RESEARCH PAPER | Zoology | Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

Age Determination and Age Related Biochemical Changes in the Hepatic Tissue of the Fresh Water Fish Notopterus Notopterus

KEYWORDS: Biochemical,Hepatic tissue,Notopterus notopterus

S.Sudarshan
Department of Zoology, Fish Research Lab, Gulbarga University Gulbarga, Karnataka India 585106

R.S Kulkarni
Department of Zoology, Fish Research Lab, Gulbarga University Gulbarga, Karnataka India 585106

ABSTRACT *The cycloid scale of the fish Notopterus notopterus is roughly oval in shape.The scales are transparent therefore suitable for study by transmitted light. The number of radii is less on the lateral sides,maximum on the anterior and very less on the posterior part of the scale.The less number on the posterior part is due to hard nature of the scale. Immediately after the formation of the larval ring/mark widely spaced circuli appear. Based on the number of annulus the scales they are considered as zero age(without annulus) one year old (with one annulus) two year old (with two annulus) three year old and (with three annulus) four year old age group fishes.From these results,it is noticed that there is change in the accumulation of tissue biochemical constituents in different age groups. The hepatic protein, lipid,glycogen,cholesterol found to be maximum in 4 year old fish and hence the age of 4 year and above should be collected and can be advised to be used for consumption.*

Introduction:
Among the fish species available in Gulbarga region *N. notopterus* is one of the prominent fish being found in the aquatic bodies and can be collected throughout the year. This fish is quite resistant despite their exploitation.

Among the fish species available in Gulbarga region *N. notopterus* is one of the prominent fish being found in the aquatic bodies and can be collected throughout the year. This fish is quite resistant despite their exploitation

Le Cren (1977) has shown comprehensively the requirement for deciding the validity of the supposed age, marks on scales, otoliths and opercular bones of fish. If scales or other bony structures sampled frequently from growing population the supposed year mark if reliable will appear at the growing edge during relatively short time of each year. As the scales or other structure continues to grow, the margin surrounding the annulus will increase in width until the next annulus makes its appearance (Weatherly, 1979). The spaces between successive circuli were also found with increased availability of the favorite food of the species with the increased growth of the fish. Hofstede (1974) after reviewing all the methods of age determination by scale method is reliable beyond doubt. White and Chittenden, (1977) found a validated scale method for determination of age in Atlantic Croaker, *Miropogonias undulatus*.

The known age determination method is a sure test of the fish and hence of length and weight, this method has application in culture fisheries only. Another method is that of tagging and clipping and realizing and capturing and is often used in capture fisheries. This is costly and often time consuming. Moreover in developing countries this has some practical implications because of non-availability of fund and ignorance amongst fishermen. Peterson's method requires large samples over long period. Hence, the only easily available method is that of using hard parts like, scales, otoliths, opercula, vertebrae, frontal bones, eleithra, and fin rays sections. From 1961 onwards, researchers used scales for age determination because by this time authenticity of scale method had been established and considered the scale method for the study of age and growth is one of the best methods.

According to Hile, (1970) it is clear from different types of curves that in most cases the body scale relationship is linear. Balan, (1974) used successfully the growth data obtained from the scale studies of common carp *Cyprino carpio* from central Europe for calculation or absolute and relative growth values. Hellawell, (1974) and Hofstede, (1974) after reviewing at the methods of determination in dace (*Leuciscus leviscus*) observed that the determination of age by scale method is reliable beyond

Besides scales, other hard parts such as opercular bones and vertebrae have also been employed for the study of age and growth, though not extensively considered superiority of the use of opercular bones to scales. Mann, (1973) used operculum for the study or growth in roach, *Rutilus rutilus*, the use of vertebrae has also been in vogue, it was observed the presence of annual rings on the vertebrae of *Ameiurus melas melas*, that the scales are most suitable for age determination than vertebrae because of difficulty to locate the first annulus in case of vertebrae

Johal and Tandon, (1993) used scale ring data successfully for determining the age and for prescribing an age limit for the capture of Catla and Mrigal at the period in the Sukhna lake, Chandigarh. Catla had 8 annuli (age 8+ years) in the largest size group while Mrigal had only 3 rings age (3 + years), Catla grew fast the end of first three years but after the age of 4 + years the weight increased faster than the length.

Age and growth estimates of southern flounder *Paralichys lethostigma* from Matagorda Bay, Texas, were made by analysis of thin sections of otoliths (Stunz *et al.*, 2000). They concluded that the maximum age differed by bay systems; but it ranged from 0 to 4 years for both males and females. They have exhibited a symptotic growth at an earlier age. Johal *et al.*, (2000) have successfully worked on the urohyal bones of silver carp for age determination and its reliability.

