



Biological Monitoring Program

FISH COMMUNITY SAMPLING PROTOCOL FOR STREAM MONITORING SITES

I. PURPOSE

To describe the methods used by the Minnesota Pollution Control Agency's (MPCA) Biological Monitoring Program to collect fish community information at stream monitoring sites for the purpose of assessing water quality and developing biological criteria.

II. SCOPE/LIMITATIONS

This procedure applies to all monitoring sites for which an integrated assessment of water quality is to be conducted. An integrated assessment involves the collection of biological (fish and macroinvertebrate communities), physical habitat, and chemical information to assess stream condition.

III. GENERAL INFORMATION

Sites may be selected for monitoring for a number of reasons including: 1) sites selected for condition monitoring as part of Intensive Watershed Monitoring (IWM), 2) sites randomly selected as part of the Environmental Monitoring and Assessment Program (EMAP), 3) sites selected for the development and calibration of biological criteria, and 4) sites selected for stressor identification. Although the reasons for monitoring a site vary, the fish community sampling protocol described in this document applies to all monitoring sites unless otherwise noted.

IV. REQUIREMENTS

- A. Qualifications of crew leaders: The crew leader must be a professional aquatic biologist with a minimum of a Bachelor of Science degree in aquatic biology or closely related specialization. He or she must have a minimum of six months field experience in fish community sampling methodology and fish taxonomy. Field crew leaders should also possess excellent map reading skills and a demonstrated proficiency in the use of a GPS (Global Positioning System) receiver and orienteering compass.
- B. Qualifications of field technicians/interns: A field technician/intern must have at least one year of college education and coursework in environmental and/or biological science.
- C. General qualifications: All personnel conducting this procedure must have the ability to perform rigorous physical activity. It is often necessary to wade through streams and/or wetlands, canoe, or hike for long distances to reach a sampling site

V. RESPONSIBILITIES

- A. Field crew leader: Implement the procedures outlined in the action steps and ensure that the data generated meets the standards and objectives of the Biological Monitoring Program.
- B. Technicians/interns: Implement the procedures outlined in the action steps, including maintenance and stocking of equipment, data collection and recording.

VI. QUALITY ASSURANCE AND QUALITY CONTROL

Compliance with this procedure will be maintained through annual internal reviews. Technical personnel will conduct periodic self-checks by comparing their results with other trained personnel. Calibration and maintenance of equipment will be conducted according to the guidelines specified in the manufacturer's manuals.

In addition to adhering to the specific requirements of this sampling protocol and any supplementary site specific procedures, the minimum QA/QC requirements for this activity are as follows:

- A. Control of deviations: Deviation shall be sufficiently documented to allow repetition of the activity as performed.
- B. QC samples: Ten percent of sites sampled in any given year are re-sampled as a means of determining sampling error and temporal variability.
- C. Verification: The field crew leader will conduct periodic reviews of field personnel to ensure that technical personnel are following procedures in accordance with this SOP.

VII. TRAINING

- A. All inexperienced personnel will receive instruction from a trainer designated by the program manager. Major revisions in this protocol require that all personnel be re-trained in the revised protocol by experienced personnel.
- B. The field crew leader will provide instruction in the field and administer a field test to ensure personnel can execute this procedure.

VIII. ACTION STEPS

- A. Equipment list: Verify that all necessary items are present before commencement of this procedure (Table 1).
- B. Data collection method: The location and length of the sampling reach is determined during site reconnaissance (see SOP--"**Reconnaissance Procedures for Initial Visit to Stream Monitoring Sites**"). The reach length, 35 times the mean stream width (MSW), is based on the distance necessary to capture a representative and repeatable sample of the fish community within a stream segment (following: Lyons, J. 1992. The length of stream to sample with a towed electrofishing unit when fish species richness is estimated. North American Journal of Fisheries Management. 16:241-256.). Reach lengths are a minimum of 150 meters and a maximum of 500 meters. Sampling is conducted during daylight hours within the summer index period of mid-June through mid-September. Sampling should occur when streams are at or near base-flow because flood or drought events can have a profound effect on fish community structure and sampling efficiency.

