North American Journal of Fisheries Management 27:782–784, 2007

DOI: 10.1577/M06-224.1

[Management Brief]

A Technique for Preparing Fin Rays and Spines for Age and Growth Analysis

JEFF D. KOCH* AND MICHAEL C. QUIST

Department of Natural Resource Ecology and Management, Iowa State University, 339 Science II, Ames, Iowa 50011, USA

Abstract.—Fin rays and spines are becoming more popular for age and growth analysis. A protocol for processing structures is first to mount the structure in epoxy, then to use a low-speed saw or handsaw to section the structure, and finally to estimate age from the resulting section. Unfortunately, scientists are often unaware of efficient techniques for mounting structures for such analyses. We describe a simple technique for mounting fin rays and spines in epoxy in preparation for sectioning. The advantages of this method include minimal preparation time, low cost, and little or no damage to hard structures. We have used this technique extensively to estimate age from the fin rays and spines of shovelnose sturgeon *Scaphirhynchus platorynchus*, catostomids, cyprinids, and ictalurids; however, this technique is useful for any species for which fin rays or spines are used in age and growth analyses. In addition, the technique is not limited to fin rays and spines; it can also be used to prepare a variety of other structures, such as scutes, otoliths, and brachiostegal rays.

Obtaining information on age structure and growth is important for describing fish population dynamics and guiding management activities. A number of structures are used to estimate the age of fish, but scales, fin rays, and spines are the structures most commonly used in age and growth analyses that do not require sacrificing individuals (DeVries and Frie 1996). Although scales are commonly used, they often fail to provide accurate age estimates for some species (Mills and Beamish 1980; Marwitz and Hubert 1995; Isermann et al. 2003). Fin rays and spines have also been used for age and growth analyses for numerous species (Beamish 1981), and their removal causes few deleterious effects to individuals (Collins and Smith 1996; Parsons et al. 2003).

The use of fin rays and spines for age and growth analysis has increased for several reasons. For instance, scales may be absent for some species (e.g., ictalurids and acipenserids), or they may provide unreliable estimates of age for species that cannot be sacrificed (e.g., endangered, threatened, or sensitive species; Metcalf and Swearer 2005). In such situations, a fin ray or spine may be the only age-estimation structure that can be obtained in a nonlethal manner. In addition, fin rays and spines often require less processing time than other structures (e.g., Isermann et al. 2003), and growth measurements can be obtained by means of modern image-analysis technologies.

Although a variety of techniques can be used to process fin rays and spines, a common approach is to cut thin cross sections (0.50–0.75 mm) of the structure for analysis. While not necessary for large structures, fin rays and spines are often mounted in epoxy or a similar substance before they are sectioned with a low-speed saw (e.g., Isomet, Buehler Inc., Lake Bluff, Illinois) or a jeweler's saw. Mounting places structures into a convenient, easy-to-handle form that otherwise may be small, fragile, or awkward to section. Mounted fin rays can be securely fastened into saw chucks to reduce slippage and vibrations that cause expensive sectioning blades to chip and break. Sections can then be mounted on glass slides or stored in coin envelopes. We describe a method for mounting fin rays and spines in epoxy that is efficient, safe, and inexpensive and that produces encapsulated structures and resulting sections that are convenient to read and archive.

Methods

Plastic 2.0-mL flat-top microcentrifuge tubes (Fisher Scientific, Pittsburgh, Pennsylvania) are used as molds, but larger-volume tubes can be used for large structures. Tapered bottoms are cut from the tubes, and caps are removed from the tube body and saved. The inner portion of the cap is filled flush with nondrying modeling clay obtained from any craft store. One end of the fin ray or spine is then placed into the clay (Figure 1). The clay holds the fin ray or spine upright at a desired angle and prevents the epoxy from adhering to the cap. After the fin ray or spine is secure in the clay, the body of the tube is placed over the upright structure. A 30-mL syringe is then used to fill the tube with epoxy mixture. Any clear epoxy probably will perform well; however, we use the Epoxicure brand of resin and hardener (Buehler Inc.). This epoxy produces a hard, clear-mounting medium that cures in 6–8 h and is relatively odor free. After the epoxy has cured, the cap is removed from the mold and a small

* Corresponding author: jkoch8@iastate.edu

Received September 15, 2006; accepted December 6, 2006
Published online June 25, 2007

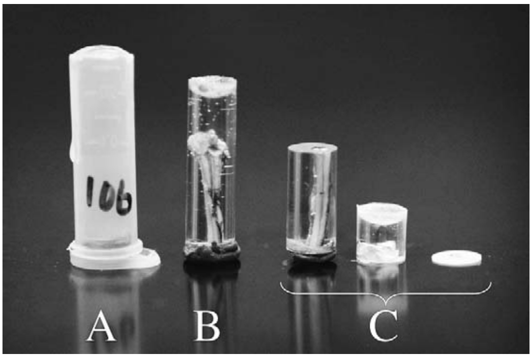

FIGURE 1.—Photograph of a modified 2.0-mL microcentrifuge tube used for mounting **(A)** fin rays or spines, **(B)** a catostomid fin ray, and **(C)** a sectioned encapsulated fin ray.

wooden dowel is used as a ram to push the encapsulated structure out of the tube. With the dowel in place on one end, a slight tap with a hammer on the top of the tube (i.e., the cap end) aids in removal of the epoxy-mounted structure. Both the cap and tube can be reused indefinitely.