Biochemical constituents:
Biochemical composition of fish tissue are considerable interest for their specificity in relation to food values of fish and evaluating their physiological needs at different periods of life.

Protein acts both as a nutrient and as an energy source . Proteins as with all other cellular constituents are in a state of continuous turnover Goldberg and Dice, (1974), have pointed out that this phenomenon may significantly enhance the organism's ability to readily adopt to changes in its environment. Protein turnover is, of course a function of the rate

Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

of synthesis and the rate of degradations, both of which are under separate control (Goldberg and Odersey, 1974).

Materials and Methods:
Age determination:
Ten to twelve scales from the area behind the pectoral fin are removed where the largest scales are located. The dull knife or scalpel is used to remove the sample scales by scraping firmly towards the head of the fish. The scales thus collected were washed and cleaned. To make the scales more clear and soft, scales were dipped in 1% KOH for about 5-10 min. Then washed in tap water and dried in air.

Sometimes the scales are not clear then scales are stained with Alizarin Red 'S' and mounted in glycerin for the study.

Biochemical determination in liver with respect to age
Biochemical contents such as protein, lipid, glycogen and cholesterol were determined in liver in different age groups of the fish *N. notopterus*.

Biochemical contents such as protein, lipid, glycogen and cholesterol were determined by using the following methods:
Estimation of protein by – Lowry's method (1951).

Estimation of lipid by – Barnes and Black Stock (1973).

Estimation of cholesterol by – Libermann and Buchard method (1952).

Estimation of glycogen by – Carrol *et al.,* (1956).

Result and discussion;
Ageing is a biological process characterized by general slowing down of all organ systems due to gradual decline in cellular activity. Ageing process is usually considered to be normal process as it occurs in all the members of the population.

For many species of fish, age can be determined with reasonable certainity using hard parts which produced a characteristic growth increment overtime e.g. otoliths, scales or spines (Tandon and Johal, 1996). Age determination of crustaceans, however is difficult because they lack permanent hard structures. As they grow, they periodically moult their calcareous exoskeleton hence their growth is a discontinuous of time (Harvey *et al.,* 1999).

It is not only possible to know the data concerning the size of fish at given age from the scales but also the size of fish at each previous year of its existence.

In the present study the age of the fish has been determined by using scales from the area behind the pectoral fin where the largest scales are located. Better growth rate has been recorded in *N. notopterus* in the fish having three years of age from Sirnoor nala. It can be concluded that upto age class-4 the growth is comparatively more. It appears that nutrient status of this aquatic body (Sirnoor nala) has profound impact on the authenticity of scales for age determination. Similar reports have been available on the analysis of growth rate of *Catla catla* from different water bodies of India.

Deshmukh, (1973) found good annuli in both scales and otoliths in the 'Karkara' *Pomadasys hasta* and studied from them for about 6 years from trawler landings along the Gujarat and Maharastra coasts and found 1, 2, 3 and 4 annuli

Age related biochemical changes:
Protein is one of the biochemical component along with glycogen In the present study the protein content has been estimated in liver and muscle in relation to different age group of the fish *N. notopterus*. It was noticed that the hepatic protein content increases gradually as the age of the fish increases from 1 year to 4 year In the present study the protein content has been estimated in liver and muscle in relation to different age group of the fish *N. notopterus*. It was noticed that the hepatic protein content increases gradually as the age of the fish increases from 1 year to 4 year

The increase in the hepatic protein content may be because of its necessity required for the reproductive activities particularly for vitellogenesis

The hepatic glycogen level in the fish *N. notopterus* was observed that it was increased from 1 year to 4 year, but there was no any marginal difference in the glycogen level of 2 year and 3 year old fish

The hepatic lipid content increased in all the age group of the fishes; from 1 year to 4 year old fish. The increase in the hepatic content suggest that its accumulation is necessary for high metabolism needed for active spawning in aged fish *N. notopterus*.

Cholesterol forms a major component of lipids. It plays a major important role in the physiological and metabolic process of the animal.

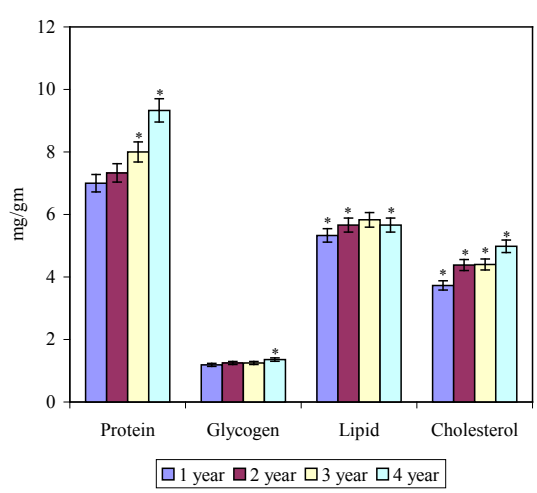
Cholesterol is a precursor for steroid hormones production i.e., steroidogenesis and is an important component in the cell membrane which are in high rates during gonadal development (Saksena and Saxena, 1999). In the present study the hepatic cholesterol content has been noticed to be increased in all the age group of the fishes (1 year to 4 year). However, there is no marginal difference in the cholesterol level of 2 year and 3 year old fish.

