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Validation of Age Estimates from White Sucker Otoliths

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Abstract.—White suckers *Catostomus commersoni* were collected by electroshocking from Lake Taneycomo, a coldwater reservoir in southwest Missouri, to validate the use of otoliths as a yearly estimator of age. Otoliths (lapillae) were sectioned through the transverse plane for age estimation. Age validation was by edge analysis, whereby the formation of an annulus at the growing edge of the otolith was tracked throughout the year. Results indicated that only one annulus was formed per year. It was determined that otoliths are a reliable estimator of yearly age for white suckers age 2–18 in Lake Taneycomo.

The white sucker *Catostomus commersoni* is a coldwater fish commonly found in streams, lakes, and reservoirs of Canada and the United States. In Missouri near the southern edge of its range, it is found statewide, except in the southeastern "bootheel" region (Pflieger 1975).

Age estimates for the white sucker in Canada were made from scales (Beamish and Harvey 1969); however, these age estimates were reliable only up to the fourth year. Ovchynnyk (1965) examined 19 bones as possible age estimators for white suckers and found 6 that were suitable and 3 that were excellent for that purpose; however, he did not validate his age estimates. Validation of fish aging techniques has often been neglected. The consequences of not validating an aging technique include nonrandom errors and biases toward younger ages (Beamish and McFarlane 1983). These biases result in accumulations of age-classes near the age at which the aging technique begins to become unreliable (Sigler and Sigler 1990).

Several methods can be used to validate an aging structure when fish of known age are not available. Mark–recapture methods permit direct validation (Chilton and Beamish 1982) but are expensive and time-consuming. Other options include marginal increment analysis, following the progression of a strong age-class in a population over time, and checking for the consistency of age data for a discrete length-group. Of these methods, marginal increment analysis is the best method for a direct validation of otolith age accuracy (Sigler and Sigler 1990). Fin rays have been validated for white sucker age estimation and are the structure most frequently used. However, fin ray counts are complicated by the possible presence of a false annulus near age 1, resulting in overestimation of ages (Beamish and Harvey 1969).

The objective of our study was to validate the otolith as a structure for estimating yearly age of white suckers. We selected otoliths for the study because in studies comparing fish aging methods, otoliths were usually the most reliable (Chilton and Beamish 1982).

Study Area

Lake Taneycomo is a coldwater reservoir in Taney County, southwest Missouri. The lake, running from Table Rock Dam to Power Site Dam, is 37 km long. Cold water released from the hypolimnion of Table Rock Lake maintains the surface temperature in Lake Taneycomo at 6–14°C throughout the year (Fry and Hanson 1968).

Methods

We captured white suckers by electrofishing in Lake Taneycomo from a boat at night. Collections were made in the upper 8 km of the lake monthly or bimonthly from September 1991 to February 1993. Collections were restricted to the main channel of the lake in water 1.2–1.8 m deep. The total length (TL) and fork length (FL) of each fish were measured to the nearest millimeter. The largest pair of otoliths, the lapillae, were removed by dissection of the cranial region. Each otolith was rinsed with water, air dried, and stored whole until processed. Otoliths were placed in silicone-impregnated molds, embedded in Embed-812 polymer, and baked in an oven at 60°C for 48 h. A 0.75-mm-thick section was then cut from the transverse plane of each embedded otolith on a Struers Minitom with a diamond-tipped cutoff wheel. The cut section was sanded with 600 grit sandpaper to remove saw marks and polished on a felt pad with a 0.3-μm alumina suspension polishing compound (Beckman et al. 1988). Otolith sections were observed at 40 or 100× magnification under transmitted light with a compound microscope. Sec-

