QUANTITATIVE SAMPLING OF WARM - WATER STREAM FISH WITH DETONATING CORD

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Abstract: Quantitative samples of fish were obtained from warm-water streams with detonating cord. Preliminary results indicate this explosive is an effective tool for fish sampling in streams. Numbers of fish collected per kilometer of stream ranged seasonally from 200 to 473.

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Platts (1974) successfully sampled cold water streams of Idaho with detonating cord. In order to avoid utilization of fish toxicants we employed this technique as a quantitative sampling method in streams of the Blackwater River system. We felt that we would not be able to completely neutralize a fish oxicant, such as rotenone, in the swift streams of this river system. We also desired an easily portable, quantitative sampling system and one which would be effective at low water temperatures.

The upper reaches of the Blackwater River and its upland tributaries could not be effectively sampled with other conventional devices such as seines, trawls, gill nets or electrofishing due to snags, swift currents, shallow depths and low conductivity. Seines were effective in capturing minnows, darters and small individuals of other fishes but did not obtain specimens of large individuals and adults of such fishes as centrarchids and suckers.

METHODS

The Blackwater River system is in northwest Florida and drains into Pensacola Bay (Gulf of Mexico). The upper river and upland tributary streams are 15 to 30 m in width, shallow (0.5-2.0 m), and moderately swift (20-50 cm/sec). Substrates are clean sand with little or no aquatic vegetation. Conductivity is normally less than 30 micromhos/cm. Total hardness and pH are generally low. Waters are usually clear but tannin-stained. Nutrient concentrations are low. Water levels fluctuate rapidly with seasonal rainfall. The watershed is relatively undeveloped, since most of the basin lies within Blackwater River State Forest.

Six sampling stations were established, 2 on the main stem of the river, and 4 on upland tributary streams. Each station was sampled once during fall 1976 and both winter and spring 1977. In addition to standard samples, a one-time tag-recapture experiment was conducted to evaluate efficiency of the technique.

Detonating cord is a flexible, rope explosive used industrially as a detonator for other explosives. A nonexplosive outer wrapper encloses a high explosive core of pentaerythritol tetranitrate (Anon. 1969). Detonating cord is relatively stable, requiring a blasting cap for initiation of explosion. We employed 50 grain reinforced Primacord (Ensign-Bickford Co.). The detonating cord was fired with a non-electric Dupont No. 6 blasting cap (Dupont de Nemours & Co.) and safety fuse. (Mention of tradenames does not imply endorsement by the Florida Game and Fresh Water Fish Commission.

A standard sampling area consisted of 30 m of stream. The detonating cord was placed on the bottom parallel with shorelines. Though the detonating cord sinks it was necessary to hold it in place with stakes and bricks. The cord may also be arranged into parallel lines, the number of lines depending upon the width of the stream. The free end of the explosive was taped to a steel rod extending above the stream surface and the fused blasting cap then taped to the detonating cord.

Approximately 5 m downstream from the explosive array, a block-net (9.5 mm bar-mesh size) was placed across the stream. Warning signs were placed in the river and at land access points. After the charge was fired, fish were recovered from the block net or picked up with dip nets. Shorelines were also searched for dead fish swept into shallows by eddy current. In the tag-recapture experiment, 10 tagged adult sunfish (bluegill and redear sunfish) were released into the center of a standard 30 m sample area approximately 5 min prior to the explosion. The marked fish were hatchery raised individuals.

RESULTS

A total of 191 fish, representing 22 species, was collected from the 18 samples (Table 1). Expanded, these figures provide an estimate of 473 fish/km of stream during the fall, 200 in winter, and 389 in spring. Major species by number were the weed shiner (*Notropis texanus*) (33.0%); blackbanded darter (*Percina nigrofasciata*) (10.5%); spotted sucker (*Minytrema melanops*) (7.3%); sailfin shiner (*N. hypselopterus*) (5.8%); speckled madtom

Table 1. Fish collected with detonating cord from six stations in the upper Blackwater River system, Florida. (Figures in parentheses indicate weights in grams.) Common names follow Bailey, et al. 1970.