Table-4.1
Determination of hepatic biochemical constituents in different age group of the fresh water fish *N. notopterus*

Age of the fish	Protein	Glycogen	Lipid	Cholesterol
1 year	7.0 ± 0.85	1.19 ± 0.13	5.33 ± 0.98*	3.73 ± 0.34*
2 year	7.33 ± 1.52	1.25 ± 0.05	5.66 ± 0.95*	4.38 ± 0.59*
3 year	8.00 ± 1.15*	1.25 ± 0.16	5.83 ± 1.16	4.4 ± 0.55*
4 year	9.33 ± 0.40*	1.36 ± 0.08*	5.66 ± 0.58*	4.98 ± 0.18*

Tissue expressed as mg/50 gm.
Each value is expressed as mean ± SE, N = 6.
NS = Not significant; * = significant P < 0.05 when compared between the years.

Fig. 4.1. Showing hepatic biochemical constituents in different age group of the fresh water fish *N. notopterus*



Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

REFERENCE

1. LeCren, E.D. (1977). The determination of the age and growth of perch (Perca fluviatilis) from the opercular bones. J. Anim. Ecol., 16: 188-204. | 2. Hile, R. (1970). Body-scale relations and calculation of growth in fishes, In: The ageing of fish, Ed. T.B. Bagenal Pusts. Unwin Brothers Ltd., Survey England, 99: 468-474. | 3. Balan, E.K. (1974). Domestication of the Carp, Cyprinus carpio L. Roy. Ont. Mus. Life Sci., MISc., Pub1 1-37. | 4. Hellawell, J.M. (1974). The problems of protracted check formation and the validity of the use of scales in age determination exemplified by two populations of dace, Leuciscsus leuciscus (C.) In: "The ageing of fish", Ed. T.B. Bengal Pusts. Unwin Brother Ltd., Survey, England, 173-180. | 5. Hofstede, A.E. (1974). Studies on growth, ageing and back-calculations of roachi, rituals Rituals rutilus (L.) and dace, Leuciscus leuciscus (L.) in "The ageing of fish Ed. T.B. Bengal Puls. Unwin Brothers Ltd., Survey, 134-147 | 6. Mann, R.H.K. (1973). Observations on the age, growth, reproduction and food of the roach, Ritilus rutilus (L.) in two rivers in southern England, J. Fish. Biol., 5: 707-736. | 7. Tandon, K.K. and Johal, M.S. (1996). Harestable size In: Age and growth in Indian freshwater fishes (K.K. Tandon and M.S. Johal, Eds.) Narendra Publishing House, New Delhi, pp. 150-156. | 8. Weatherly, A.H. (1979). Growth and ecology of fish population, Academic Press London. | 9. Johal, M.S. and Tandon, K.K. (1983). Age and growth length weight relationship and Catla catla (Hamilton) and Cirrhina mrigala (Hamilton) from Sukha Lake, Chandigarh, India, Vest C.S. Spolee, Zool., 47: 87-98. | 10. Stunz, W. Gregory, Thomas, L. Limton and Robert, L. Colura (2000). Age and growth of southern flounder in Texas waters, with Emphasis on Matagonda Bay, Trans. Of the American Fish. Soc. 129: 119-125. | 11. Goldberg, A.L. and Dice, J.F. (1974). Intracellular protein degeneration in mammalian and bacterial cells. Anu. Rev. Biochem. 43, 835-869 | 12. Goldberg, A.L. and Odessey, R. (1974). Regulation of protein and amino acid degradation in skeletal muscle. Excerpta. Med. Int. Congr. Ser. 333, 187-199. | 13. Harvey, H.R., D.H. Secor and JU Se Jong, (1999). Biochemical Measures of Age in the blue Crab Collinectus sapidus. NOAA Chesapeake Bay Stock Assessment committee Workshop Report, pp. 41-50. | 14. Deshmukh, V.M. (1973). Fishery and biology of pama Dasys hasta (Bloch). Indian J. Fish., 20 (142): 497-522. | 15. Saksena, M. and Saxena, D.N. (1999). Events of biochemical integration during the reproductive cycle found in murrel Channa orientalis (Lin.) In Ichthyology Res. Advan. 345-354, Oxford and IBH Publishing Com. Pvt. Ltd., New Delhi, Editor, D.N. Saxena and Meena Saksena. |