IDNR-Fisheries Stream Sampling Guidelines (2001)

IDNR fisheries managers and others involved with the management of Illinois streams need accurate and consistent data on which to base their decisions. Guidelines for IDNR stream sampling help standardize the collection of stream-fish information. Standardized collection allows valid comparisons among sites by minimizing variability in sampling technique. Such comparisons are necessary for effective management and stewardship of stream resources throughout the state. Because Illinois streams differ greatly in physical and biological characteristics, statewide sampling guidelines must be flexible enough to accommodate this variability. These guidelines are intended to optimize data standardization while also accommodating the practical need to adjust sampling procedures to particular situations.

These guidelines were developed for professional, experienced fishery biologists, thoroughly acquainted with the operation, handling and maintenance of the sampling equipment; use of this equipment by inexperienced or uninitiated personnel could result in serious injury.

Background

The baseline and monitoring data collected by the Division of Fisheries provide sport fish population assessments which are important to stream fisheries management and protection (e.g., Sallee et al. 1991, Putman et al. 1995). Additionally, the sampling conducted by Fisheries biologists assists with delineating threatened and endangered species distributions (e.g., Burr et al. 1996) and fish community assessments. As part of the fish community assessments, fisheries data are used for characterizing stream health through the use of the Index of Biotic Integrity (Karr 1981, Karr et al. 1986). Subsequently, the IBI was revised by Hite and Bertrand (1989) and adapted for use in Illinois through the Biological Stream Characterization (BSC) Work Group. The IBI is a major component of the BSC rating of streams (Illinois EPA 1996a) and is used in the Aquatic Life Use-Assessment of the IEPA 305(b) (Illinois EPA 1996b) report to the US EPA, which rates the water quality of Illinois streams. The BSC is also incorporated into the Illinois EPA Targeted Watershed Approach to stream protection and restoration (Illinois EPA 1997).

Stream Sampling Guidelines address the three main objectives of the Division's stream fish sampling. These objectives are: 1) Fish community compostion, 2) Sport fishery characterization and 3) Special (targeted) fish studies.

The goal of fish community sampling is to determine the identity and number of fish species present (species richness) and the relative number of individuals of each species (relative abundance) in a stream segment. Because length and weight of individual fish are routinely measured, estimates of species-specific population size and age structure can be obtained. Stream segment fish biomass estimates can also be calculated.

The second objective, Sport fishery characterization, is useful to the Fisheries Division in its strategic planning efforts and for informing the public on sport fishing opportunities in Illinois streams.

Special (targeted) fish studies are conducted to obtain detailed estimates of population size, population age and growth structure, or migration and movement patterns of particular target species. These studies are often conducted with specific management objectives in mind, such as fish stocking assessments, watershed management evaluations or fisheries response to habitat improvement efforts.

Section 1. Station Selection Criteria

Stations should be selected based upon the following criteria:

1. Sites which have been previously sampled (particularly during the 1981 - 1998 cooperative basin survey effort) should receive priority over sites for which no data have been collected.
2. If no historical fisheries data are available, then site selection should be based on general characteristics of stream habitat, location relative to tributaries or point source pollution, relative position within the watershed (e.g., headwaters, middle, mouth). Consideration should be given for ***both*** representative and unique habitats. For example, if a stream is predominantly channelized, then at least one station should be placed in a channelized reach, even if this is not considered the "best" section of the stream.
3. IEPA ambient water quality or macroinvertebrate sampling sites. Typically, IEPA ambient water quality sites have a substantial water chemistry data set and therefore can be supportive for fisheries data.

Section 2. Sampling station selection

A reconnaissance trip is strongly recommended to familiarize the lead biologist with each potential sampling site. During the reconnaissance, the upstream and downstream limits of the sampling station may be determined and noted on the Stream Reconnaissance Form. The information on the reconnaissance forms should be sufficient to allow any IDNR fisheries biologist to lead the sampling. Although stream conditions can change from time of reconnaissance to time of sampling, this information can reduce confusion regarding where the sample is to be collected.

