Study 1. Age Corroboration using Marginal Increment Analysis

This study documents the annual nature of otolith growth through the year, by documenting the faster, summer opaque growth, and the slower winter hyaline growth.

To do this we used edge type data for all ages collected by an experienced age reader from 1989 to 2002. We categorized this data into four edge categories: (1) a full increment of opaque growth or a hyaline zone on the edge (Fig. 1a), (2) slight opaque edge growth beyond the last hyaline zone, (3) an opaque edge with ¼ to ½ the opaque growth of the previous opaque increment (Fig. 1b), (4) an opaque edge with ½ to a full year’s opaque growth on the edge.

Categories 1 and 3 are the critical edge categories. If the marks we are interpreting as annular are truly annular, we should see a flip flop of the proportion of each type during the year (Fig. 1c).

Study 2. Age Corroboration using the Strong 1978 Year Class

Fish age determination can be corroborated if a strong year class can be followed over time. This indicates that the age criteria being used is providing correct ages.

The 1978 year class in the eastern Bering Sea is perhaps the strongest year class of walleye pollock on record (Janelli, 2002). It showed up as well as 1-yr-olds in summer length frequencies in both the bottom trawl survey (Fig. 2a) and the acoustic-midwater trawl survey (Fig. 2b) in 1979 (Bakala and Wespestad, 1983).

The frequency of age classes from survey samples from 1982 to 1991 also show the predominance of the 1978 year class (Fig. 2c). In interpreting these data, it should be noted that age samples were length stratafied on a vessel basis so that tails of the distribution were over sampled.

Study 3. Age Corroboration by Comparing Otolith Ages with Vertebra Ages

The basis of age corroboration using an additional hard structure is that if both structures provide similar ages, then the age criteria used on each structure is corroborated.

Two age readers made independent readings of otolith and vertebrae. In this study age structures were randomized so that knowledge of otolith age was not known when reading vertebrae. Reader 1 (Fig. 3a) was experienced in aging walleye pollock using both otoliths and vertebrae. Reader 2 (Fig. 3b) was extremely experienced in aging pollock using otoliths, but had never before aged vertebrae.

Conclusions

Examinations of age corroboration and validation suggest that these terms really constitute a continuum of evidence supporting the age criteria being used on a particular species and not necessarily two separate classifications.

Study 1: Age Corroboration using Marginal Increment Analysis provided strong indication that presented annuli are being formed on an annual basis.

Study 2: Age Corroboration using the Strong 1978 Year Class indicates that the otolith aging criteria successfully followed this year class from ages 4 yr to 13 yr.

Study 3: Age Corroboration by Comparing Otolith Ages with Vertebra Ages showed that in general ages read using the whole vertebrae centrum give ages similar to otolith ages.

Taken together these corroborative studies give considerable confidence in the otolith aging criteria (mixed surface and cut and burn) being used for walleye pollock.

A corroborative study might be more useful in arguing basic reasonableness of the data where large differences in aging criteria are conjectured, rather than the fine interpretation of annular zones.

Should age researchers pursue corroboration of fish ages? Yes, we conclude that corroborative studies can contribute greatly to a scientific evaluation of age determination criteria.

Should age researchers pursue corroboration of fish ages? To answer this question we look at three corroboration studies of otolith ages from walleye pollock.

Validation

The concept of validation is one of degree and should not be considered in absolute terms. If the method involves counting zones, then part of the validation process involves confirming the temporal meaning of the zones being counted. Validation of an age estimation procedure indicates that the method is sound and based on fact (Kalish et al. 1995).