

ESTIMATING THE AGE OF SHORthead REDHORSE (*Moxostoma macrolepidotum*) USING SEVERAL CALCIFIED STRUCTURES

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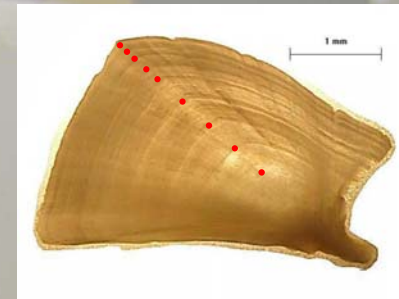
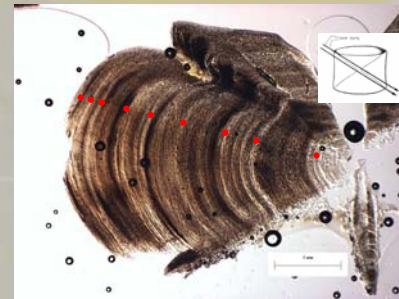
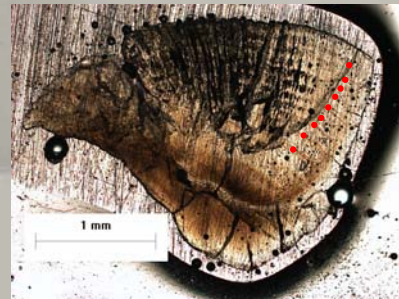
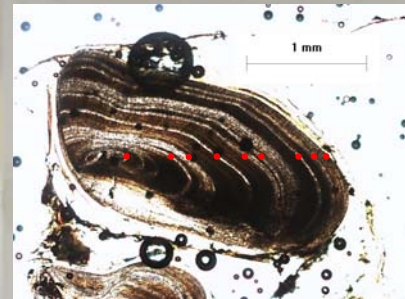
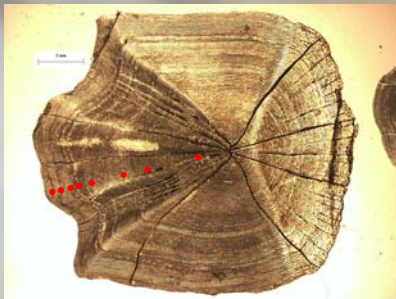


Fig. 1) Scale from male shorthead redhorse, 420mm FL (SH_82) photographed with transmitted light. The annuli (indicated with red dots) correspond to areas where the circuli are closer, cross over or are interrupted. Mature redhorse shorthead cannot be aged using scales.

Fig. 2) 0.35mm section of the right pectoral fin ray (SH_82) photographed with transmitted light. Annuli indicated with red dots. Pectoral fin rays are not suitable for estimating the age of mature (>5 yrs) shorthead redhorse due to crowding of the annuli. The presence of a distinct false annulus makes ageing one and two year old shorthead redhorse problematic.

Fig. 3) 0.35mm section of the sagittal otolith (SH_82) photographed with transmitted light. Annuli indicated with red dots. Otoliths can be used for age estimation of all age classes of shorthead redhorse. The otoliths of young (<5 yrs.) are hard to prepare for age estimation due to their microscopic size.

Fig. 4) 0.5mm section of the 2nd vertebra (SH_82) photographed with transmitted light. Annuli indicated with red dots. The inset indicates how the vertebra were sectioned. Vertebra of shorthead redhorse are easier to prepare than otoliths and can be used for estimation of all ages.

Fig. 5) Left opercula (SH_82) photographed with transmitted light. Annuli indicated with red dots. The opercula of shorthead redhorse can be used for age estimation of all age classes. However the annuli of fish older than ten years may become obscured when the opercula is too thick.

Introduction In general fish can be aged using their calcified structures like scales, pectoral fin rays, otoliths, vertebra, or opercula. The use of the calcified structures of shorthead redhorse has not been studied before in Canada, although related species like the white sucker have been studied. For the white sucker the use of scales of mature (approx. 5 yrs and older) white sucker were found to be inappropriate for ageing¹. Otoliths, vertebra, and opercula have been found suitable for age estimation of white sucker². The purpose of this study determine which calcified structures of shorthead redhorse can be used for age estimation.