A reasonable attempt must be made to obtain landowner permission prior to sampling. The process of landowner contact can begin during reconnaissance, or by contacting the Natural Resources Conservation Service, in the county in which the stream segment to be sampled is

located, to obtain the name, address and telephone number of the landowner in question. Landowners can then be contacted by phone and/or mail for permission to sample. Landowner information should be filed for subsequent sampling efforts.

Stream sampling locations should be chosen based on the physical characteristics, including stream width and depth, that will influence the amount of stream sampled. Stream segments to be sampled should be selected based upon habitat. Habitat diversity will also influence the length of stream sampled.

For non-channelized or old channelized (> 40 years) streams, *at least one* and preferably two to three pool/riffle sequences should be sampled. The number of pool/riffle sequences will depend upon the geological conditions, stream size and other factors, but this should be a minimum goal. No station should be less that 100 meters in length. If the hydraulic habitat is of a homogeneous nature (e.g., channelized), then a minimum of 15-21x normal base-flow width should be sampled. Normal base-flow is that volume of water that occupies the stream channel up to the vegetation (forbs, grasses, shrubs) line.

Setting the Station limits

Using the the habitat criteria listed above, the upstream and downstream limits of the station are blocked with nets. When setting the nets, every effort should be made to avoid disturbing the area to be sampled. Crew members should not enter the area to be sampled until the nets have been secured and should remain downstream of the sampling area to minimize turbidity disturbance. The preferred location for setting the nets are constrictions or upstream limits of riffles. Consideration should be given to the effects of hydraulic modifications to the stream caused by a bridge, because bridges often present anomalous habitat conditions, they should generally be avoided. The nets should be long enouth to block the entire stream width. Net height should be 6 ft and mesh should be 0.25 inch bar measure. Net stakes should be used to prevent the net from collapsing during the sampling. Usually, one stake for every 10 ft of stream width should be used in low flow conditions. More stakes may be required at higher stream discharges. The stakes are to be placed through the lead line and angled upstream. Metal bottom anchors (J-hooks) should be placed through the lead line to minimize fish escape. These may be supplemented with rocks. The float line should be pulled sufficiently taut to keep fish from jumping over the net, but not so tight that the lead line lifts off the stream bottom.

General Stream Conditions for Sampling

To maintain consistency with IDNR historical collections and optimize efficiency, sampling should be conducted during typical summer **low-flow** conditions. This is typically from early July to mid-September, although sampling could be conducted in June in far southern Illinois. Sampling should not be conducted at high flows without sufficient justification. Due to the lack of gauging stations on small-to-intermediate sized streams, it is difficult to develop standardized criteria for determining the range of flows that is acceptable for sampling, rather this is at the discretion of the lead biologist. Fish sampling and habitat data must be collected at the same flow levels, preferably on the same day or contiguous days.

Related to stream flow, water clarity (turbidity) is a critical component to sampling efficiency. Ambient turbidity will vary regionally in Illinois. For example, in south-central Illinois, the presence of clay-ladened soils contributes to high turbidity levels even in low or no-flow conditions. By comparison, northern Illinois streams with rocky substrates, may have very low turbidity even in high flows. Turbidity should be characteristic for low-flow conditions. In eutrophic streams, phytoplankton blooms or floating aquatic macrophytes may also reduce visibility.

General Fish Sampling Procedures

Wadable sampling techniques should be used in streams with a **average depth of 1.5 ft or less.** Deep pools, up to 3.5 ft may be encountered in these streams, but they should not be common. When flow is present, wadable electrofishing is conducted from downstream to upstream. This is necessary to avoid creating plumes of silt in the area to be sampled. The increased turbidity limits visibility and reduces sampling efficiency. Only in "no-flow" or pooled conditions can sampling in an upstream to downstream direction be considered an option. Boat sampling and minnow seining may be conducted in either direction.

For all electrofishing, the amount of shocking time and length of stream sampled should be recorded. For minnow seining, the number and length of hauls, width of net used for each haul and average depth should be recorded.

