Journal of the Arkansas Academy of Science

Volume 41 Article 36

1987

Efficiency of Different Storage Methods for Preserving Lake Trout (Salvelinus namacush) Eye Tissue

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EFFICIENCY OF DIFFERENT STORAGE METHODS FOR PRESERVING LAKE TROUT *(Salvelinus namacush)* EYE TISSUE

Sea lamprey predation and over-fishing during the past 40 years have caused lake trout *(Salvelinus namaycush)* populations in the Great Lakes to be greatly reduced. The U.S. Fish and Wildlife Service in cooperation with State Fishery Agencies and the Canadian Government is working on a program to restore lake trout populations to the Great Lakes region. The National Fishery Research Development Laboratory, Wellsboro, Pennsylvania, is studying inheritance of cataracts in lake trout, as a recurring problem in hatchery fish populations. Brandt *et al.* (1986) studied the incidence of corneal cloudiness in transported large mouth bass and found that 80% of the eyes cleared within 20 to 36 hours after transport. It also was demonstrated that nutritional problems, pollution and other physical parameters may increase the incidence of cataracts in hatchery reared fish (Steucke *et al.*, 1986; Bodammer 1985; Ketola, 1979). As a part of the inheritance project, we conducted a study to determine how cataracts collected in field locations can best be stored for shipment to the laboratory for analysis without significant distortion or deterioration. An extended storage period would allow adequate time for collections at remote field stations to reach the lab for analysis.

Four methods of fish eye tissue storage were used: 1) dry storage at 40°F.; 2) storage in iced water; 3) frozen (without additional water); and 4) fixed in 10% buffered formalin solution. All samples were evaluated daily over 10 days to determine stage of tissue deterioration. A total of 20 fish (five fish per treatment) with cataracts were tested with the four methods. The cataracts were evaluated under low magnification (7 X power). Deterioration in eye tissue due to preservation method was defined in two stages. Stage 1 was indicated with a distinct ring around the deteriorating cataract; this was designated as a rim cataract (Orme and Lemm, 1974). Stage 2 was indicated by the disappearance of the rim and a progressive breakdown of lens tissue leading to an opague then solid white lens. This indicated destruction of the cataract.

The number of days to stages one and two for each treatment are shown in Table 1. The normal lake trout eye is lucid and shining and does not contain light colored spots or lines in the lens. Our initial findings revealed that for the nuclear cataract to remain visible in any of the storage methods, the cornea of the eye had to remain moist or refrigerated. Lake trout eye tissues were preserved longest without deterioration in both the refrigeration and water treatments.

Table 1. The average number of days to stages 1 and 2 for each storage treatment of Lake trout eye tissue.

TREATMENT	REFRIGERATED	WATER	FROZEN	FORMALIN
Number of days to stage 1	2	3	1	1
Number of days to stage 2	3	3	1	1

During the first three days of observations, 10% of the samples in the refrigeration method changed from normal to stage 1. From days 4-7, an additional 40% of the samples changed from stage 1 to stage 2. With each method what appears to be a halo or rim cataract developed in the outer layer of the lens. The halo appeared as a ghostly circle with or without feathered edges, and the posterior lens surface may have a mirror-like appearance. In the iced method, 20% of the fish developed the halo, and during days 3-5, 60% of the fish lenses deteriorated to stage 1. Fish eyes preserved by methods 3 and 4 reached stage 2 within one day of treatment. The freezer method caused widespread lesions in the lens tissue, which totally obliterated visual evidence of the cataract. In the formalin method, lesions in the lens tissue were filled with formalin solution which completely obscured the cataract after the second day of treatment. These results suggest that laboratory storage of corneal eye tissues may best be accomplished with refrigeration or water storage in ice for short term preservation of fresh tissues. Under field conditions without refrigeration, eye tissues may be adequately stored in iced water and remain relatively fresh for up to three days. This should provide ample time for transport to laboratories.

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REDISCOVERY OF THE SUCKERMOUTH MINNOW, *PHENACOBIUS MIRABILIS* (GIRARD), IN ARKANSAS

The suckermouth minnow, *Phenacobius mirabilis* (Girard), is primarily a northern and western prairie stream species and is quite common in sand and gravel-bottomed riffles of permanent streams throughout much of Indiana, Illinois, Iowa, Missouri, Kansas, and Oklahoma. It is known to occur today in every state bordering Arkansas. Although *P. mirabilis* was originaly described from the Arkansas River at Fort Smith (Girad, Proc. Acad. Nat. Sci. Phila., 8:165-213, 1856) is has always been rare in this state, and the lack of any recent records, despite numerous collecting attempts, suggested the possibility of its extirpation from Arkansas waters.

