CHAPTER

11

Age determination in fishes and validation using fish using hard parts

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Fisheries management relies on understanding the fish population dynamics while determining the biological parameters, including size at maturity, duration of spawning season, mortality estimates, age and growth, Accurate information on age of fish is an important pre-requisite for extracting precise information on growth, mortality, recruitment and other fundamental population parameters of fishes for stock assessment. The outcome of conventional age estimates using length frequency data depends upon the sample quality, selectivity of the fishing gear etc. The stock assessment results may therefore be affected and sometimes give results which is having no bearing on reality. The hard parts of the fishes also grow with the fish and the growth process may left some inscription on such parts and if that can be interpreted properly, will get precise idea on growth. These inscriptions may result from either changes in the environment which the fish inhabits, or food availability, or physiological states of the fish. However, free swimming fishes always lives in ideal conditions and do not leave any environment related markings in their skeletal structures. So interpretation of hard part inscriptions need utmost care.

Ageing techniques

Several methods were wmployed to

Direct observation

This is the simple method, where age and growth is monitored directly fattening them under confinement or physical/chemical tagging and releasing of fishes of known age to wild and monitoring their growth against time when captured. The data so generated were used to interpret the age of wild caught fishes. Fattening in confinement is the oldest technique described initially by the fish culturists. Tagging and marking experiments are conducted as the data collected are useful in estimating the population size, mortality rates and migration. Tagging does not enable individual fish to be aged unless the age of the fish at tagging is known. The method is very useful for fish living in areas where the growth is continuous throughout the year. It is useful when large numbers of fish recaptured at annual intervals are available. However, cultivated or tagged fish seldom have the same growth rate as that of the wild or untagged fish. Tagging or marking of fish usually involves considerable time and recapturing is not assured.

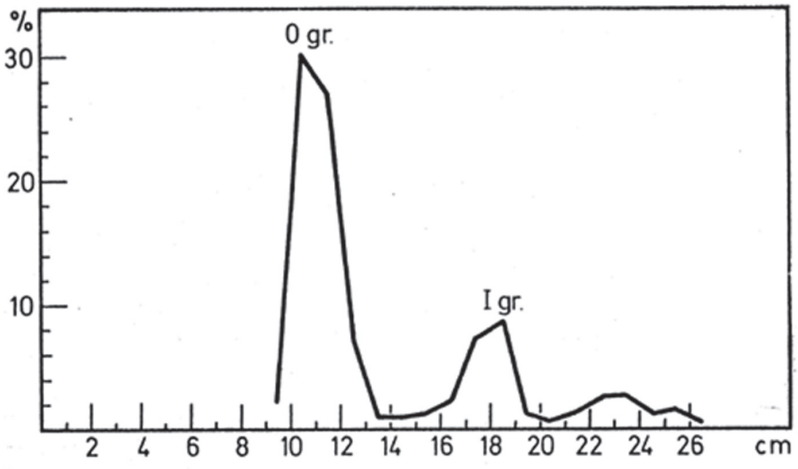
Analysis of progression of modes in the length frequency data

Length frequency data are used in various analytical, graphical and software assisted techniques to estimate the age, growth and other population parameters The common methods employed are**;**

a. Petersen method:

This is a single sample method and is very simple, fastest but most inaccurate method of ageing fishes. This method can be used only with species which have a restricted spawning season so that

the fish bred in a single season can be identified as a single mode in a polymodal length distribution. The mode with the lowest value is identified as O-year group fish. Subsequent modes will be 1-year group, 2-year group fish and so on. The method can be very good for young fish but becomes increasingly less useful for older fish as the growth rate slows down and the modes merge.



In practice length-frequency distributions of fish caught over the shortest time period possible are plotted; the shorter the time period the more precisely the modes will be defined. A regular sequence of such length frequency distributions enables the progression of the modes to be followed.

b. Monthly modal progression analysis

Length frequency data collected at random from the commercial and experimental fishing are used to estimate the age of the age and growth of the fish.

c. Scatter diagram technique of monthly modal length

By plotting the monthly modal values of the length frequency data of fish as a scatter diagram, growth as well as the number of broods recruiting per year can be estimated.

d. Bhattacharya method

This is a graphical method of splitting a composite distribution into separate normal distributions, i.e. when several age groups or cohorts of fish are represented in the same sample. (For details consult FAO Fisheries Technical Paper No. 306.1 ,Rev.).

e. Probability paper/plot method

The aims to resolve the normally distributed components of a length frequency distribution.

Age determination using hard parts of fish

Basic principle: Fishes grow continuously, but growth rate varies over time and season. All calcareous structures in the body also grow in the similar pattern. Any changes in growth rates may

be reflected as some pattern of structural discontinuities or as zones or bands in the hard parts based on the rate of mineral deposition. By tracking down these discontinuities termed as 'rings' age of the fishes can be determined if allot some time-scale to thee patterns.

Hard parts

All hard parts are not suitable for age determination. Hard parts on which distinct growth inscriptions available includes scales, otoliths, opercular bones, spines, vertebrae etc. Among skeletal structures, otoliths and scales are most widely used as they are easy to collect and store.

Otoliths

Otoliths are three-dimensional structures but do not necessarily grow at the same rate equally in all dimensions. If there is a pattern in the otolith it will be composed of a number of concentric shells with different radii. Depending on the amount of organic material in each shell or zone, its appearance will vary from extremely opaque to hyaline.

There are three pairs of otoliths in teleost fishes. Among these, Sagittal otolths are generally used for age determination as they are the largest and easy to collect and process.

Scales

Scales vary in shape depending on the species. Scales are almost two-dimensional structures. The anterior part is formed of a series of sclerites which should extend in a regular pattern from the centre of the scale. The structural discontinuities used for age determination result from irregularities in the pattern of the sclerites and are usually called as 'rings'. Scales are thin structures they need no preparation before viewing.

Validation

Age and growth estimates obtained from hard-parts may be cross checked with estimates from conventional methods for validation for correctness and improvement.

In all cases, detailed information on the biology and population dynamics of the fishes under study is an essential pre-requisite for ageing work.