When electrofishing, fish should not be kept in the dip nets and repeatedly subjected to the electrical field. Dip net handles must be made of non-conductive fiberglass or similar material and the net mesh should not be larger than 0.25 inch bar measure.
In community sampling, it is extremely important that ALL nettable fish be collected. Every fish is important and could represent another species. To obtain this type of coverage, all representative habitats should be sampled and must be included in the sampling station.

A reasonable effort should be made to keep all fish alive. For most sampling, an oxygen supply is required and to prevent undo stress which may cause mortality, the use of a 0.5% solution (0.04 lbs per gallon) of non-iodized salt is used. For wadable streams an "R" oxygen bottle provides a convenient source. During any electrofishing effort, if it appears that the number of fish is excessive and will result in stressed fish, then fish must either be redistributed to holding containers with adequate oxygen or sampling must be stopped and fish processed. If sampling is stopped, a block net should be placed at the location where sampling is interrupted. Fish should then be processed and released downstream of the station. A floating cage can also be used to hold fish while being processed. Upon completion of fish processing, sampling should then resume upstream of the temporary block net.

Section 3. Fish Sampling Techniques

Gear selection criteria

1) Boat electrofishing, supplemented with minnow seine hauls, is the method of choice when the habitats present within the station can be reasonably sampled with a boat (i.e., motor lower unit does not frequently contact the substrate and there is enough depth to operate the boat).
2) The electric seine (with block nets) should be used when the station is entirely wadeable (average depth is 1.5 ft or less) and narrow enough to block.
3) The backpack shocker (with block nets) is used when conditions won't permit use of boat electrofishing or electric seine (e.g., small headwater streams).

Boat electrofishing

A boat sampling crew should consist of a minimum of two (2) and up to five (5) people. Although only two people (one netter, one motor operator) are able to sample at a time, the additional people can collect water chemistry data and conduct minnow seining. When the electrofishing crew returns to the access site, fish can be processed immediately by two people and electrofishing can continue for the next run.

For small, non-wadable streams a 12'-14' boat is the preferred size as it allows movement over riffles and in confined areas. Dip net mesh size should be .125 to .25 inch. The motor operator and netter must communicate by using a variety of hand signals because generator noise usually precludes verbal communication. The netter and motor operator must watch for underwater obstructions, livestock fences or other potential hazards, and immediately alert one another to their presence. If anglers are encountered, the motor operator should either turn off the electricity to the electrodes or divert course to reduce disturbance.

If sampling is to be conducted upstream and downstream of the access point, then the downstream segment should be sampled first. This will reduce the likelihood of recapturing fish that are processed from the first sampling run. Because the effects of electrofishing differ among fish species, the crew should often check behind the boat for stunned fish. Frequent circling is recommended to assure adequate coverage of the station.

As at wadable sites, the actual length of a boat sampling station will vary with the stream size, habitat diversity and presence of impassable obstructions. Typically, a boat station will cover from 0.25 mile to one (1) mile. The electrofishing crew should sample all available habitats, including open water and midchannel areas, not just shoreline habitats. Electrofishing time must be accurately recorded. The length of stream sampled (combined length along both banks and midchannel) should be estimated (to within 10ft). This can be done on site (with tape measure or rangefinder) or may be measured on USGS topographic 7.5 minute quadrangle. Unlike wadeable sites, boat sampling stations are sampled for a given time (usually 15 or 30 min individual runs), rather than for a pre-determined distance.

When sampling in shallow water it may be necessary to get out of the boat to push the boat or retrieve fish. If this occurs, the power to the electrodes must be turned off before getting out of the boat.

Minnow Seine

The major emphasis of minnow seine sampling is to determine species occurrences. Minnow seine samples are usually collected to supplement boat electrofishing samples. A minnow seine crew should have a minimum of two (2) and optimally three (3) people. Minnow seining should not be the exclusive gear for non-headwater streams (> 10 ft) wide. In headwater streams, conditions may be conducive for efficient minnow seining because stream width and depth allow sufficient 'sampling space' for this method. The length of seine used will vary with stream conditions, depth should be 6 ft and mesh should be 0.125 to 0.25 inch (bar measure). For pool or run conditions, an area relatively clear of obstructions should be selected. Sampling may be conducted either in an upstream or downstream direction. Number and length(s) of seine hauls should be recorded with the fish data. Circular sweeps allow sampling where debris or other obstructions restrict linear sampling.

