

Reliability of urohyal bone of silver carp, *Hypophthalmichthys molitrix* (Val. 1844) for age determination

In most commercial carps, the use of scales is in vogue for age determination and calculating various growth parameters. The growth parameters are useful for the judicious management of a particular fish species. Other hard parts such as otoliths, vertebrae, cleithra, opercular bones, dentary, frontal bones, fin rays and spines are employed for age determination in fishes in which either scales are absent, e.g. members of the order Siluriformes or when scales fail to record the exact number of annual marks or the fishes have deciduous scales¹⁻³.

Use of the urohyal bone for age determination in *Lutjanus vittus* (Quoy and Gaimard) has been reported from Australian waters⁴ but there is no such report in the case of carps.

In the present communication, a successful attempt has been made to determine the age of exotic carp, *Hypophthalmichthys molitrix* (Val. 1844) using the urohyal bone, because it has been observed that the scale of this fish poses some problems in age determination, especially after the third year when the annual growth rate decreases drastically and there is overcrowding of annuli. The fishes

were collected from Gobindsagar reservoir, Himachal Pradesh (lat. 31°25'N and long. 76°25'E) during August 1998 to April 2000, using gill nets of various mesh sizes to study their biology in order to pinpoint the factors for the excellent establishment of this exotic fish in a new environment.

The urohyal bone is a single median triradiate solid bone (Figure 1) with the anterior tip generally connected to the ventral hypophyals, the antero dorsal part connected to the first basibranchial and the posterior part connected to the pectoral girdle by means of muscles. It has horizontal and vertical components, which are flat.

For the present study urohyal bones were removed from fresh specimens and muscles were separated by dipping them in water at 60–70°C for 5 min. The cleaned and dried urohyal bones were stored in ordinary envelopes with relevant data, e.g. total length, standard length, weight (in metric system). Transverse sequential sections were then cut from the anterior tip of the urohyal bone (Figure 1) using a fine jeweller's saw. Each section was ground and polished using carborundum

stone and fine ground glass. The ground and polished sections having a thickness of 0.3–0.58 mm were mounted on the 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 (Figures 2 a and b).

The urohyal bone shows circular shape in its transverse section from the anterior side (Figures 2 a and b). The annual marks are very clear in the form of circular rings and are easily distinguishable. The incomplete mark at the centre of some of the sections of the urohyal bone gives an impression of the first annulus.

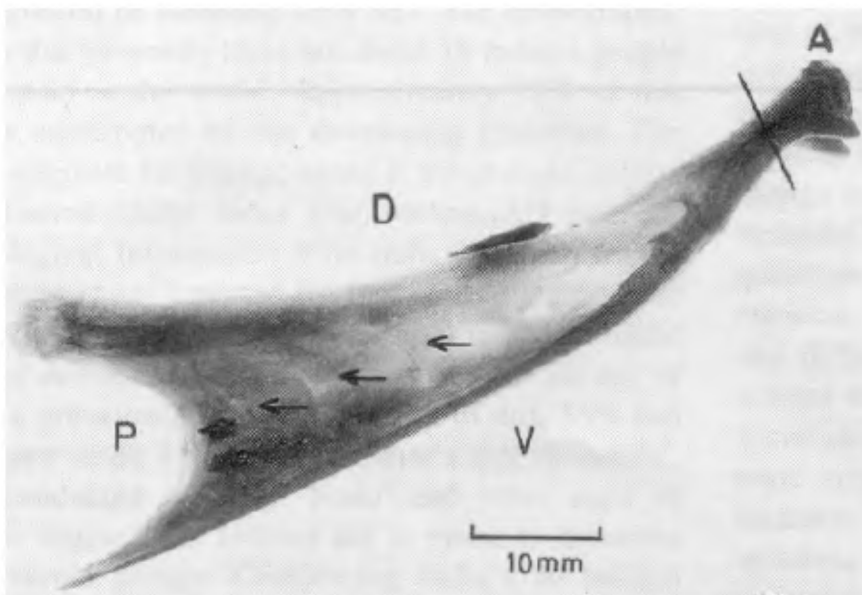


Figure 1. Lateral view of urohyal bone of *Hypophthalmichthys molitrix* (Val.1844) collected on 31 March 2000. Total length, 710 mm; standard length, 552 mm; weight 3340 g; age 4 years. Arrows indicate annual marks. Line indicates the region from where the sections have been cut. A, anterior side; P, posterior side; D, dorsal side; V, ventral side.