Until now, the only verified records of *P. mirabilis* from Arkansas were five pre-1940 collections, all from western Arkansas (Black, Ph.D. Dissertation, Univ. Michigan, Ann Arbor, 500 pp., 1940). However, on 16 July 1986, a single adult specimen of *P. mirabilis* was collected from Little Bay Ditch (St. Francis River drainage), 3 miles southeast of Jonesboro, Craighead County, Arkansas (R5E, T13N, Sec 18) by William E. Keith, Roland McDaniel, Bob Singleton, Mark Brady, and Bo Smith of the ADPC&E. The specimen, 73 mm in standard length, which will be deposited in the Arkansas State University Museum of Zoology in Jonesboro, possessed the following meristics: 46 lateral line scales, 8 dorsal rays, 7 anal rays, and 14 pectoral rays.

Little Bay Ditch is a channelized stream with a drainage area of approximately 45 square miles. Land use within this watershed is about 60% agricultural and 40% suburban. Habitat at the collecting site consisted of 70% shallow, slow-flowing pools and 30% shallow, fast-flowing riffles. The substrate consisted of 78.3% sand and 21.7% mud and silt. Brush, logs, and debris comprised the instream cover (17.5% of mean stream width). Other physical habitat features were: a stream gradient of 0.9 ft/mi, a mean stream width of 41.4 ft, a mean stream velocity of 1.01 ft/sec, an observed flow of 27.4 cfs, a mean depth of 0.9 ft, and a maximum depth of 2.5 ft. The following water quality data were recorded: water temperature 27 °C, dissolved oxygen 5.1 mg/1, pH 7.99, turbidity 90 NTU, Total suspended solids 142 mg/1, Total dissolved solids 302 mg/1, BOD_5 3.8 mg/1, BOD_{20} 12.4 mg/1, Total phosphate 0.3 mg/1, NO_3 + NO_2-nitrogen 0.29 mg/1, NH_3-nitrogen 0.38 mg/1, chloride 9.0 mg/1, sulfate 18.0 mg/1, conductivity 426 μmho, Total hardness 166 mg/1, alkalinity 174 mg/1, chlorophyll-a 13.4 μg/1, fecal coliform 700 counts/100ml. A substantial summer rain had occurred 2-3 days previously resulting in above normal stream flow.

The single *P. mirabilis* specimen was collected in a shallow sandy-bottomed riffle in swift current with a 110 volt AC backpack electric shocker. The most abundant fishes by number at the collecting site were: *Gambusia affinis* (83), *Ictalurus punctatus* (76), *Lepomis cyanellus* (70), *Lepomis megalotis* (22), and *Notropis venustus* (22). Other fishes collected at this site were: *Amia calva* (1), *Lepisosteus oculatus* (6), *Dorosoma cepedianum* (11), *Cyprinus carpio* (10), *Notropis atherinoides* (2), *Fundulus notatus* (1), *Ictalurus natalis* (5), *Lepomis macrochirus* (1), and *Aplodinotus grunniens* (10).

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EVALUATION OF STRIPED BASS *(MORONE SAXATILIS)* AGE FROM BODY SCALES, OPERCULAR SCALES, OPERCLES AND DORSAL SPINES

Scales have been used in aging fish for almost a century (Carlander, 1987). Age estimates from scales often lead to systematic errors if the fish are very slow growing, or are old (Casselman, 1983). It is further complicated by resorption of scales to provide calcium to fish during periods of deficiency associated with ovary development and cessation of feeding during spawning migrations (Simkiss, 1974). Ever since Scofield (1931) demonstrated the validity of using striped bass *(Morone saxatilis)* scales to determine age, aging of striped bass was done mainly by the scales (Horn, *et al.*, 1984). Collins (1982) stated that incidence of age disagreements between readers increased over 50% in older striped bass due to compacted nature of annuli at the scale margin. Heidinger and Clodfelter (1987), using known age fish, found that otoliths correctly aged striped bass while scales mis-aged 20% of fish. It is apparent that there is a need to search for a suitable hard part other than the body scale for easy and accurate assessment of fish age. The objective of our study was to compare and evaluate four calcified structures — dorsal spine, opercle, opercular, and body scales — in assessing the age of Beaver Reservoir striped bass.

A total of 28 striped bass (total length 635-979 mm) was obtained in August 1986 from the Beaver Lake National Striped Bass Tournament at Rocky Branch. Body scales from below the lateral line at the tip of the left pectoral fin, the left opercle, and the second spine from the dorsal fin were collected from each fish. The opercular scales were of two types — oval and circular. The ovoid scales were located at the antero-dorsal region of the opercles. The ovoid opercular scales were used in this study due to the clarity of annular rings compared to the circular scales. Opercular and body scales were cleaned, mounted on glass slides, and photographed by microfiche reader-printer. Opercles were cleaned of tissue by boiling them in water. Spine sections of 0.45-0.50 mm thickness were mounted on glass slides in Permount and examined under phase-contrast microscope and photographed. Fish were aged by counting the number of annuli on the scales and the translucent zones on the opercles and spine sections.

The spine annuli (translucent zones), even of the older striped bass, were very distinct and denumerable under the phase-contrast microscope. Hence, the spine ages were used as the basis of comparison with ages estimated from the other three calcified structures. Graphical comparison (Fig. 1) showed that the opercular scale and body scale ages were lower than the spine ages. The percentage agreements of opercle, body scale,