Riffles or deep, fast runs can be sampled by placing the net across the riffle and having a crew member kick from upstream towards the net. If it is a large riffle, select an area up to 15 ft in width and place the net across that area. Then, one or more persons should walk upstream approximately 20 ft and begin kicking the substrate; moving downstream toward the net . When they arrive at the net, "kickers" should reach into the water, find the lead line and purse the net.

For all minnow seine sampling, it is very important that the lead line be kept on the bottom. If an impediment is encountered during a haul, attempts should be made to quickly dislodge or bypass the obstruction. When beaching the seine, keep the lead line pressed to the substrate and pull the seine towards shore. Quickly remove all fish from the seine and process (or preserve). The number and length(s) of seine hauls should be recorded with the fish data.

Electric Seine

For electric seine sampling, the crew should consist of a minimum of five (5) persons with an optimum of six (6). One (1) person is responsible for generator operation and assuring that fish are kept oxygenated. Three (3) members of the crew net fish and two (2) members operate the brails of the electric seine. Skilled brail operators may also opt to carry a dip net for maximum efficiency in confined areas. All persons will wear heavy duty (lineman) rubber gloves and either hip boots or chest waders (preferred). Prior to activating the seine, one of the brail operators must indicate verbally that the seine is going to be turned "ON". Similarly, when it is turned "OFF" one of the operators must indicate that the seine is "OFF".

The pace of sampling should accommodate the netters so that when large numbers of fish are present, the operators should reduce forward progress until fish have been netted and placed in live wells. When appropriate, brush, logs, or shoreline cover should be sampled by having one or both of the brail operators wrap around the cover. The netters should keep pace with the brail operators as they surround the object, to collect stunned fish. Using their dip nets, the netters may need to push the electric seine into the brush or deeper pool to assure full coverage. After this process, the seine could briefly be turned off for the crew to regroup.

If the stream is wider than the electric seine the sampling crew should follow the thalweg, concentrating on instream cover and minimizing deep water fish escape routes. If depth is sufficient across the channel, a second pass may be needed to cover the "unsampled" side.

Riffles should be sampled by first carrying the electric seine upstream of the riffle and having the netters place the nets side by side at the downstream end of the riffle. The brail operators, with the seine "ON", should then kick the riffle to dislodge fish. Depending upon the length of the riffle, this could be done multiple times. If time and manpower allows, a minnow seine can be positioned below the riffle instead of or in addition to side by side dip nets.

Backpack Electrofisher

The backpack electrofishing crew will consist of a minimum of two (2) persons, with three (3) optimal. One person will operate the backpack, one person will net fish and carry a bucket to hold stunned fish. Block nets will be set as noted above. All persons will wear rubber gloves and either hip boots or chest waders. Electrofishing settings will be contingent upon water conditions including conductivity and depth, but settings should be sufficient to optimize collection, but to minimize harm to fish.

Backpack shocking is generally done in an upstream direction for reasons noted above. For optimal catch efficiency, the anode probe is thrust into cover (e.g.,undercut bank, log jam) with the power "OFF", then drawn slowly back to the operator with the power "ON". This minimizes scaring fish and utilizes the galvanotaxic response of fish to DC current.

Section 4. Habitat and Methods Data

Procedures for completion of stream investigation forms and stream methods and habitat form are in the Operations Manual - FDM 6230 and FDM 6230.1, respectively.

Section 5. Fish Workup

1) Small fishes (e.g. minnows, darters and y-o-y sunfishes) and fishes not easily identified should be preserved in 10% formalin as quickly as possible for ease of identification and value as voucher specimens. Make sure preserved samples are clearly labeled with sampling location, method and date.

2) Weigh and measure length of all fishes greater than or equal to 6", measure length of smaller fishes

3) All reasonable effort should be made to return fish alive back to the stream.

4) Dead fish should be buried (preferred) or scattered throughout the surrounding area

at least 50 ft from the stream in areas unlikely to cause inconvenience to stream users or landowners.

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