



# Standard Practice for Sampling Fish with Rotenone<sup>1</sup>

This standard is issued under the fixed designation D4131; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers determination of the quantitative and qualitative species composition of fish in a specified area. The successful use of this technique is dependent on: (1) preventing fish from escaping the sample area and (2) retrieving all affected fish, which may take up to three days.

### 1.2 Advantages:

- 1.2.1 Easily detoxified.
- 1.2.2 All native freshwater fish are susceptible, but it has low toxicity to mammals and birds.
- 1.2.3 At low concentrations fish toxicity depends on species, age, and size.
- 1.2.4 The suffocating action is reversible.

### 1.3 Limitations:

- 1.3.1 It is less effective in cold (below 20°C) and highly alkaline water.
- 1.3.2 Smaller fish and those without air bladders usually do not float.
- 1.3.3 Completely random selection of sample areas is not possible.
- 1.3.4 Overkill beyond sample area can sometimes occur.
- 1.3.5 Food web organisms may be eliminated.

1.4 *Applications*—this practice is useful in both short- and long-term studies for management and impact assessment purposes. It is adaptable to both lotic and lentic situations in littoral and limnetic areas.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. For specific hazards, see Section 6.*

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.24 on Water Microbiology.

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## 2. Referenced Document

- 2.1 *ASTM Standards*:<sup>2</sup>  
D1193 Specification for Reagent Water

## 3. Summary of Practice

3.1 The sample area is blocked off with a small mesh net(s) and the volume of water to be treated is calculated. The required quantity of rotenone is diluted and distributed throughout the water column in the sample area. All fish should be affected and they should be collected for processing (1).<sup>3</sup>

## 4. Apparatus

- 4.1 *Vessels*, for measuring and mixing rotenone and for collecting fish.
- 4.2 *Chemical Applicator*, for boat use.
  - 4.2.1 *Venturi Siphon or Automatic Boat Bailer* that attaches to outboard motor's cavitation plate.
  - 4.2.2 *Gasoline-Powered Pump and Weighted Perforated Hose*.
- 4.3 *Block-Off Net(s)* ¼-in. (6.4-mm) bar mesh for lake-reservoir and small stream use or ¾ to 1-in. (19 to 25-mm) bar mesh for larger streams).
- 4.4 *Dip nets*, for collecting fish.
- 4.5 *Flat-Bottom Boats*, 12 to 14-ft or larger.

## 5. Reagents

5.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.<sup>4</sup> Other grades may be used,

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The boldface numbers in parentheses refer to a list of references at the end of this standard.

<sup>4</sup> *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean Type II reagent water conforming to Specification **D1193**.

5.3 *Rotenone*, emulsion with 5 % active ingredient **(2)**.

5.4 *Potassium Permanganate Crystals*, any size.

## 6. Hazards

6.1 Avoid skin-eye contact and ingestion.

## 7. Procedures

7.1 In lakes and reservoirs, fish samples can be obtained if the block-off net is long and deep enough.

7.1.1 Four to six people and two boats are usually required to conduct a 1-acre (4046 m<sup>2</sup>) survey. The selected sample area is first secured and delimited with the block-off net(s). Verify that the nets are securely on the bottom with SCUBA divers or if shallow by walking along the net. The volume of water to be treated is calculated from the net perimeter and the average of several depth readings through the area.

7.1.2 The target concentration of rotenone in the sample area is \_\_\_ oz (0.5 to 2.0 mg/L) depending on water conditions and whether a partial or complete kill is required (0.5 to 2 gal (1.89 to 7.57 L) 5 % liquid per 3 acre-ft will give this concentration). Mix the required amount of rotenone in a tub and dilute it with enough water to disperse uniformly over the sample area.

7.1.3 Applied first along the block-off net(s) by pumping through a weighted perforated hose or by a venturi siphon attached to the outboard motor. The remainder of the cove is treated in a zigzag pattern. In shallow waters it can be poured into the prop wash.

7.1.4 When fish start to surface, collect fish as quickly as possible, or they will sink and may be lost.

7.1.5 Detoxify by dispersing potassium permanganate equal to the rotenone concentration in the same manner as the rotenone. Avoid dispersing excessive quantities of potassium permanganate because it is also toxic to fish.

7.2 In flowing streams and small rivers, fish samples can be taken, but as the size and volume increases, so does the complexity of the operation.

7.2.1 Initial procedures are as explained in **7.1.1** and **7.1.2** except two or more additional people are needed, divers are not usually necessary, and the block-off net is placed across the downstream edge of the sample area.


7.2.2 Apply the rotenone by pumping through a perforated hose that is laid on the bottom across the stream at the upstream edge of the sample area. The pump and rotenone supply can be on shore or in an anchored boat. In shallow streams rotenone can be poured along the upstream edge. As soon as the treatment begins, several floating plastic jugs are released in the water to visually mark the progress of the rotenone slug. When rotenone has been dispensed, several more floating jugs are placed in the water.

7.2.3 Collect surfacing fish in the downstream section and in front of the block-off net. Keep the net as free of debris as possible. When the first floating jug reaches the net, disperse equivalent potassium permanganate concentration along the downstream side of the block-off net until the last jugs have reached the net.

7.2.4 Refs **(3)**, **(4)**, **(5)**, and **(6)** are provided which give a detailed description of the process and equipment needed to take rotenone samples in streams up to 600 ft (183 m) across and 5000 ft<sup>3</sup>/s (141.6 m<sup>3</sup>/s).

## REFERENCES

- (1)** Schnick, R. A., "A Review of the Literature on the Use of Rotenone in Fisheries," PB-235-454, Bureau of Sport Fisheries and Wildlife, 1974.
- (2)** Anonymous. "Noxfish and Pro-Noxfish for Fisheries Management," S. B. Penick and Co., 100 Church St., New York, N.Y., 1963.
- (3)** Johnson, T. L. and Pasch, R. W., "Improved Rotenone Sampling Equipment for Streams," *Proceedings Annual Conference*, South Eastern Association of Game and Fish Commission. Vol 29, 1975, pp. 46–50.
- (4)** Ober, R. D., "Operational Improvements for Rotenone Sampling on Streams," Game and Fish Division, Georgia Department of National Resources, Albany, Ga.
- (5)** Holder, D. R., "A Technique for Using Rotenone to Sample Fish Populations in Georgia's Warm Water Streams," Game and Fish Division, Department of Natural Research, Atlanta, Ga. Technical Report No. 1, 1975. pp. 28.
- (6)** Nelson, D. and Smith, D. W., "Rotenone Stream Fish Sampling in Michigan," Michigan Department of Natural Resources, Grand Rapids, Mich. 1979, pp. 6.

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