Fiberglass resin, such as Bondo (Bondo Corporation, Atlanta, Georgia), is a less expensive option for a mounting medium; however, there are numerous drawbacks associated with the use of resin for mounting structures. One problem is that fiberglass resin produces semiopaque mixtures. Opaque mounts may obscure observation of encapsulated fin rays or spines, which makes sectioning in a standard location difficult. Other problems associated with using fiberglass resin include handling unpleasant materials such as petroleum jelly, which is used to prevent resin from bonding with mounting materials, and the resin itself, which may cause mounted structures to adhere to storage envelopes and saw chucks, may foul sectioning blades, and may pose inhalation or chemical-burn hazards.

To better illustrate our process, we use the marginal pectoral fin ray from the shovelnose sturgeon *Scaphirhynchus platorynchus* as an example. Specifically, we estimated the volume of epoxy and the amount of time required to mount fin rays. To determine whether processing time differed between mounted and unmounted fin rays, we timed the process of placing a fin ray into the saw chuck of an Isomet low-speed saw and cutting two 0.75-mm-thick sections from 10 mounted and 10 unmounted fin rays.

Results and Discussion

Approximately 1.7 mL of epoxy mixture was required to set one shovelnose sturgeon fin ray. At this rate, the Epoxicure brand of epoxy costs about US$0.06 per fin ray. For comparison, Bondo fiberglass resin costs approximately $0.01 per fin ray or spine. The process of cleaning residual tissue and debris from air-dried structures, removing excess portions of the structure not needed for analysis, and numbering envelopes and tubes with corresponding identification numbers required about 0.9 min per fin ray. In addition to the time required for mounting, approximately 1.6 min per fin ray was needed to place the encapsulated structure into the saw chuck and to cut two sections. Thus, the total preparation and sectioning time was approximately 2.5 min per fin ray, not including time required for the epoxy to cure. The time required to secure an unmounted shovelnose sturgeon fin ray in the saw chuck and cut two sections was approximately 2.1 min. Sectioning unmounted fin rays (2.1 min) required more time than sectioning mounted fin rays (1.6 min) because increased care was needed to avoid breaking the fin rays and saw blades (i.e., time to secure the fin ray in the saw chuck, slower sectioning speed, less downward force). Although the process of sectioning unmounted fin rays requires less total time, using our technique to mount structures has numerous intangible benefits. These include reduced slippage in saw chucks (i.e., reduced damage to sectioning equipment) and the production of convenient disk-shaped sections that can be easily stored and marked for archival purposes. In addition, fin rays not mounted in epoxy often flex while they are being sectioned, resulting in a slightly wedge-shaped section that makes reading difficult and may bias back-calculation estimates. In contrast, the epoxy does not flex and results in a section with uniform thickness. Finally, some structures are simply too small (e.g., from small fish) to be sectioned without first mounting in epoxy.

We have used this technique extensively for mounting pectoral fin rays of shovelnose sturgeon and fin rays and spines from catostomids, cyprinids, and ictalurids. Initially, we used the technique on small, delicate structures, but given the efficiency, low cost, and decreased damage to sectioning equipment, we now use this technique to mount fin rays and spines from fish of all sizes. Although we have used fin rays and spines as our example in describing this technique, the technique also may be used for other elongated structures, such as the brachiostegal rays used to age lepisosteids (Klaassen and Morgan 1974). We have also used this technique to mount shovelnose sturgeon scutes by removing the lateral edges of the scute and retaining the central portion for mounting. Once this technique has been learned, the time and cost associated with preparing structures in the manner described can be considered comparable to the time and cost associated with preparing scales and otoliths (e.g., Isermann et al. 2003). Most important, this technique produces a structure for age and growth analysis that is convenient for sectioning, analysis, and storage.

Acknowledgments

We thank Wayne Hubert and Bobby Compton for discussions associated with preparing fin rays and Matt Hangsleben for sectioning structures used in the study. We also thank Zac Jackson and three anonymous reviewers for providing comments on an earlier version of the manuscript. Use of trade names does not imply endorsement by the authors or Iowa State University. Funding for this project was provided by Iowa State University, Department of Natural Resource Ecology and Management.

References

Beamish, R. J. 1981. Use of fin-ray sections to age walleye pollock, Pacific cod, and albacore, and the importance of this method. Transactions of the American Fisheries Society 110:287–299.

Collins, M. R., and T. I. J. Smith. 1996. Sturgeon fin ray removal is nondeleterious. North American Journal of Fisheries Management 16:939–941.

DeVries, D. R., and R. V. Frie. 1996. Determination of age and growth. Pages 483–512 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Isermann, D. A., J. R. Meerbeek, G. D. Scholten, and D. W. Willis. 2003. Evaluation of three different structures used for walleye age estimation with emphasis on removal and processing times. North American Journal of Fisheries Management 23:625–631.

Klaassen, H. E., and K. L. Morgan. 1974. Age and growth of longnose gar in Tuttle Creek Reservoir, Kansas. Transactions of the American Fisheries Society 103:402–405.

Marwitz, T. D., and W. A. Hubert. 1995. Precision of age estimates of Wyoming walleyes from different calcified structures. Prairie Naturalist 27:41–49.

Metcalf, S. J., and S. E. Swearer. 2005. Nondestructive ageing in *Notolabrus tetricus* using dorsal spines with an emphasis on the benefits for protected, endangered, and fished species. Journal of Fish Biology 66:1740–1747.

Mills, K. H., and R. J. Beamish. 1980. Comparison of fin-ray and scale age determinations for lake whitefish (*Coregonus clupeaformis*) and their implications for estimates of growth and annual survival. Canadian Journal of Fisheries and Aquatic Sciences 37:534–544.

Parsons, G. R., J. J. Hoover, and K. J. Killgore. 2003. Effect of pectoral fin ray removal on station-holding ability of shovelnose sturgeon. North American Journal of Fisheries Management 23:742–747.