

Winter Sampling of Benthic Stream Fishes in Minnesota With a One-Man Net

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ABSTRACT—Newly designed one-man nets were used extensively between 1973 and 1977 to collect fishes in a variety of stream habitats in southeastern Minnesota. They proved to be especially effective in winter sampling of benthic stream fishes such as *Etheostoma zonale*, *Etheostoma caeruleum*, *Percina phoxocephala*, *Percina shumardi*, *Percina caprodes*, *Rhinichthys cataractae*, and *Noturus flavus*. Effectiveness and potential importance of these one-man nets as winter sampling devices was demonstrated during three consecutive winters of use in the Cannon River at Welch, Goodhue County, Minnesota.

Although the need for investigating the winter ecology of fishes has long been recognized (Hubbs and Trautman, 1935) it is quite obvious that very few ichthyologists working in regions where there is considerable ice cover during the winter months have completed such studies. The paucity of winter field studies on etheostomatine fishes is especially noticeable. With the exception of studies by Daiber (1956), Fahy (1954), and Erickson (1977), the literature on the winter ecology of darters is in the form of incidental observations of limited scope (Jaffa, 1917; Lake, 1936; Petravicz, 1936; Raney and Lachner, 1939; Starrett, 1950; and Karr, 1964).

There seem to be only two reasonable explanations for the noticeable lack of winter investigations of darters. Ichthyological investigators have either made little or no attempt to collect data during the winter months or their attempts have been largely unsuccessful. If the latter is true, it is quite possible that failure was the result of improper equipment and techniques. This paper reports on some equipment and techniques that have proved to be quite successful in collecting darters and other riffle inhabitants during the winter months.

During the course of a life history study of *Etheostoma z. zonale*, the banded darter, in southern Minnesota, it became necessary to devise a one-man net that could be used to sample most stream habitats on a year-round basis. The one-man nets proposed by Strawn (1954) and Speare (1967) did not seem practical, especially for use in the larger streams of Minnesota during the winter. Therefore, a new one-man net was designed that consisted of three components: a detachable handle unit (1.8 m); a rectangular steel rod frame (96 x 33 cm); and a deep bag (1.2 m) made of 1.6 mm square mesh nylon netting. Three such nets were built in 1973 and have been used extensively in Minnesota streams since that time. They have proved to be durable, easy to use and transport, and very effective in collecting darters and numerous other fish species. (See cover, Figure 2 and Figure 2).

Two basic techniques can be employed by the single operator of this net. In the first, the net is cast upstream and dragged behind the user moving downstream. Downward pressure applied through the handle helps keep the bottom of the net in close contact with the substrate. This net does

not slip over rubble or roll up in vegetation as the lead line on a seine often does. Rather, it turns rubble over upon contact, thus enhancing one's chances of collecting bottom-dwelling fishes. Since the collector precedes the net, any large obstructions (e.g. boulders or logs) can be avoided easily by lifting the net off of the bottom and over them. This technique works well in all wadable depths and over all types of substrate as long as the current is slow to moderate. The method is also very effective when sampling close to river banks with overhanging vegetation and in habitats with considerable submerged and emergent vegetation.

A second technique, long used by ichthyologists but first described by Karr (1963), must be employed when collecting in areas with a moderate to swift current. The net is placed firmly on the substrate downstream from the collector, and as he stirs up the substrate with his feet, fishes are dislodged and swept into the net by the current. Schenck and Whiteside (1976) found this method to be more efficient than seining to collect *Etheostoma fonticola* in heavily vegetated areas. When several collectors are working together, this technique can be expanded by placing two or three one-man nets side by side across a given section of stream. Such a barrier is much easier to set up and maintain in fast, deep water than is a stretched-out seine.

These one-man nets played a unique role in winter stream sampling in southeastern Minnesota from 1974 to 1977. Although most Minnesota rivers freeze over entirely at some time during the winter, small channels often remain open in riffles with swift currents. These channels of open water were often only 0.5 to 2 m wide and in areas where the clearance between the ice and the stream bed was less than 0.5 m. With one-man nets, fishes were effectively sampled not only in the open water areas of these channels but also under the ice on either side (Figure 1 which appears as cover illustration). Successful winter field work was carried out at ambient air temperatures as low as -30 C. At such low temperatures, however, the netting material tended to ice-up to such an extent that the net became extremely heavy and unmanageable. In such instances it was necessary to have a spare net on hand. The results of three consecutive winters of collecting with one-man nets on the Cannon River at Welch, Goodhue County, Minnesota (Table 1), demonstrate their effectiveness at catching a variety of fishes as well as their potential importance as winter sampling devices.

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TABLE 1. Fishes collected with one-man nets during three consecutive winters from the Cannon River

	Winter of 1974-75 (No. of fishes)			Winter of 1975-76 (No. of fishes)			Winter of 1976-77 (No. of fishes)		
	20 Dec	16 Jan	8 Feb	10 Dec	17 Jan	18 Feb	13 Dec	15 Jan	12 Feb
<i>Rhinichthys cataractae</i>		16			42	44	47	23	90
<i>Notropis atherinoides</i>	8								
<i>Notropis dorsalis</i>	8								
<i>Notropis stramineus</i>	7								
<i>Campestris anomala</i>								1	2
<i>Hypentelium nigricans</i>								1	
<i>Moxostoma</i> sp. (Juvenile)								2	1
<i>Noturus flavus</i>	1	17	17		11	2	3		4
<i>Percina caprodes</i>		4	2	13	3	6	2	1	4
<i>Percina maculata</i>				1					
<i>Percina phoxocephala</i>		1	1	3			7	2	10
<i>Percina shumardi</i>		7	4	2		1			1
<i>Etheostoma nigrum</i>	7	3	2						1
<i>Etheostoma caeruleum</i>	22	115	92	26	33	28	66	28	79
<i>Etheostoma s. zonale</i>	54	79	70	41	11	10	58	11	78



Figure 2. — The one-man net's size is indicated in this photo. Cover illustration shows it in use.