Designation: D4211 – 21

Standard Guide for Fish Sampling[1]

This standard is issued under the fixed designation D4211; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This guide covers the use of lethal and non-lethal collection practices for fish.

1.1.1 Lethal practices include the use of rotenone and antimycin which are used to collect or eradicate fish; numerous chemicals have been used but presently only rotenone and antimycin are U.S. Environmental Protection Agency (EPA)-approved for this use.

1.2 Non-lethal collection practices typically do not cause mortality to fish.

1.2.1 Non-lethal practices include surface or bank observation, underwater observation, gill netting, beach seines, hoop nets, fyke nets, trap nets, electroshocking, minnow traps, enclosure (pop drop and throw) traps, angler surveys, commercial surveys.

1.3 The focus of this guide is to provide sampling practices for fish collection. This standard does not cover the identification of species or any statistical methods for the sampling data.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Refer to the MSDSs for all chemicals used in this procedure.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1129 Terminology Relating to Water

D4131 Practice for Sampling Fish with Rotenone

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this standard, refer to Terminology D1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *rotenone, n*—an odorless, colorless, crystalline isoflavone used as a broad-spectrum insecticide, piscicide, and pesticide.

3.2.1.1 *Discussion*—This chemical is commonly used as nonselective piscicide (fish killer).

4. Significance and Use

4.1 Fish sampling includes a number of lethal and non-lethal practices.

4.2 This guide provides an overview of commonly used fish sampling practices.

4.3 This summary serves as a brief accounting of options available to personnel responsible for determining the fish sampling practice or practices that best serve the sampling objectives.

5. Basis of Classification of Practices

5.1 *Lethal Practices*—The significance of using chemical fish toxicants is that more complete population analyses or total eradication, or both, can be accomplished. Target species can be selectively eradicated by varying concentrations. This provides a very effective tool in fisheries investigations and management programs. Water conditions (that is, pH, temperature, alkalinity, and so forth) and morphology can be limiting factors.

[1] This guide 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] 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.

***A Summary of Changes section appears at the end of this standard**

5.1.1 *Rotenone*—Rotenone used as a fish toxicant is highly versatile and can be used effectively to collect fish samples; to eradicate fish; and to selectively remove certain fish species (see Practice D4131).

5.1.1.1 Its effectiveness is reduced in cold <20°C, and dosage required increases with alkalinities. It may also eliminate food web organisms. Fish may be repulsed from treated areas.

5.1.2 *Antimycin*—Antimycin is versatile in the selective removal of scalefish or even more selectively against certain centrarchids (sunfish) and minnows.

5.1.2.1 Its effectiveness is reduced in water with pH above 8.5.

5.2 *Non-lethal Practices*[3]—Such practices are used when the goal is to assess an ecosystem without changing it from the assessment perspective. Non-lethal practices are designed to meet assessment goals without the introduction of foreign chemicals or toxicants into the environment in which the target species exist.

5.2.1 *Surface or Bank Observation*—These employs visual counts from streambanks. It is a preferred method for assessing fish populations when shallow water depths preclude underwater observation or when alternative capture methods can cause mortality and is to be avoided. Visual counts from streambanks may also be combined with underwater survey methods. Counts from stream banks are relatively simple to perform and require only a modest amount of equipment. The observer should be trained how to identify the different species under investigation.

5.2.2 *Underwater Observation*—Underwater observations can be made by snorkeling, by using SCUBA, or with underwater video cameras. The observer should be able to identify the fish observed without having them in hand. Diver/snorkeler observations can be recorded on underwater writing tablets and video can be recorded. Fish can be counted across the entire width of streams, using single or multiple observers. This technique depends on stream width and visibility.

5.2.3 *Gill Netting*—Gill nets consist of mesh with square openings fastened to a positively buoyant line at the top, often referred to as the float line, and a negatively buoyant line at the bottom, often referred to as the lead line. The net is left in place and fish are captured when they swim into it. Gill nets are most often set with the lead line resting on the bottom, the float line floating above it, and the mesh stretched between the two. Because the fish get trapped by contact with the net with the back of the gill plates, the practice can be lethal if certain species are entrapped for a prolonged amount of time.

5.2.4 *Beach Seines*—Beach seines consist of a length of fine mesh strung between a positively buoyant line (the float line) and a negatively buoyant line (the lead line) that is pulled through the water to encircle fish. Often a *bag* of the same mesh that extends behind the plane of the net is built into the midpoint, so that fish move into the bag as the net is pulled forward.

5.2.5 *Hoop Nets*—This device traps fish inside a mesh enclosure. The mesh is supported by rigid frames or hoops. These frames were historically made of wood but today are usually made of aluminum tubing. The hoops may be round, D-shaped or square. The tunnels are cones of mesh that are attached to a pair of hoops, so that when the net is set and the hoops are separated the narrow end of the tunnel points to the rear. Usually there are two tunnels per net.

5.2.6 *Fyke Nets*—A fyke net is simply a hoop net to which wings and a lead (or leader) are attached. Wings are short lengths of mesh with float and lead lines that are attached to the lateral margins of the first hoop and extended at ∀45° to the longitudinal plane of the trap. A lead is a length of mesh that is attached to float and lead lines and is fastened to the midpoint of the first hoop and extended forward parallel to the longitudinal plane of the trap.

5.2.7 *Trap nets* are similar to a fyke net, in that it has wings and a lead attached and a tunnel or tunnels through which fish enter, but it is does not have rigid frames. It relies instead on floats, weights and attachment to anchors or other fixed points to maintain the shape of the enclosure. Trap nets have a seam in the top of the heart, the mesh box that contains the trapped fish, that is laced or zipped closed while the net is fishing but can be opened to provide access so that fish can be removed, usually with a dip net.

5.2.8 *Electrofishing* is the term generally applied to a process that establishes an electric field in the water to capture fish. When exposed to the field, most fish become oriented toward the anode and as the density of the electric field increases as fish swim toward it. Near the anode, fish become immobilized. The actual sequence of responses to the electric field is more complex and varies depending upon the type of current applied (AC, DC, pulsed DC), the initial orientation of the fish with respect to the field and field density. Most electrofishing equipment in North America uses pulsed DC. Typically, the electrofishing operators move through habitats accompanied by assistants who collect shocked fish with dipnets.

5.2.9 *Minnow traps* or Gee traps are widely used by anglers to collect small fish for bait and are readily available at sporting goods stores. They are typically circular, slightly tapered toward the ends, and made of metal or, more recently, plastic with inward facing funnels at each end. The traps split into two halves so that fish can be removed, or bait added, and they can be nested for storage.

5.2.10 *Enclosure (pop drop and throw) traps* surround fish from a relatively small area at a single point in time. They are sometimes described hand-held samplers made of garbage cans or wash tubs with the bottom removed that are plunged through the water and into the substrate, thus trapping fish. Drop traps are typically constructed of mesh stretched around a rigid frame, with an open bottom. They are suspended from structures placed on or driven into the bottom. The trap is released remotely, usually by a rope attached to a simple release

[3] Portt, C. B., Coker, G. A., Ming, D.L., and Randall, R. G., "A review of fish sampling methods commonly used in Canadian freshwater habitats," *Canadian Technical Report of Fisheries and Aquatic Sciences*, 2006, available from https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1240.pdf.