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Long Term Resource Monitoring (LTRM) electrofishing techniques: An addendum to the methods outlined in Ratcliff et al. (2014)

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Research Article

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Abstract

This document provides clarifications related to field procedures for the fisheries component of the Long Term Resource Monitoring (LTRM) element of the Upper Mississippi River Restoration (UMRR) program. Our goal is to clarify procedural field nuances for day electrofishing methods and sampling under LTRM fish component procedures and protocols (Ratcliff et al. 2014). The need to document such nuances was realized at the 2023 UMRR LTRM fish component field practicum, held in May 2023 at Western Illinois University's Kibbe Biological Station in Warsaw, Illinois, following cross-agency field training and practice. As such, this document should be considered an addendum to the existing standardized field procedures for the UMRR LTRM fish component (Ratcliff et al. 2014). Moreover, this content should be incorporated into the next update to the fisheries procedure manual.

Introduction

Since publication of the Upper Mississippi River Restoration (UMRR) program's Long Term Resource Monitoring (LTRM) element fish component field protocols (Ratcliff et al. 2014), there have been questions about the interpretation of the electrofishing methods outlined in Chapter 5.3.2. Acknowledging Ratcliff et al. (2014) as the primary source for all LTRM fisheries field protocols and methodologies, the purpose of this document is to capture the experiences, collective wisdom, and electrofishing techniques of the most experienced LTRM fish component personnel. Specifically, we intend to capture institutional knowledge of electrofishing methods for dissemination to new personnel within the fish component and, perhaps more importantly, new personnel using the LTRM methods who may not be funded by LTRM (e.g., Multi-Agency Monitoring personnel in Illinois or Mississippi River pools not sampled by LTRM, "out pool" sampling by the Iowa Department of Natural Resources).

Before continuing to read this document, please read all of Chapter 5.3. in Ratcliff et al. (2014).

Topics Requiring Clarification

Width of the site:

Specifically, within Chapter 5.3.2 of Ratcliff et al. (2014), on page 18 the protocols state:

"Individual electrofishing runs should have a 15-minute duration and are approximately 200 m (220 yards)-long and 30 m (33 yards)-wide. If a run is modified from the target of 15 min and 200 m, the actual effort in minutes and length in meters are recorded."

Site width is listed as 30 m, and this should be considered the maximum distance that a boat pilot may back away from shore. This does not mean that every pass of the shocking boat must back 30 m away from the shore. This wording exists to allow boat pilots flexibility to thoroughly electrofish long, shallow, gentle sloping habitats where 30 m from shore may only be, for example, 1 m deep. Even if a 30 m wide sampling path is not constrained by depth, any current, eddies, structures, vegetation, etc. could also limit the site width.

Conditions and habitat vary greatly from Pool 4 to the Open River Reach, but electrofishing boat pilots generally back away 12–18 m (or 2–3 boat lengths) from shore during an electrofishing run. This can be adjusted if 12–18 m puts the boat and dippers in ≥4 m of water, which greatly reduces the efficacy of the gear. On an "average" electrofishing run, LTRM boat pilots usually back away until the boat/dippers are moved to the edge of their effective zone (i.e., depth >4 m) or 12–18 m from shore. It is up to the boat pilot to try to best transit a representative sample of the site while keeping sampling efficiency, safety, and other practical concerns in mind.

For example, on outside bends in high flow, a boat pilot may only back away from shore 10 m on each pass. In this example, 10 m from shore could potentially be >4 m deep (or deeper) with high water velocity; thus, backing away farther would exceed the efficacy of the gear. In addition, the high current velocity causing boat drift may extend the sampling over greater distances (e.g., >200 m) if the boat pilot attempted to back away 12–18 m from shore during each pass. Backing away to 30 m from shore would further exacerbate this problem.

Boat pilots may encounter specific habitat features at individual sites that appear to attract greater densities of fish. In these cases, pilots are encouraged to concentrate electrofishing efforts of these specific locations to maximize fish capture rates. It is permissible to concentrate more time along these specific locations than elsewhere along the site width axis, usually by loitering on the way toward the bank, if the boat pilot remains engaged in evaluating whether fish continue to occur within these specific locations. The boat pilot can also decide whether other potentially important fish-holding features within the designated sample site location are encountered that should also be investigated.

Length of the site:

The approximate length of the site is listed as 200 m and the boat pilot "*….operates the boat at a speed and along a path such that 15 min of effort allows coverage of the approximate sampling area.*" However, in times of high current velocity (e.g., >0.5 m/s; outside bends, windy conditions, or during flooding), sites can exceed 200 m to electrofish for a full 15 minutes, which is the standardized unit of electrofishing effort. Conversely, if current velocity is low (e.g., a backwater or inside bend) and catches are high, the boat pilot may not cover ~200 m before the 15-minute run ends. In either case, record the approximate length of the site in meters.

Do not electrofish the same area twice under any circumstances. The site can be longer or shorter than ~200 m if conditions and catch require. Do not electrofish exactly 200 m and then go back to the top of the site and electrofish the same water to complete the 15-minute run. For example, if the boat pilot has electrofished 200 m of shoreline and has only electrofished for 11 minutes, continue to electrofish the shoreline past the 200 m mark for another 4 minutes and record the approximate distance traveled.