For wadeable streams, fish community sampling is conducted in conjunction with the physical habitat assessment protocol (see SOP--"**Quantitative Physical Habitat Assessment Protocol for Wadeable Stream Monitoring Sites** or **MPCA Stream Habitat Assessment (MSHA) Protocol for Stream Monitoring Sites**"). Fish sampling should be conducted before the physical habitat assessment so as not to disturb the fish community prior to sampling. Sample all habitat types available to fish within the reach in the approximate proportion that they occur. An effort is made to collect all fish observed. Fish < 25 mm in total length are not counted as part of the catch.

All fish that are alive after processing should be immediately returned to the stream, unless they are needed as voucher specimens. Considerable effort should be expended to minimize handling mortality, such as using a live well, quickly sorting fish into numerous wet containers, and replacing their water supply.

Fish survey results are recorded on the **Fish Survey Record** data sheet. A copy is attached and guidelines for filling out this data sheet are described in the following pages.

C. Fish Survey Record Data Sheet

This data sheet summarizes the location, sampling characteristics, and fish community composition of the sampling site. The variables recorded are as follows:

C.1. Location and Sampling Characteristics

- a) *Field Number* – A seven-digit code that uniquely identifies the station. The first two digits identify the year of sampling, the second two identify the major river basin, and the last three are numerically assigned in sequential order (example 02UM001).
- b) *Stream Name* – The name of the stream as shown on the most recent USGS 7.5" topographic map. Include all parts of the name (i.e. "North Branch", "Creek", "River", "Ditch", etc.).
- c) *Date* – The date fish sampling is conducted in month/day/year format (MM/DD/YY).
- d) *Crew* – The personnel who conducted fish community sampling.
- e) *Gear Type* – The specific type of electrofisher utilized for fish collection. The MPCA's Biological Monitoring Program utilizes four electrofishing gear types. Care is taken to select the gear type that will most effectively sample the fish community. Gear selection is dictated by stream width, depth, and accessibility. General guidelines for determining the appropriate gear type and their use are as follows:

Backpack: Generally used in small, wadeable streams (typically < 8 m MSW and < 50 mi² drainage area). A single electrofishing run is conducted in an upstream direction. In very small streams (<2 m wide) it is possible to sample most of the available habitat but in larger streams it is often necessary to meander between habitat types. Two personnel are necessary; one to carry the unit and operate the anode and another to collect the fish. In most small streams, a minimum of 1200 seconds of electrofishing should be conducted to collect a representative sample. Indicate the type of backpack electrofisher utilized by circling the appropriate option; Smith-Root generator, LR-24, or Halltech model.

Double Backpack: Used in larger wadeable streams and rivers (typically > 8 m MSW and 50-500 mi² drainage area) where access limits the ability to use the stream shocker. This electrofishing method is considered last and typically is only utilized on randomly selected sites where access is very difficult or in wide, shallow, riffle and boulder strewn reaches. A single electrofishing run is conducted in an upstream direction using two backpack units simultaneously. Four personnel are necessary, two to carry the units and operate the anodes and two personnel to net and carry the fish. Total time fished is determined by adding the times of both electrofishing units. Indicate the type of backpack electrofisher utilized.

Stream-shocker: Used in larger, wadeable streams and rivers (typically > 8 m MSW and 50-500 mi² drainage area). The stream-shocker is a towable unit that can effectively sample larger streams because it has additional power capabilities and employs two anodes, thus increasing the electrified zone. Five personnel are required for operation, one to control the electrofisher, two to direct the anodes, and two to net fish. A single electrofishing run is conducted in an upstream direction weaving between habitat types. The amount of time electrofished is variable due to differences in reach length, stream width, and habitat complexity; however, most circumstances would require a minimum of 2000 seconds of electrofishing to be conducted. In rare instances, when stream-shocker access is too difficult or the site is a wide, shallow riffle prohibiting utilization of a tote barge it may be necessary to sample larger streams utilizing two backpack electrofishers simultaneously.

