Christein and Taylor[8] monitored two breeding ponds of *Bufo americana* and found that males greatly outnumbered the females (7 : 1). Schaub and Larsen[9] reported that females of *H. regilla* have more turn-over rate than the males in their breeding ponds. Bashkov and Jameson[10] reported that in *Bombina variegata*, the sex ratio is three males to one female. In *H. annectans* also, males were found to outnumber the females in the breeding sites.

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Received 18 July 2000; accepted 31 August 2000

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Postcleithrum of silver carp, *Hypophthalmichthys molitrix* (Val. 1844), an authentic indicator for age determination

Although different methods like tagging, length–frequency analysis, RNA–DNA ratios, glycine uptake by scales, hepatosomatic index and structures like scales, otoliths, vertebrae, cleithra, opercular, dentary and frontal bones, fin spines, fin rays, medial nuchal, dorsal scutes and clavicles[1–10] have been used in the past for the determination of age and growth rates of different fishes, there is no information regarding ageing of cyprinid fishes by using cross-sections of the postcleithral bones. Out of all these structures, scales and otoliths have been widely used to assess age and growth. In case of silver carp, *Hypophthalmichthys molitrix*, annual marks are diffused on the scale[11], making it difficult to be used for determining age. On the other hand, the otoliths are small, hazy and fragile, and it is difficult to read annual rings on them. Hence, they too cannot be used for determining age authentically. It has been suggested that other structures should be used for age determination and cross-checking for its effective management strategies in natural waters.

During our investigations on the biology of silver carp, *H. molitrix* from Gobindsagar reservoir, we found that postcleithrum of this fish can be used authentically for determining the age. The postcleithra can be easily removed and analysed. The postcleithrum is a part of the pectoral girdle, which is situated near the inner surface of cleithrum and passing backwards and downwards among the muscles of the pectoral region.

For the present study postcleithra were removed from fresh specimens and the muscles, separated by dipping them in water at 60 to 70°C for 5 min. Boiling was avoided. The cleaned and dried postcleithra were stored in ordinary envelopes with relevant data, e.g. total length, standard length and weight of the fish. Transverse sequential sections were then cut from the middle of the postcleithrum (Figure 1) using fine jeweller's saw. Precision in transverse sections assured inclusion of all annuli. Each section was ground and polished using carborundum stone and fine ground glass of 12 mm thickness using water or liquid paraffin as lubricant. The ground and polished sections having a thickness of 0.3 to 0.5 mm were mounted on glass slides in DPX and observed under transmission light using Carl Zeiss DL 5.3 VEB Documator or Getner Stereobinocular microscope. For photography, the sections mounted on the microslides have been used as negatives (Figure 2 *a* and *b*).

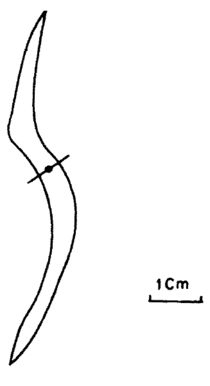

Figure 1. Postcleithrum of silver carp, *H. molitrix* showing the region from where the sections have been cut (line).

The postcleithrum shows an oval shape in its transverse section when cut in the middle region (Figure 2 *a* and *b*).

Like the other hard parts, the annual growth pattern of postcleithrum comprises an opaque zone and a translucent or hyaline zone. The latter is called annulus or annual mark or annual ring, representing a time of reduced growth, and former represents a zone of active growth. With transmitted light under stereobinocular, the annulus appears light and the opaque zone is dark. When viewed in reflected light the opposite is observed, the annulus is dark and the opaque zone is light.

In the sections of postcleithrum, these annual marks are very clear in the form of oval rings and easily distinguishable.

Our experience shows that collection, cleaning and storage of postcleithra are easy compared to cleithra. Moreover, the rings are very clear, so they can be employed in the determination of the age of silver carp, *H. molitrix*. It has been observed that the long-term storage of

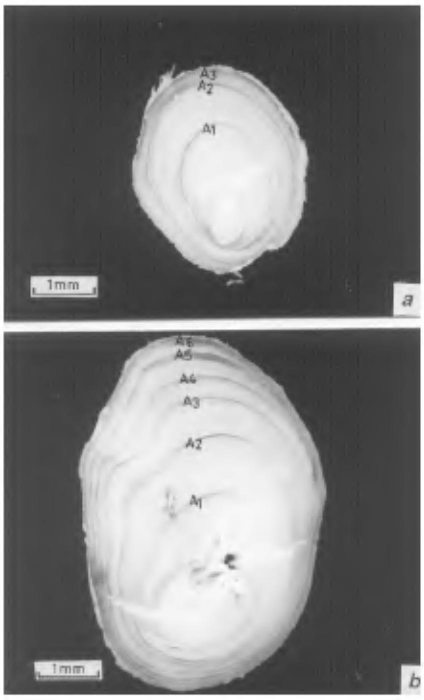

Figure 2. Transverse sections of postcleithrum of silver carp, *H. molitrix*. ***a***, Total length 641 mm, standard length 513 mm, weight 2820 g, age 3 years collected on 30 March 2000; ***b***, Total length 924 mm, standard length 744 mm, weight 8180 g, age 6 years collected on 30 March 2000.

sections does not affect the clarity of the annual marks. For the purpose of back-calculation, the following equation can be employed:

$$L_n = \frac{A_n - A_n}{C_1 - C_1} L,$$

where C_1–C_1 should be considered as maximum postcleitheral width. The respective annuli are marked as A_1–A_1, A_2–A_2, A_3–A_3, A_n–A_n (Figure 3). L is the total length of the fish at the time of capture and L_n is the length at the time of formation of an annulus. There is no correction factor since the bones are an essential part of the body and are formed early during ontogenesis.

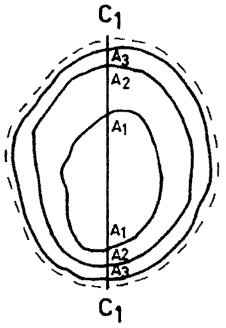

Figure 3. Diagrammatic sketch of the cross-section of the postcleithrum showing the annuli and the method of measuring them.

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ACKNOWLEDGEMENTS. We thank the Ministry of Culture and Higher Education of Iran for the award of fellowship to H.R.E. and Dr Kuldip Kumar, Chief Warden and Director of Fisheries, Himachal Pradesh Government, Bilaspur and his staff for the collection of research material. We also thank Prof. H. S. Banyal, Chairman, Department of Zoology, PU, Chandigarh for providing the laboratory facilities to carry out the present research work.

Received 12 June 2000; accepted 14 July 2000

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