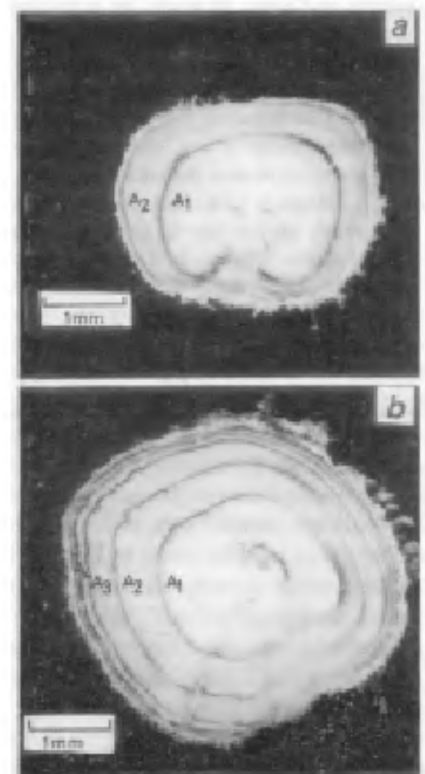


Figure 2. Transverse sections of urohyal bone of *H. molitrix* (Val.1844). **a**, Total length, 531 mm; standard length, 421 mm; weight, 1600 g; age 2 years, collected on 15 November 1998. **b**, Total length, 759 mm; standard length, 609 mm; weight, 4100 g; age, 4 years, collected on 15 October 1999. A₁, A₂ ... A_n; annual marks.

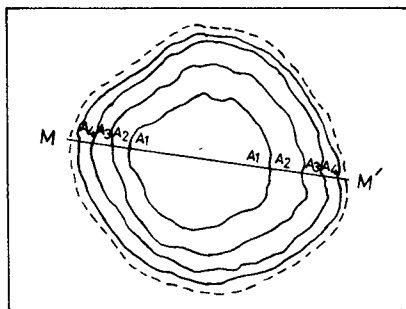


Figure 3. Scheme of measurement of transverse section of anterior region of the urohyal bone. MM' , Maximum transverse distance; A_1-A_1' ; A_2-A_2' ; A_3-A_3' ... A_n-A_n' , annular distance of respective annuli.

To find the back-calculated length it is not possible to measure the radius because distinct focus has not been marked. Hence the following method in the transverse section of the anterior part of the urohyal bone is suggested.

Draw the outline of the transverse section of the urohyal bone showing the margin and rings or marks on a tracing paper at a particular magnification, preferably at $10\times$ on the screen of Carl Zeiss DL 5.3 VEB Documator. Draw the straight line between two points having maximum distance and designate it as maximum transverse distance (Figure 3, MM'). Measure the distance between two points on the line of the respective annual marks (Figure 3, A_1 to A_1' , A_2 to A_2' , A_3 to A_3' ... A_n to A_n') and find the back-calculated lengths using the following formula.

$$L_n = \frac{A_n - A_n'}{MM'} \cdot L,$$

where L_n is the length of the fish when the annulus n was formed; L is the length of the fish at the time of capture; A_1-A_1' , A_2-A_2' ... A_n-A_n' are the distances between the respective annuli; MM' is the maximum transverse distance of the urohyal bone.

While ascertaining the exact age in order to find the back-calculated length, it was found that the scale was not reliable for age determination due to crowding of annuli after the third year; therefore, the exact age could not be determined. As an alternative, transverse sections of anterior regions of the urohyal bone have been found to be more reliable. The literature shows that so far the urohyal bone has only been used in *L. vittus* in a different way, i.e. using annual marks on the vertical (lateral) wing of the urohyal bone. The vertical wing of the urohyal bone is extremely reliable as far as age determination is concerned, but the precise measurements are not possible to calculate the back-length, hence, the final choice has fallen on the transverse sections of the anterior region of the urohyal bone.

It may be added here that annual rings present on the urohyal bone as observed in the transverse sections are more distinct, easy to count and measure, and hence most suitable to find the back-calculated length. Moreover, removal of the urohyal bone causes minimum damage to the fish.

Hence we conclude that the urohyal bone can be used for age and growth studies with high degree of precision and reliability in the silver carp, *H. molitrix* (Val. 1844) from Gobindsagar.

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