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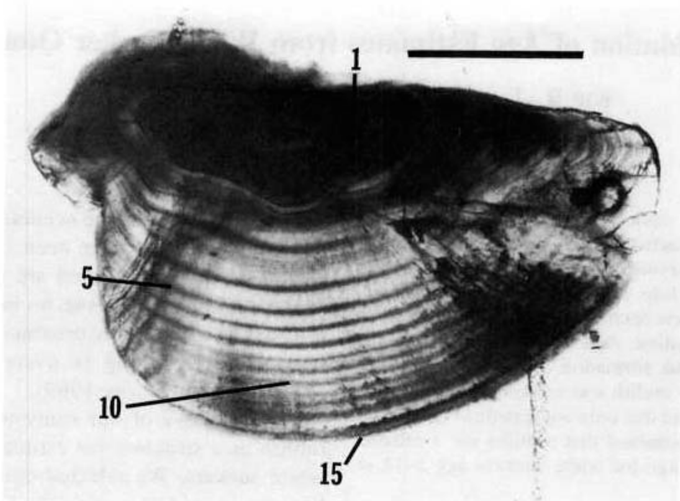

FIGURE 1.—Photomicrograph of a transverse section of a white sucker otolith under transmitted light. The otolith has 15 annuli and an opaque edge. Bar = 1 mm.

tions exhibited alternating opaque and translucent zones. We estimated ages by counting annuli (opaque zones) from the distal to the proximal edge of the sulcal groove, with one annulus equal to 1 year (Figure 1). The presence or absence of an annulus at the marginal (growing) edge of the otolith was recorded. The percentage of fish with an annulus at the marginal edge was plotted against the month of collection to validate the deposition of one annulus per year and to determine the time of annulus formation. Annulus counts and marginal edge analysis were conducted independently by two readers.

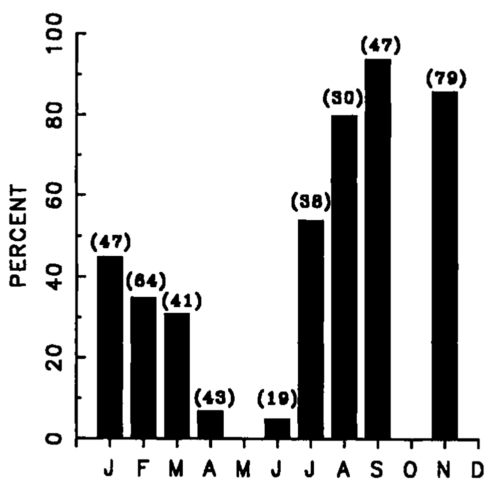

FIGURE 2.—Percent of otoliths with an annulus at the growing edge, by month (January to December). Sample sizes are given in parentheses.

Results and Discussion

Otoliths from 409 (88%) of the 467 white suckers collected from Lake Taneycomo were readable. Fish with an annulus at the marginal edge decreased from about 45% in February to a low of about 5% in May–July and increased steadily to a high of about 90% in September (Figure 2). The single annual peak indicated formation of only one annulus per year (Beckman et al. 1988). Opaque zones were deposited during fall and winter, primarily in August–December. Collections of age-0 fish showed that the first annulus was formed in the fall of the first year of life. This timing of annulus deposition corresponds to the timing of annulus formation observed by Beamish and Harvey (1969) in fin rays of Canadian white suckers.

Initial agreement for fish age between readers was 94% (385 of 409 otoliths). Agreement for the presence or absence of an annulus at the marginal edge was 100%. When counts disagreed, both readers recounted the annuli and conferred if necessary until agreement was reached. Age estimates were based on spawning periodicity and an assumed hatch date of April 1. Fish in our collections were 2–18 years old.

