# A Comparison of Swimming Performance of Orangebelly Darters Collected by Kick-seining and Backpack Electrofishing

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# INTRODUCTION

Electrofishing is considered a standard method of capturing fishes for a variety of studies (Reynolds 1983). Indeed it may be superior in some environments when compared to other methods of collection (Layher and Maughan 1985). Efforts have been made to standardize techniques and improve on this method of sampling fishes (Burkhardt and Gutreuter 1995).

Of concern to managers and scientists employing this technique are injuries that may be incurred by the fishes sought. Studies have been performed on electrofishing injury, mortality, and physiological changes for several fishes, especially those that are harvested by anglers and may cause strains in relations between anglers and those capturing the fishes for management purposes or scientific studies (Horak and Klein 1967; McMichael 1993; Mesa and Schreck 1989; Roach 1962; Schreck et al. 1976; Sharber et al. 1994; Spencer 1967; Taube 1992; Whaley et al. 1978; and Zalewski and Cowx 1990.

During the collection of fishes for use in swimming performance tests it was noted by the authors of this paper that many mortalities were observed among darters of the genus Etheostoma. Additionally Layher (1993) noted differences in swimming performance of golden shiners (Notemigonus crysoleucas) that were collected by seining and those collected by electrofishing. As the authors considered electrofishing to be a

superior method of collection for darter species inhabiting positions in the substrate as compared to seining, it was decided to conduct a simple preliminary test to compare the swimming performance of one darter species when collected by electrofishing to members of the same species collected by kick-seining.

## MATERIALS AND METHODS

Orangebelly darters (Etheostoma radiosum)were collected from a riffle area in the headwaters of the Ouachita River in Arkansas. Eight darters were collected by disturbing the stream substrate with a kicking motion. Darters were collected with small mesh dipnets held against the stream bottom. Seven darters of the same species were then collected using a backpack electrofishing unit. Small bursts of electricity were used for collection. The collector depressed the switch for milliseconds and released the switch so that a continual burst of power was not employed. Darters were transported to the laboratory in large live wells filled with water from the point of collection.

Specimens collected were placed in 20-gallon aquaria. Temperature was held constant in both aquaria housing darters collected by the two methods. Orangebelly darters were fed commercially prepared bloodworms in a similar manner for twenty days. After the twenty day waiting period no mortalities or visual signs of injury were noted for members of either group.

The apparatus used to determine swimming endurance was similar to that described by Matthews et al. (1990) and modified by Layher

(1993). Christened the ichthyonatometer (Ralston and Layher 1997), the system consists of a submersible pump with an 18-inch (45.72 cm) riser with a pipe diameter of 1.5 inches (3.81 cm). This discharges water through a diverter valve controlled by the valve handle, which is equipped with a guide marked in degrees for regulating flow velocity. Bushings in pipe size divert water flow through a 3 inch (7.62 cm) clear vinyl pipe that allows observation. A petcock valve allows air to be bled from the tubing, allowing the pipe to fill completely. An access plug located at the end of the clear tubing provides a means of fish entry and exit from the system. Strainers are located at either end to prevent the fish from escaping the system and to prevent eddy formation within the swimming chamber. Flows are circualated by the pump from a 200-gallon fiberglass tank where the pump is located, through the system and returned to the tank.

Water flow calibration was conducted by allowing the pump to run at a known setting and time was recorded. The volume of water pumped was measured in milliliters. Water volume per unit time was divided by the cross-sectional area of the pipe to obtain velocity. This process was repeated five times at five diffferent settings to obtain calibration values. Valve settings (Vset) used were regressed against velocities, obtaining a regression equation to calculate velocities at any setting: Velocity (cm/sec) = 4.168 + 11.941(Vset). In these trials velocities from 0 to 60.0 cm/sec were achieved.

Fish were placed in the unit one at a time. Velocity was recorded at the point at which the darter began to exhibit some

difficulty in maintaining its position. The velocity at which the darter was swept back against the current was also noted. Velocities were increased very gradually but continuously in these experiments. Means for the two groups of darters were compared for diffficulty and the cannot hold position. The mean lengths of darters used in the two groups were also compared to insure that size groups were similar as fish length may influence swimming performance.

## RESULTS

No significant difference was found between the two groups of darters for total length using a student's T-test (prob > T = 0.840). Differences between means for the point at which darters in the two groups experienced difficulty in maintaining position were significant at the 0.181 level using a T-test to compare means. However, the point at which the darters could no longer hold position were significant (Table I). Darters collected by electrofishing exhibited lower velocities at which they failed and were swept back in the chamber by the current.

Reasons for this poorer performance were not investigated. However various researchers have investigated physiological changes, injuries to musculature, and injuries to spinal columns in other fishes. Because these specimens used in this study were held for a considerable time before being subjected to swimming performance trials it appears that causes for decreased performance may be rather long term. When collecting fishes for various

studies these data suggest small fishes such as darters may be subjected to more difficult survival regimes than their nonshocked counterparts. Increased predation of the darters or more difficulty in obtaining food items may be of concern. Sampling streams where a species occurs, if it occurs no where else, may present a threat to their continued existence and caution should be used. When collecting species that are quite common or that inhabit other areas in the stream sampled from which recruitment could occur, electrofishing injury or resulting poor performance of the fishes subjected to the sampling technique may be of less concern.

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Table I. Mean lengths of orangebelly darters collected by two sampling methods.

| Kick-seined | Electrofished |
|---|---|
| Mean= 49.0 mm | Mean= 49.7 mm |
| SD= 8.618 | SD=4.347 |
| n= 8 | n= 7 |

Table II. Mean velocities at which orangebellly darters have difficulty maintaining position and at which they cannot hold position by collecting method.

| Kick-seined | | Electrofished |
|---|---|---|
| | Difficulty | |
| Mean= 28.049 cm/sec | | Mean= 23.785 cm/sec |
| SD= 6.807 | | SD= 3.798 |
| | Cannot Hold | |
| Mean= 37.005 cm/sec | | Mean= 29.755 cm/sec |
| SD= 8.443 | | SD= 3.384 |