Manual of Fisheries Survey Methods II: with periodic updates

Chapter 22: Guidelines for Sampling Warmwater Rivers with Rotenone

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TOC
NEXT PAGE
PREVIOUS PAGE
CITATION

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TOC

NEXT PAGE

PREVIOUS PAGE

CITATION

Chapter 22: Guidelines for Sampling Warmwater Rivers with Rotenone

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Michigan contains a number of medium- to large-sized warmwater rivers, some of which attract significant angler attention. Nearly all of these presently have good-to-excellent water quality and have the potential to be high quality fishery and recreational resources.

Riverine fishes are very difficult to sample with conventional methods. Spot sampling with rotenone has proven to be effective tool (Seelbach et al. 1994). Rotenone samples reveal not only presence/absence of all species – both of sport and conservation interest – but also provide a true picture of relative numbers in the fish community. Periodic rotenone surveys are recommended for complete inventories of warmwater river fish communities and for monitoring the status of these communities through time. Rotenone surveys are not intended to provide annual population estimates.

Rotenone and other fish toxicants are valuable fisheries tools but must be used very judiciously to avoid over-kill of fish. See "Policy and Procedures for the Use of Piscicides and other Compounds by Fisheries Division in Ponds, Lakes, and Streams" dated March 29, 1993. Any project must be preceded by extensive public education and discussion and conducted with great care.

TOC
NEXT PAGE
PREVIOUS PAGE
CITATION

22.1 Sampling methods

Major river systems should be surveyed with a minimum frequency of once every 20 years. River systems, or portions of systems, that are actively managed or receive a high degree of angler interest should be surveyed more frequently.

The sampling methodologies described below are based on those described by Nelson and Smith (1980) and Towns (1987).

Sampling stations should be selected based on (1) being representative of the particular river reach, (2) having reasonable access, and (3) having velocities sufficient to carry fish downstream to the barrier net. Stations should be approximately 600-700 feet in length, although longer and shorter lengths may be used to accommodate differences in stream size and unusual channel structure or habitat. Measurements should be taken at each station to describe the morphology of the river and to allow calculation of rotenone and potassium permanganate concentrations. Measurements should include water temperature, stream discharge, and station length and average width. Stream discharge can either be measured using a current meter or extrapolated from discharge measured at a nearby U.S. Geological Survey gaging station.

At the downstream end of the station, a blocking net is placed across the river. Where possible, it is best to add a second net approximately half way through the station. This mid-station net will collect upstream fish which might otherwise settle to the stream bottom and be lost. An additional net is set across the upstream end of the station to prevent migration of fish out of the station. Nets of several lengths and depths may be needed to accommodate the various station morphologies encountered. Mesh sizes may range from small mesh (3/16 inch stretch), which can be used with low current velocities, to larger mesh (2-inch stretch), which can be used at higher velocities. Small mesh nets can be assumed to capture all fish of 2 inches in total length and larger and should be used whenever possible. Larger mesh nets will allow small fish to pass through; these are subsampled using several small-mesh fyke nets placed just downstream from the blocking net at random intervals across the

river. The catch of these fyke nets can be extrapolated across the total cross-sectional area of the river to yield an estimate of the total number of small fish that pass through the blocking net.

The float line of the barrier net should be attached to a head rope that had been previously set across the river and pulled taut. At most stations braided dacron line can be used for this head rope, however, steel aircraft cable should be substituted at stations where the river is wide and the current is swift. The lead line of the net is held in place with trap net anchors. The lead line should not be anchored until the treatment is ready to begin. This helps to minimize the build-up of debris in the net that tends to pull the float line under the water's surface. In high velocity situations, it may be necessary to attach additional lines to the head rope to prevent downstream sag of the net. These lines should be directed upstream and attached to overhead tree limbs or similar structures.

Rotenone should be applied in most warmwater rivers at a concentration of 3 ppm. For this concentration apply 5 gallons of rotenone per each 100 cfs of river discharge; this amount should be metered into the river to provide a constant concentration throughout an exposure time of 35 minutes. Other concentrations may be calculated on a straight-line proportional basis (3 ppm/5 gallons). Two ppm of rotenone is suggested for clear headwater streams that have low turbidity, low amounts of silt substrate, and where rotenone-resistant fish species are expected to be absent. Even lower concentrations should be used if this method is employed in cold-water trout streams. In rivers with high turbidity, where silt and organic detritus are the predominant substrates, and where large numbers of resistant fish (for example carp and bullheads) are expected, up to 5 ppm of rotenone may be applied. Silt and organic detritus absorb rotenone and thus reduce its effectiveness. Rotenone concentrations higher than 5 ppm should be avoided. In stations with large slow-water pools the leading edge of the rotenone plume is rapidly diluted by the static water volume and either the concentration or exposure time of rotenone must be increased to ensure adequate results. The addition of fluorescein dye at the beginning of rotenone application is useful for tracking the progress of the treated water mass.