Earlier investigators obtained support for validation from age-frequency distributions (Figure 3) by following the progression of the strong 1986 year-class from one year to the next (Chilton and

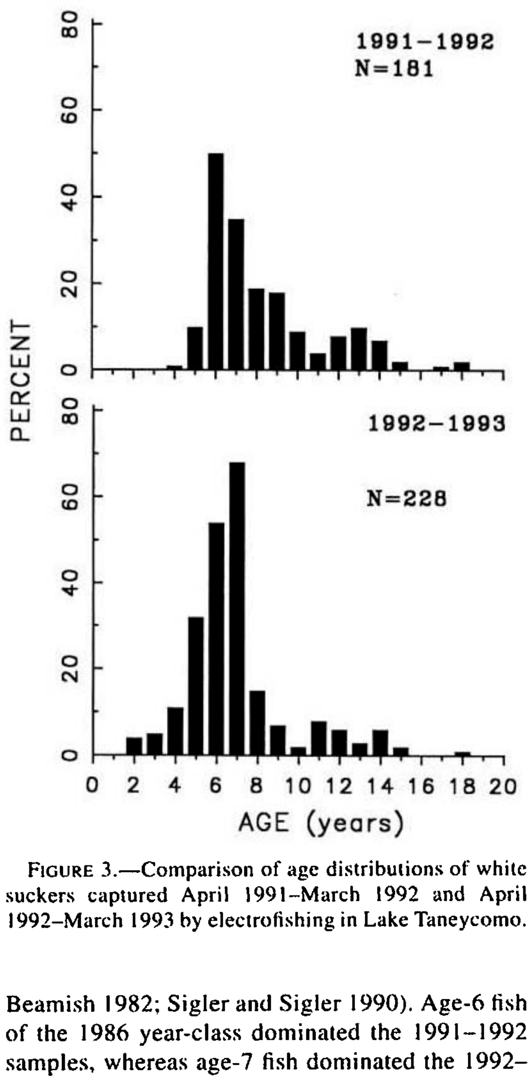

FIGURE 3.—Comparison of age distributions of white suckers captured April 1991–March 1992 and April 1992–March 1993 by electrofishing in Lake Taneycomo.

Beamish 1982; Sigler and Sigler 1990). Age-6 fish of the 1986 year-class dominated the 1991–1992 samples, whereas age-7 fish dominated the 1992–1993 samples.

Ages estimated from otoliths in our study differed from those reported in previous studies on white suckers in Missouri. Purkett (1958) aged white suckers from the Salt River in northeast Missouri by their scales and found few fish older than age 5. It has since been shown that white suckers reach sexual maturity at about age 5 and that scales are not reliable estimators of growth after this age because of reduced somatic growth (Beamish and Harvey 1969). In the present study, we used otoliths to determine valid ages for white suckers 2–18 years old, and we recommend the use of otoliths for aging white suckers.

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References

Beamish, R. J., and H. H. Harvey. 1969. Age determination in the white sucker. Journal of the Fisheries Research Board of Canada 26:633–638.

Beamish, R. J., and G. A. McFarlane. 1983. The forgotten requirement for age validation in fisheries biology. Transactions of the American Fisheries Society 112:735–743.

Beckman, D. W., C. A. Wilson, and A. L. Stanley. 1988. Age and growth of red drum, *Sciaenops ocellatus*, from offshore waters of the northern Gulf of Mexico. U.S. National Marine Fisheries Service Fishery Bulletin 87:17–28.

Chilton, D. E., and R. J. Beamish. 1982. Age determination methods for fish studied by the groundfish program at the Pacific Biological Station. Canadian Special Publication of Fisheries and Aquatic Sciences 60:1–101.

Fry, J. P., and W. P. Hanson. 1968. Lake Taneycomo: a coldwater reservoir in Missouri. Transactions of the American Fisheries Society 97:138–145.

Ovchynnyk, M. M. 1965. On age determination with scales and bones of the white sucker, *Catostomus commersoni* (Lacepede). Zoologischer Anzeiger 175:325–345.

Pflieger, W. L. 1975. Fishes of Missouri. Missouri Department of Conservation, Jefferson City.

Purkett, C. A., Jr. 1958. Growth of fishes in the Salt River, Missouri. Transactions of the American Fisheries Society 87:116–131.

Sigler, W. F., and J. W. Sigler. 1990. Recreational fisheries. University of Nevada Press, Reno.

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