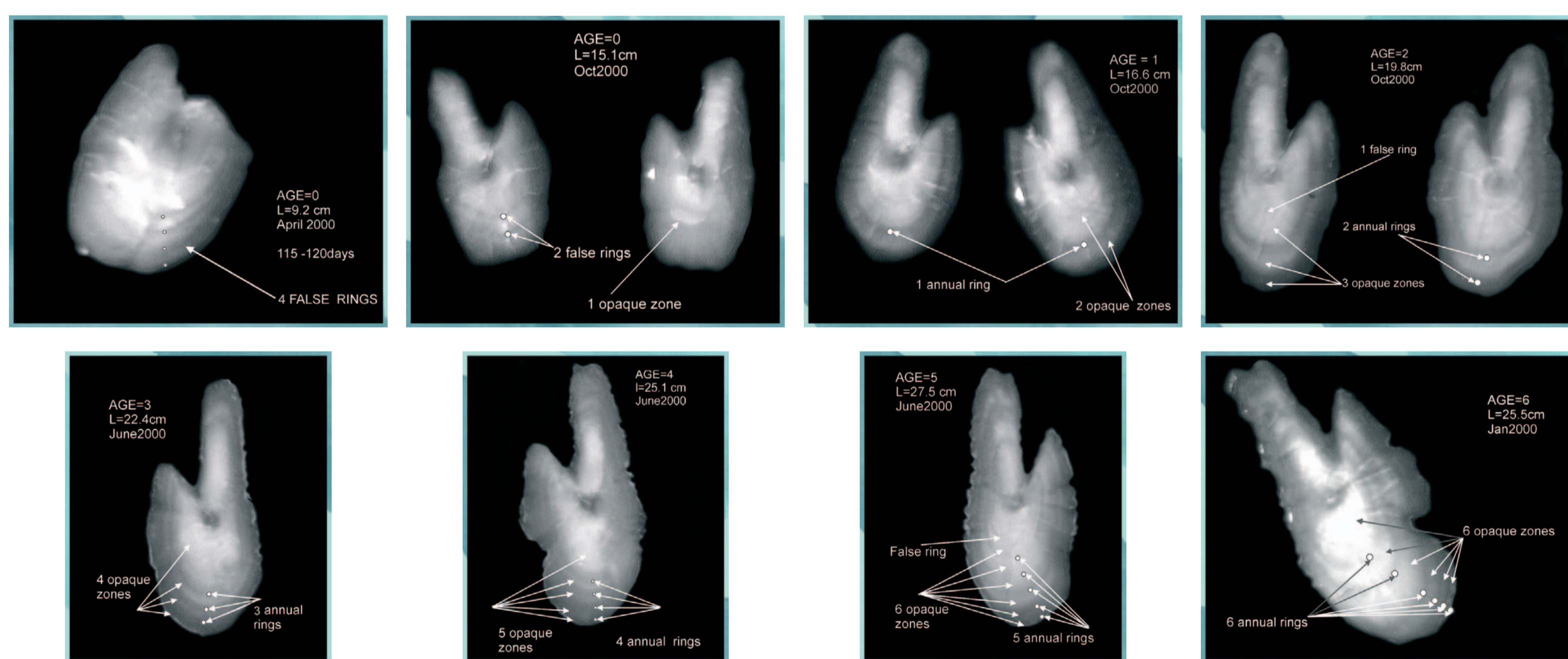
Several initiatives including otolith exchanges, workshops and onboard training have been organized at various locations (Kaliningrad, Tenerife, Dakar, Casablanca, onboard the R/V Dr. Fridtjof Nansen) aiming to standardize the Northwest African sardinella and sardine age reading methodologies through the establishment of age reading criteria and a common understanding of the interpretation of these criteria.

Scientists from research institutes in Morocco, Mauritania, The Gambia, Senegal, Spain, the Russian Federation and Norway as well as FAO were involved.