TOC
NEXT PAGE
PREVIOUS PAGE
CITATION

The method used to apply rotenone is based upon water depth at the upstream limit of the station. When the river is shallow and easily wadable, rotenone can be applied by spraying with one or more water pumps. Where the water is too deep to wade, rotenone can be applied from a boat; the rotenone is gravity fed into the outboard motor back-wash while the boat moves back and forth across the river.

Immediately downstream from the blocking net, the rotenone is neutralized by adding potassium permanganate to the river. In most warmwater rivers a concentration of 5 ppm permanganate is sufficient to detoxify 3 ppm rotenone. The permanganate should be metered into the river to provide a constant concentration for 45 minutes. In other situations the concentration of potassium permanganate needed can be calculated using the ratio of 5 parts permanganate to 3 parts rotenone. Permanganate amounts can also be determined according to the ratio of 15 pounds of permanganate to 1 gallon of rotenone. When the flow of rotenone through the station is impeded by a large static water volume, additional application time will be required. In situations where 5 ppm of rotenone has been employed, up to 8.5 ppm of potassium permanganate should be used. Permanganate concentrations above 12 ppm are likely to cause fish mortalities. Extra potassium permanganate or longer exposure times may be used in trout streams where there is great public concern over inadvertent downstream fish mortalities; in warmwater streams the use of extra permanganate is generally not necessary.

The potassium permanganate is first dissolved in river water placed in spray barrels and then sprayed into the river with water pumps. In this instance a double-intake pumping system is required. The smaller intake hose (approximately 3/4" to 1**",** with shut-off valve) is placed in the spray barrel and the main intake in placed in the river. The rate of permanganate addition is controlled by regulating the small intake valve. Alternatively, the permanganate may be pumped directly from a perforated spray barrel placed directly in the river. In this case, dry permanganate is added to the perforated barrel at a predetermined pound-per-minute rate. At large-river stations several detoxification units are necessary. Two workers are needed per detoxification unit – one to spray and one to add permanganate throughout the spraying period. To ensure detoxification in the event of a pump

failure, it is essential to have at least one back-up pump at the detoxification station, pre-tested, primed, and ready.

As many fish as possible should be collected from the station. Dead and distressed fish can be immediately collected with hand nets. Dead fish that accumulate on the barrier net may be allowed to remain. Several sweeps of the entire study area should be made by boat and/or wading to collect fish that settle to the bottom, are washed ashore, or become lodged in obstructions. When it is determined that no additional dead fish are accumulating on the barrier net, the net can be lifted and the fish removed.

22.2 Data collection

The following data collection procedures should be followed:

1. Count and identify to species all fish. If necessary, ice can be used to help preserve fish during identification. Save questionable specimens for verification by experts.
2. Weigh fish in aggregate by species.
3. Measure total length (round down to the nearest inch) of all game fish, sucker species, and carp. For extremely abundant sucker species, individuals should be separated into "less than or equal to 3 inch" and "larger than 3 inch" groups. Individuals in the first group can simply be counted and weighed in aggregate. A random subsample of 400 individuals of the latter group should be measured. The length range of individuals of other species should be recorded.
4. Take scale samples for age analysis from ten fish per inch group for all game fish (take pectoral spines from channel catfish). In typical swift-water reaches, "game fish" include smallmouth bass, rock bass, northern pike, muskellunge, channel catfish, and walleye. In slower reaches "game fish" might also include largemouth bass and crappies.

TOC
NEXT PAGE
PREVIOUS PAGE
CITATION

22.3 Report format

Results from each survey site should be reported on standard fish collection (R–8058) and fish growth analysis (R–8070) forms, or their electronic equivalents in the Fish Collection System. A Fisheries Technical Report should be written following surveys of major river systems. Report formats should follow that of Towns (1987).

22.4 References

Nelson, D. D., and D. W. Smith. 1980. Rotenone stream fish sampling in Michigan. Michigan Department of Natural Resources, Fisheries Technical Report 80-2, Ann Arbor.

Seelbach, P. W., R. N. Lockwood, and J. R. Ryckman. 1994. Efficiency of sampling river fishes with rotenone. Michigan Department of Natural Resources, Fisheries Research Report 2009, Ann Arbor.

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TOC
NEXT PAGE
PREVIOUS PAGE
CITATION