Species	*Fall* Number		*Winter* Number		*Spring* Number	
Southern brook lamprey (*Ichthyomyzon gagei*)			1	(1.7)		
Redfin pickerel (*Esox americanus*)	1	(15.0)				
Chain pickerel (*E. niger*)	1	(123.0)				
Blacktail shiner	6	(146.0)	4	(101.0)		
Weed shiner	13	(5.2)	20	(56.5)	30	(102.0)
Sailfin shiner	10	(12.8)			1	(2.2)
Flagfin shiner (*N. signipinnis*)	2	(2.0)			2	(2.8)
Longnose shiner (*N. longirostris*)	1	(3.0)			2	(3.7)
Blacktail redhorse (*Moxostoma poecilurum*)	3	(520.0)	3	(1,095.0)		
Spotted sucker (*Minytrema melanops*)	2	(384.0)	3	(1,381.0)	9	(5,291.0)
Sharpfin chubsucker (*Erimyzon tenuis*)					1	(251.0)
Speckled madtom	7	(20.6)	1	(7.0)	3	(9.0)
Black madtom (*N. funebris*)					1	(3.2)
Pirate perch (*Aphredoderus sayanus*)	3	(11.8)				
Blackspotted topminnow (*Fundulus olivacens*)			1	(8.0)	2	(8.0)
Spotted sunfish (*L. punctatus*)	4	(68.2)			2	(91.0)
Bluegill (*L. macrochirus*)	5	(54.1)			1	(21.0)
Longear sunfish	4	(152.0)			6	(257.0)
Spotted bass	4	(383.0)	1	(313.0)	4	(1,131.0)
Rock bass (*Ambloplites rupestris*)	1	(67.0)	2	(379.0)	3	(378.0)
Blackbanded darter	17	(54.9)			3	(16.0)
Etheostoma sp.	1	(0.1)				
Total	85	(2,032.7)	36	(3,342.2)	70	(7,566.9)
Southern brook lamprey	473.3	(2,032.7)	200.0	(3,342.2)	389.0	(1,261.1)
Sample Mean	14.2	(338.8)	6	(557.0)	11.6	(1,261.1)
No. per kilometer	473.3		200.0		389.0	
Biomass (kg) per km	11.3		18.6		42.0	

(*Noturus lpetacanthus*) 5.8%); blacktail shiner (*N. venustus*) (5.2%) and longear sun fish (*Lepomis megalotis*) (5.2%). Principal game fish were longear sunfish and spotted bass (*Micropterus punctulatus*) (4.7%).

In the tag-recapture experiment, 8 of the 10 tagged fish were recovered, indicating 80 percent efficiency of the technique.

DISCUSSION

We found detonating cord to be a satisfactory technique for sampling fish of warm-water streams. However, we consider our results to be preliminary. Further studies should be conducted in a wide range of stream types. In order to verify the efficiency of the method, additional tag-recapture experiments should be performed using fish of species other than bream (*Lepomis*).

Several limiting factors were confronted. While depth, width and current velocity do not prevent emplacement of the detonating cord these factors do affect the facility of block net emplacement. As any of these factors increase in magnitude, pressure upon the net increases and the effort required to maintain the net increases. Degree of effort required to maintain the barrier also increases with decreasing net mesh size. However, these limitations also apply to nets employed in applications of fish toxicants such as rotenone. The explosive, however, kills fish instantly. Netting time is thus much shorter than required for rotenone sampling.

While moderate to swift currents facilitate recovery of fish by sweeping them into the net, slow currents may not deposit all fish downstream. In such cases it would be necessary to visually examine the stream bed for unrecovered fish. The method appears to have limited application in still or sluggish waters.

Other advantages of the explosive include ease of use, portability, nonselectivity of species, absence of detoxification requirements, and wide temperature tolerance. We utilized the explosive at stream temperatures as low as 3.5 C.

It would not be appropriate to close this discussion without the warning this method involves use of a high explosive. Safety precautions applicable to all explosives should be exercised.

LITERATURE CITED

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