Methods

In the exchanges several otolith collections were circulated among readers. The otolith collections covered the whole year and a large length range. The results were then combined and analysed applying the method developed by Eltink *et al.* (2000). During the Workshops several otoliths from the exchange sets were analysed by all readers to have consensual age estimation. After the individual readings, the otolith was projected on a screen and readers were asked to explain their own age interpretation and the criteria applied. Subsequently, all the rules used for sardine and sardinella age estimation were discussed and common criteria were agreed to.

Examples of aged otoliths of *Sardina pilchardus*



Results

The results of the 2006 Workshop reading showed that the total percentage of agreement was 54.3% with a coefficient of variance (CV) of 34.2% for sardine and 51.7% with a CV of 59% for sardinella. In general terms, reader's biases were low.

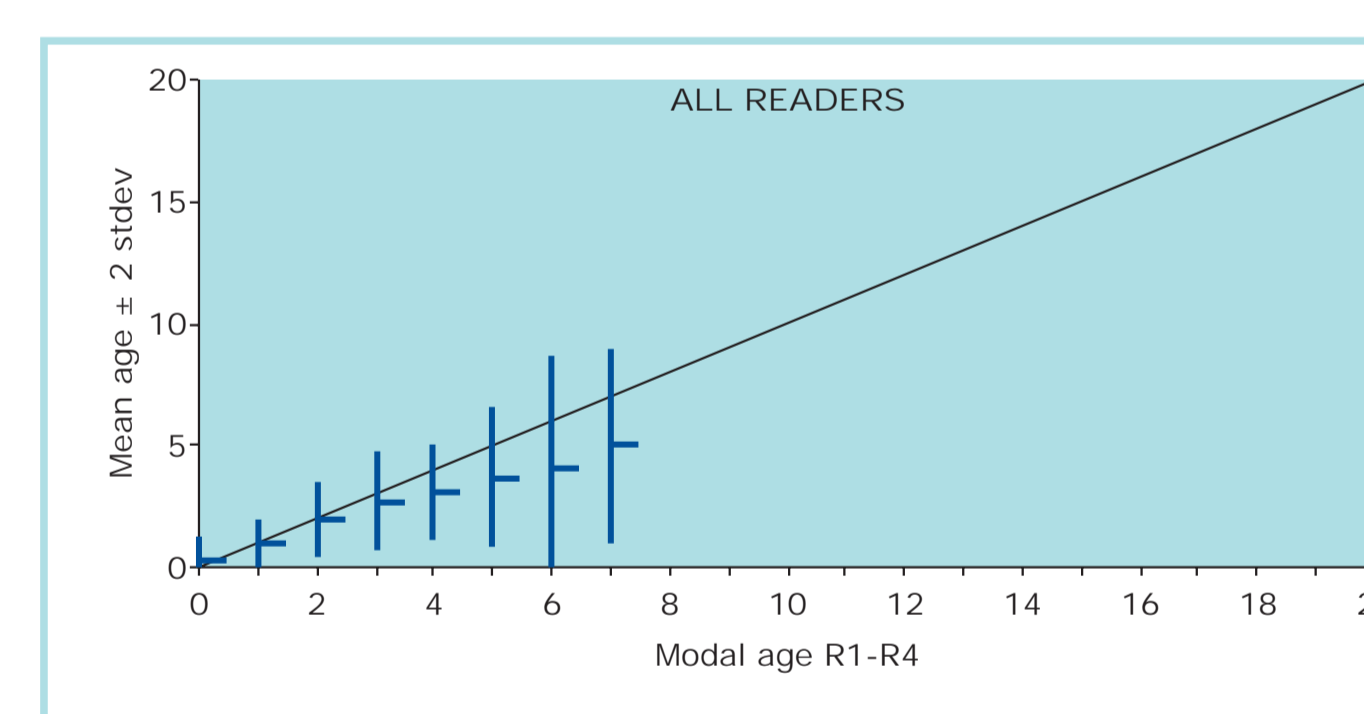


Figure 1 Age bias plots of Sardine AtlantiNIRO Collection

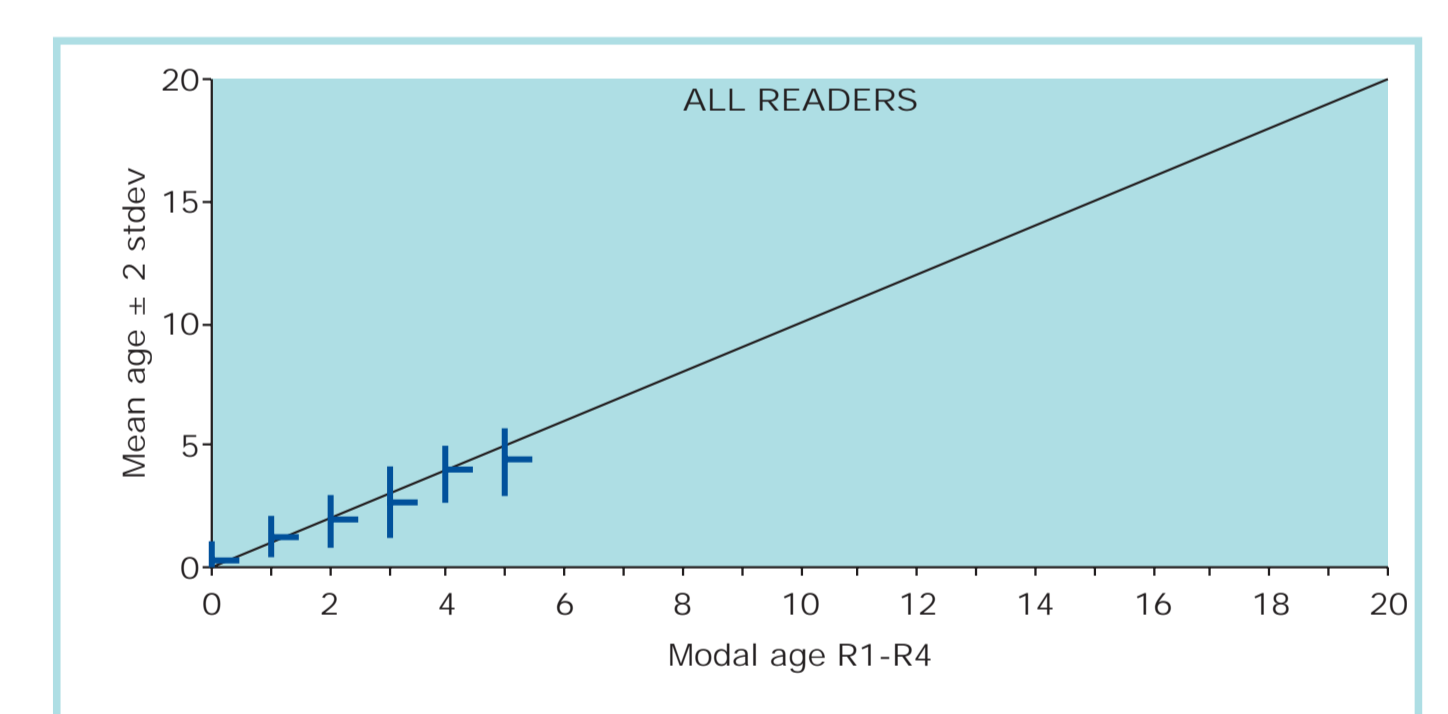


Figure 2 Age bias plots of Sardinella AtlantiNIRO Collection

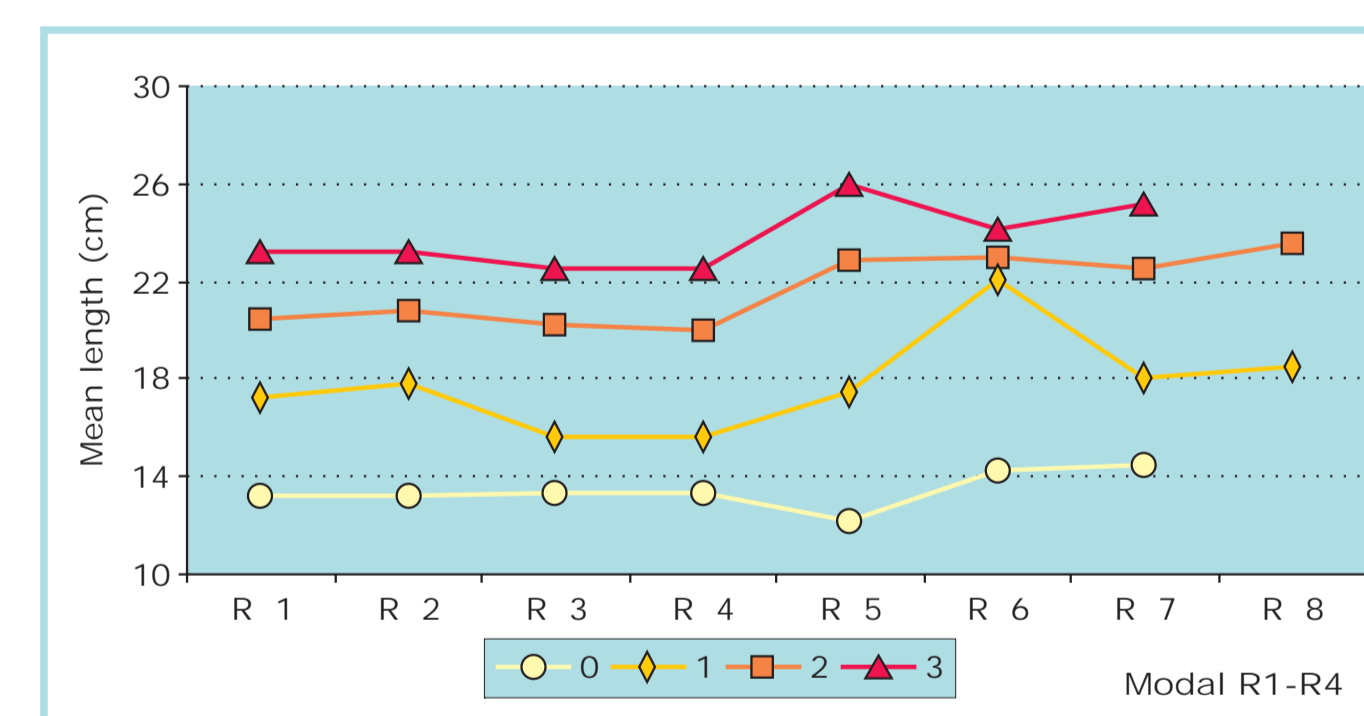


Figure 3 Mean length at age of Sardine AtlantiNIRO Collection

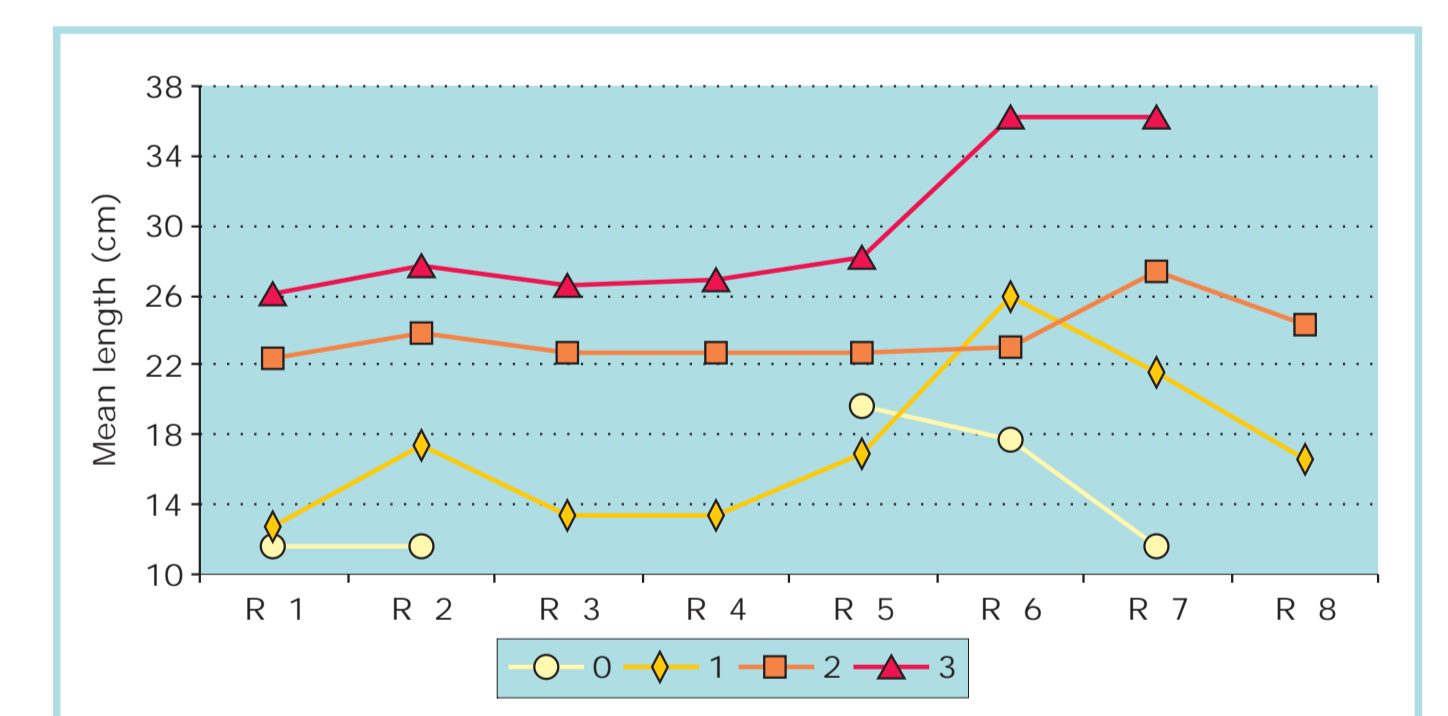


Figure 4 Mean length at age of Sardinella AtlantiNIRO Collection

General Conclusions

The majority of the readers involved in the age reading activities in 2006 showed:

- a good agreement in sardine age reading.
- lower bias between readers, indicating an improvement in age reading precision of sardine
- an improvement in the sardinella age interpretation. Less experienced readers tended to overestimate younger ages and underestimate ages older than 2 years.
- Less experienced readers show a tendency to consider as the first annulus a false ring that appears before the true annual ring. This false ring has a radius smaller than 20 unities and should not be considered in the ageing process.

Recommendations

Age estimation requires continuous effort by the people involved. Although improvements have been observed among the various readers in the region, some discrepancies still exist and it is therefore recommended to continue with otolith exchanges and Workshops at regular intervals to monitor the application of the agreed criteria.

Furthermore it is recommended that:

- A monthly sampling programme with at least 10 individuals from each length class should be carried out every year. Sampling should include small and larger individuals. Biological information (total length, weight, sex, maturity stage, etc.) should be collected for each individual.
- Biological sampling should also be carried out onboard the research surveys.

References

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Acknowledgements

All colleagues that have participated in the various activities and thus contributed to the preparation of the guidelines are greatly acknowledged.

Thanks are due to Emanuela D'Antoni and Fabio Carocci (FAO-FIMF) who assisted with the preparation of this poster.

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