Move downstream when electrofishing in nearly all circumstances. Exceptions can be made in certain circumstances, such as areas of low/zero current velocity and strong winds that may push the boat upstream.

The physical makeup of random sampling sites can also dictate how an electrofishing run is conducted and/or how far from the shore a boat pilot can back away. For example, in narrow channels (<20 m) it may be necessary to alter the perpendicular electrofishing pattern outlined in Figure 4 (Ratcliff et al. 2014) since it may be impossible to back a 6 m long electrofishing boat 12–18 m away from the shore. This may also be the case around dense vegetation or in shallow water

that may hinder proper piloting during electrofishing runs.

Independent of circumstances, it is up to the crew leader to determine if a site can be sampled using LTRM protocols. If it cannot, an alternate site should be sampled instead.

Summary of distance of electrofishing run

Electrofishing is a complex sampling activity, and its efficacy is influenced by many factors. The goal of LTRM electrofishing is to safely regulate as many of these factors as possible, while also sampling as many fish within the site as possible to get a representative sample of the fish community as a whole. Guidelines for boat speed and travel path are provided as a framework within which we can control a large amount of potential variation in human operation. The spectrum of habitats and environmental conditions under which LTRM conducts sampling operations requires that LTRM boat pilots use best professional judgement and common sense on a regular basis. The best outcomes will be gained when all crews are thoroughly versed in the procedures, and when experiences are universally shared through frequent communication.

Wing dams

LTRM Fish Component Leads have worked to identify all wing dams in LTRM reaches that can be safely sampled using the methods described in Ratcliff et al. (2014). A simple random selection (not a stratified design) of these discrete wing dams is selected during each sampling time period to be monitored via electrofishing. Note that La Grange is the only pool routinely sampled by LTRM without wing dams.

As wing dams are not included within the stratified random sampling (SRS) component and vary so much in size, shape, and hydrologic impacts/dynamics, sampling them safely has always been the top priority while striving to efficiently achieve a representative sample of the fish assemblages present. As such, proper protocol for sampling wing dams varies between LTRM pools. Universally, the boat pilot should keep the boat perpendicular to the wing dam structure, similar to shoreline electrofishing during an SRS sample.

Our objective is to communicate what has been historically done procedurally by LTRM field staff (i.e., the institutional knowledge) so that data can be consistently collected into the future.

In the northern three LTRM sampling pools (pools 4, 8, and 13), the boat pilot should start at the shore on the upstream side (i.e., where the wing dam meets the shoreline) and electrofish out to the end of the wing dam. Upon reaching the end (i.e., the point where the minimum depth over the top of the structure is 2 m), reorient the boat and electrofish the downstream side back to shoreline. When finished, record the total elapsed time and estimate the total distance traveled. It is helpful to mark a GPS waypoint at the outer extent of the wing dam and navigate to that waypoint during sampling for distance estimation. Distance recorded is for BOTH the upper and lower paths combined. To electrofish the entire wing dam, electrofishing runs for wing dams may extend past the standard SRS unit of effort (15 minutes).

In Pool 26, sampling of wing dams is based on conditions and safety is paramount when electrofishing a wing dam. For example, there are times the combination of current velocity and water pushing over the top of the wing dam makes it unsafe to work from the upstream side. When conditions do not allow the boat pilot to electrofish the upstream side, start the electrofishing sample at the shoreline on the downstream side of the wing dam. Electrofish the downstream side using the same methods outlined for electrofishing the upstream side. When conditions allow, start on the upstream side at the shore and electrofish the wing dam as described for Pools 4, 8, and 13. In Pool 26, most wing dam sites have been electrofished on the upstream and downstream sides regularly when conditions allow.

In addition, wing dams in Pool 26 vary greatly in length and on very long wing dams the entire structure is not always sampled. Generally, the site is limited to the standard effort of 15 minutes and approximately 200 m. However, if the entire upstream side can be sampled by adding a few extra minutes, this can be done at the boat pilot's discretion. If this is done, the amount of time and approximate distance is recorded by the boat pilot.

In the Open River Reach, a typical wing dam electrofishing site starts on the downstream side at the shoreline and extends for 15 minutes. Due to the long length of wing dams on the open river, the boat pilot usually can electrofish for 15 minutes and approximately 200 m before reaching the end of the wing dam. If 15 minutes has not been reached after the entire downstream side has been sampled, the boat pilot is to reorient the boat and sample the upstream side with the remaining time (if safe conditions allow).

Safety while electrofishing:

Safety is paramount when conducting any LTRM sampling, including electrofishing. Crew leaders and boat pilots must assess if any site, whether electrofishing or netting, can safely be sampled before proceeding. It is not the purpose of this document to set safety protocols or outline proper personal protective equipment (PPE) when sampling or electrofishing. Long Term Resource Monitoring crew leaders work for different agencies in different states, and the authors of this document do not wish to counter or supersede any safety policy of any LTRM partner agency.

The authors, however, recommend that rubber gloves and rubber boots be worn during electrofishing runs to reduce the risk of accidental electrical shock. Ear protection should be worn by the boat pilot due to their proximity to generators mounted in electrofishing boats, and polarized sunglasses are recommended for dippers to reduce any potential glare from the sun off the surface of the water.

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