Mini-boom: Used in non-wadeable streams and rivers that are either too small or that do not afford the access necessary to utilize a boom-shocker. The mini-boom electrofisher is a jon-boat that is light enough to be portaged, yet provides a stable work platform. Personnel consist of one person to operate the boat, monitor the control box, and ensure the safety of a single fish collector on the bow. In most cases, a minimum of 3000 seconds of electrofishing should be conducted to collect a representative sample. A single electrofishing run is conducted in a downstream direction weaving between habitat types, both stream banks,

and mid-channel areas ensuring that the entire reach is thoroughly sampled. In larger streams (500 m reach lengths) the sampling effort should essentially equate to electrofishing the entire left bank, right bank, and mid-channel as prescribed in the boom-shocker protocol.

Boom-shocker: Used in large, accessible rivers. Three electrofishing runs are made in a downstream direction, one each along the right bank, left bank, and mid-channel. Personnel consist of one person to drive the boat, monitor the control box, and ensure the safety of the two fish collectors on the bow. Each electrofishing run is typically at least 1200 seconds of effort, or a minimum of 3600 seconds for all three passes combined.

- f) *Channel Position* – If the site is sampled with a boom-shocker, circle the appropriate channel position of the electrofishing run (determined while facing downstream); right bank, left bank, or mid-channel. A separate **Fish Survey Record** data sheet is used for each of the three runs.
- g) *Distance* – The length of stream sampled for fish, measured to the nearest meter following the center of the stream channel. If the entire reach is electrofished, the distance sampled for fish is the same as the *station length* recorded on the **Visit Summary** data sheet (see SOP--“*Physical Habitat and Water Chemistry Assessment Protocol for Wadeable Stream Monitoring Sites*”). In the event the entire station cannot be electrofished, measure the portion of the reach that was not sampled and subtract this distance from the *station length* to calculate the distance sampled for fish. Possible explanations include the occurrence of a culvert or beaver impoundment within the reach.
- h) *Time Fished* – The number of seconds electrofished. Reset the timer on the electrofisher before each sampling event.
- i) *Identified By* – The person(s) who field identified the fish collected, must meet the minimum requirements of a field crew leader described previously.
- j) *Visit Comments* – Record any additional information about the fish sampling visit in the space provided.

C.2. Fish Community Composition

- a) *Species* – The common name of each fish species collected during the electrofishing run. If a fish cannot be identified to species with certainty, identify to the lowest possible taxon (e.g. to genus) and voucher for later lab identification.
- b) *Length Range* – The minimum and maximum length for each fish species collected (fish < 25 mm are excluded). Measure to the nearest millimeter using Maximum Total Length protocol: the distance from the anterior-most part of the fish to the posterior-most tip of the caudal fin while it is being compressed. If only one individual of a fish species is captured, record the length as both the minimum and maximum total length.
- c) *Weight* – The total wet weight of each fish species collected. Together, weigh all individuals of the same species to the nearest 0.5 gram. Multiple batch weights may be necessary if scale capacity is exceeded; these can be recorded on the back of the data sheet in the space provided. Only species totals should be recorded here.
- d) *Number* – The total number of individuals of each fish species.
- e) *Anomalies or YOY* – Record the total number and type of anomalies observed on all individuals of a fish species. Recognized anomalies and their codes are located on the bottom of the **Fish Survey Record** data sheet. In addition, instances in which young of year (YOY) trout species are collected note the total number of YOY individuals.
- f) *Voucher* – The number of specimens of each fish species retained for verification and deposition in the Minnesota Bell Museum of Natural History. For fish that are identified with certainty to species level, several individuals of each species should be preserved in 10% formalin solution (37% formaldehyde:water)

in the “A-jar”. For each species of fish, document the number of individuals preserved in this data field. The person recording the fish information is in charge of the voucher bottle, and specimens will only be added to the voucher bottle upon the recorder’s approval, to ensure accuracy of numbers. All fish that could not be identified to the species level should be preserved in a separate container (B-jar) in 10% formalin solution. Record the number preserved.