Materials and Methods 32 shorthead redhorse were collected using an electro-fishing boat on the Grand River near Paris, Ontario on December 3, 2003 and taken to the lab for further examination. Weight, length, and sex, were measured and the ageing structures removed. **Scales:** Three scales were collected from the right side of the fish above the lateral line between the origin and rear insertion of the dorsal fin, cleaned with a small brush and water and air dried before viewing them under a stereo microscope. The annulus is characterized by dense circuli, that are in places interrupted or crossing over (fig. 1). **Pectoral fin rays:** The pectoral fin rays were collected from both sides of the fish: left side with pliers as close as possible to the base of the ray. The right side was sawed off with a bone cutter saw. The thickest part of each pectoral fin ray was embedded in epoxy resin and sectioned with a jeweler's saw to sections of 0.35mm. The sections were fixed between two micro slides with resin. The annuli appear as light bands when the pectoral fin ray is observed through a compound microscope using transmitted light (fig. 2). The pectoral fin rays of redhorse sucker, like those of white sucker³ have an apparent false annulus in the first year, often leading to over-estimation of the age of 1 and 2 year old fish. **Otoliths:** Both sagittal otoliths were removed, rinsed with water, air dried, embedded in epoxy resin and sectioned (0.35mm) with the jeweler's saw except those that weighed less than 15 mg which were fixed on a micro-slide and sanded until a thin transverse section through nucleus remained. The microscopic size of the otoliths <15mg resulted in several unsuccessfully prepared sections i.e. not through the transverse plane of the nucleus. The annuli appear as light bands when the otolith is observed through a compound microscope using transmitted light (fig. 3). **Vertebra:** The 2nd vertebra were removed, boiled in water for 3 minutes, air dried, embedded in epoxy resin and sectioned (0.5mm) diagonally through the center and along the sides (see insert in fig. 4) with the jeweler's saw. The annuli appear as light bands when the vertebra is observed through a compound microscope using transmitted light (fig. 4).

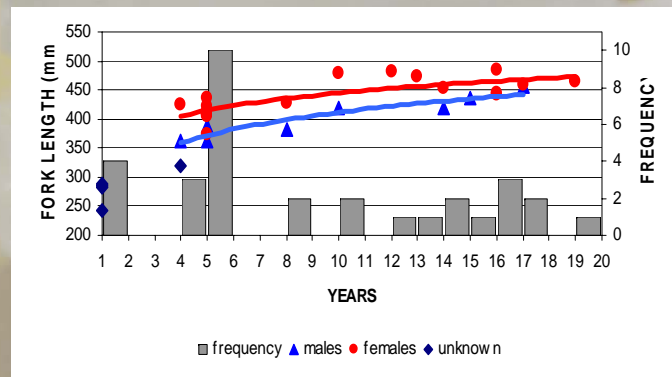


Fig. 6) Length at age for male, female and sex unknown shorthead redhorse plotted on the 1st y-axis (left). Numbers of fish per age class plotted on 2nd y-axis (right). The ages are "best" estimates using all five structures in the following way: scales from 0 – 5 years/ pectoral fin rays, otoliths, vertebra and opercula 5 – 10 / otoliths, vertebra and opercula >10.

Opercula: The opercula were removed, boiled in water for 3 minutes and air dried. The annuli on the opercula appear as thin light bands when observed through a stereo-microscope (fig. 5). The first annulus is harder to distinguish when the opercula becomes thicker in ten years or older fish.

Results To produce the age structure of the population scales were used up to age 5, pectoral fin rays were used for fish 3-5 years, and finally otoliths, vertebra and opercula for mature fish (>5). The precision (difference between the age estimation and best estimate/best estimate) is averaged for four age groups (see table 1). Scales and pectoral fin rays of mature (>5 yrs.) redhorse sucker have low precision. The apparent false annulus on the pectoral fin rays of 1 or 2 year old fish, results in overestimation of the age and low precision. Otoliths, vertebrae, and opercula yield acceptable results in all age classes. Few otoliths of young fish (< 5 years) were successfully processed because of their microscopic size. Sawed-off pectoral fin rays resulted in better quality sections, but did not have different age estimates compared to pectoral fin rays clipped off with pliers.

Recommendations Mature redhorse sucker can be estimated using otoliths, vertebra and opercula but not scales or pectoral fin rays. The age of pectoral fin rays of one or two year old shorthead redhorse is often overestimated due to the presence of an apparent false annulus in the first year. If pectoral fin rays are used they should be sawed off the fish with a fine saw, rather than clipped with pliers to achieve superior sections. Otoliths of redhorse shorthead younger than five years are not recommended for routine age estimation because of their microscopic size.

fish age	0-2	3-5	6-10	11-20
scale	0	0.134	0.449	HIGH
pectoral (clipped)	0.34	0.075	0.345	0.25
pectoral (sawed)	0.275	0.143	0.331	0.264
otolith	0.154	0.025	0.156	0.03
vertebra	0.131	0.054	0.238	0.13
opercula	0.118	0	0.209	0.128
fork length (mm)	0-300	300-450	400-475	>425

Table 1) Index of precision (number of annuli on the structure – age assigned to the fish using all structures / age assigned to the fish using all structures) averaged for four age class (approximate FL's below). Fields with high average index of precision (>0.250) indicated by red squares. Age estimates from clipped pectoral fins are comparable to those from sawed pectoral fin rays.

@ Questions and/or comments? → tacodenhaas@nec.ca

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