Voucher containers should be labeled externally and internally. On the outside of the jar write the field number, sampling date, and jar identification (A or B) with a permanent marker. Place a label inside each jar identifying the field number, sampling date, stream name, jar identification, county, gear type, and collectors. Write this information on an index weight label in pencil or a solvent proof marker. If an “A” and “B” jar are used, tape them together.

For specimens that are too large to preserve, a photograph may be taken to serve as a voucher. Place a card with the site field number and sampling date visibly into the picture frame with the fish positioned in a manner that allows key characteristics to be identified. Indicate that a photograph was taken by writing ‘photo’ in the voucher column.

- C.3. Individual or Batch Measurements: Often times it is necessary to weigh large fish individually or conduct multiple batch weights for a species of fish, these measurements can be recorded in this section of the data sheet. The data fields are the same as those described above. After fish processing is complete, combine the information for fish of the same species so that only species totals are recorded in the previous section.

Table 1. Equipment List – This table identifies all equipment needed in the field in order to implement the sampling protocol as described.

Electrofisher – for sampling the fish community, use appropriate gear type
(includes control box, generator, anode(s), and cathode)

Nets – for collection of fish; 1/8” mesh, fiberglass handles

Rubber gloves – for safety during electrofishing; electrically rated

Holding tank – for holding fish during electrofishing; of sufficient size to minimize stress

Wet containers – for holding fish during processing; of sufficient size and number to minimize stress

Balance or spring scales – for weighing fish

Measuring board – for measuring total length of fish

Waders – for safety during electrofishing

Polarized sunglasses – for aid in capturing fish

Clipboard – to store forms and record data

Forms – for recording data

Pencil – for filling out forms

Permanent marker – for labeling voucher bottle

Taxonomic key – to assist in identifying fish

Voucher bottle – for storing preserved specimens

Formalin – for preserving voucher specimens

Labels – to label voucher jars

Camera – to document fish species collected that are too large to preserve

FISH SURVEY RECORD

MPCA

Field Number:	Stream Name:		
Date (mm/dd/yy):	Crew:		
Gear Type (circle one): Backpack* Stream-Shocker Boom-Shocker Mini-Boom			
*Type of Backpack (circle one): Generator LR-24 Halltech			
Channel Position: (circle one if boom-shocking site)	Right Bank	Mid-Channel	Left Bank
Distance (m):	Time Fished (sec):	Identified By:	
Visit Comments:			

Species (common name)	Length Range (mm)	Weight (g)	Number	Anomalies or YOY	Voucher
1.					
2.					
3.					
4.					
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7.					
8.					
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Anomalies: **A**-anchor worm; **B**-black spot; **C**-leeches; **D**-deformities; **E**-eroded fins; **F**-fungus; **G**-yellow grub; **L**-lesions; **N**-blind; **P**=parasites; **PL**-parasite lesion; **Y**-popeye; **S**-emaciated; **W**-swirled scales; **T**-tumors; **Z**-other. (Heavy **[H]** or Light **[L]** code may be combined with above codes).

(Cont.)

Species (common name)	Length Range (mm)	Weight (g)	Number	Anomalies or YOY	Voucher
29.					
30.					
31.					
32.					
33.					
34.					
35.					
36.					
37.					
38.					

INDIVIDUAL OR BATCH MEASUREMENTS

Species (common name)	Length Range (mm)	Weight (g)	Number	Anomalies or YOY	Voucher
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2.					
3.					
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