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ELECTROFISHING

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General Information:

Electrofishing is an effective fish sampling technique that will be used to collect fish in ISB - STPS, OSB, SCC - DEEP, SCN, and TRM (SMLL and LRGE) macrohabitats. Several factors including water conductivity, water temperature, turbidity, and operator expertise influence the effectiveness and quality of electrofishing in these macrohabitats. Electrofishing will NOT occur where populations of pallid sturgeon and paddlefish potentially will be harmed.

Burkhardt and Gutreuter (1995) demonstrated that power (wattage available for transfer from water to the fish, calculated as the product of peak voltage and peak amperage) is an important factor in electrofishing. They found that from 1 to 36% of the variability of pulsed-DC electrofishing catch rates could be explained by differences in the amount of power used at different water conductivities and temperatures. Because water conditions will differ among sections and segments of the Missouri River, power must be standardized for all electrofishing collections. Gutreuter et al. (1995) list power output goals (power delivered to the water) to achieve a power transfer of 3,000 W to the fish based on different combinations of water conductivity and temperature. For the Missouri River project, a power transfer goal of 3,000 W will be used. Participants should have a working knowledge of the electrofishing information contained in these two publications.

In addition to power transfer, voltage gradient (V/cm) is an important electrofishing concept. Reynolds (1983) recommends voltage gradients ranging from 0.1 - 1.0 V/cm to effectively stun fish. Because boat and electrode designs vary among units, participant are required to map the electrical field of their boats at the established power transfer goal of 3,000 W. This is necessary to ensure that the effective electrofishing range of all boats is standardized.

Materials:

A. Aluminum electrofishing boat
B. Generator (5,000 W capacity)
C. Variable Voltage Pulsator (VVP-15)
D. 2 dip nets (3/16" mesh)
E. Single electrode (Sphere)
F. Water temperature and conductivity measurements (from YSI 30 meter)
G. Volt meter
H. Rubber gloves and boots
I. Personal flotation devices

Standardization of electrofishing power:

Pulsed DC electrofishing will be used in this project. Prior to electrofishing, all participants should have thoroughly read the instruction manual for the VVP-15. Field procedures for power establishment and field mapping are listed below.

1) Position the boat in an unobstructed area of water (no brush, trees, etc., should be near the boat). The electroshere should be partially submerged.

2) Measure water conductivity and temperature (refer to temperature and conductivity SOP). Following temperature and conductivity measurements, refer to Gutreuter et al. (1995, Table A-2) for the appropriate power output goal for the measured conductivity and temperature. The appropriate pages from this publication may be laminated for field reference).

3) Make sure all workers are wearing rubber gloves and insulated waders. Make sure all on/off switches on the VVP-15 are in the "off" position. Make sure the Output Voltage and Amperage switches are dialed off (turned counter-clockwise). Set the appropriate VVP-15 switches to DC Output and Pulse. Start the generator.

4) Turn on all VVP switches.

5) Activate the foot switch. When activated, dial the Pulse Frequency to 20 Hz and the Duty Cycle to 25%. Adjust the Output Voltage and Amperage dials until the product (volts x amps) equals or nearly equals the desired setting from Step 2. You are now electrofishing with optimum power.

Step 6 (below) refers to mapping the electric field and must be conducted once prior to the June workshop each year. Prior to mapping the electric field, data sheets and a voltage measuring device are needed. An example data sheet is provided (Table 1). The voltage measuring device may either be purchased or constructed with minimal effort. It consists of two electrodes spaced exactly 1 cm apart (recall, the voltage gradient is measured in V/cm).

6) With the power on (Steps 1-5), measure the voltage gradient 1 cm from the sphere. Then record the voltage gradient at 20-cm increments out to the distance where the voltage gradient drops to < 0.1V/cm. Repeat this procedure at seven positions (Figure 1).

Send the completed voltage gradient maps to Pat Braaten at the Kansas Coop. Unit. The voltage gradient maps will be examined for similarities and/or differences among boats. Based on the results, boat-specific modifications may need to be made.

Macrohabitat electrofishing protocols:

Steps 1-5 listed above are the procedures used prior to electrofishing any macrohabitat. It is important to check conductivity and temperature in each macrohabitat because certain macrohabitats (e.g., TRM) may have drastically different temperature and conductivity values than ISB and OSB.

A. TRM - SMLL:

Electrofishing will be initiated before single gill net is pulled. The electrofishing sample consists of two - 10 min collections. Starting at the point where the tributary bank joins the main river, electrofishing will be started and proceed upstream adjacent to the tributary bank for 10 min (600 sec). After 10 min, electrofishing commences on the opposite tributary bank and proceeds downstream for 10 min. Fish from each bank will be enumerated separately. Power should be continuously applied during electrofishing on each bank, but stopped when moving from one bank to the other. A coin toss will be used to determine the starting bank.

The boat operator should maneuver the boat as close to the bank as possible and try to maintain the boat parallel to the bank. In extremely shallow areas where boat movement is hindered, the operator should maneuver the boat perpendicular to the bank and sweep the shallow areas with the electrode. Movement of the boat during electrofishing should be pulsed, such that the boat never completely stops moving in the direction of sampling unless the boat becomes stuck or entangled in brush or trees. After electrofishing, the distance electrofished on each bank should be measured (m). Catch per effort will be expressed as number of fish collected per min of electrofishing.

B. TRM - LRGE:

The electrofishing sample consists of two - 10 min collections. Starting at the point where the tributary bank joins the main river, electrofishing will be started and proceed upstream adjacent to the tributary bank for 10 min (600 sec). After 10 min, electrofishing commences on the opposite tributary bank and proceeds downstream for 10 min. Fish from each bank will be enumerated separately. Power should be continuously applied during electrofishing on each bank, but stopped when moving from one bank to the other. A coin toss will be used to determine the starting bank.

The boat operator should maneuver the boat as close to the bank as possible and try to maintain the boat parallel to the bank. In extremely shallow areas where boat movement is hindered, the operator should maneuver the boat perpendicular to the bank and sweep the shallow areas with the electrode. Movement of the boat during electrofishing should be pulsed, such that the boat never completely stops moving in the direction of sampling unless the boat becomes stuck or entangled in brush or trees. After electrofishing, the distance electrofished on each bank should be measured (m). Catch per effort will be expressed as number of fish collected per min of electrofishing.

C. OSB:

Electrofishing collections from an OSB will consist of three 10 - min subsamples. The sample sites will be based on the position of the thalweg on the bend determined from maps and general shoreline references (Figure 2). The starting point for the most downstream site is the point on the bend where the thalweg begins to deviate from the shoreline. The starting point for the middle site is the middle of the bend where the thalweg is adjacent to shore. The starting point for the most upstream site must be estimated at about 500 m downstream from the point where the thalweg begins to deviate from the shoreline.

Following establishment of the starting points, fish sampling will proceed upstream from the first starting point at the lower site. After this site has been sampled for 10 min, the second area is electrofished for 10 min, then the third site. Fish will be enumerated separately for each subsample. .

The boat operator should maneuver the boat as close to the shoreline as possible and try to maintain the boat parallel to the shoreline. Movement of the boat during electrofishing should be slow and continuous in an upstream direction, such that the boat never completely stops moving upstream unless the boat becomes lodged on rocks or entangled in brush or trees. High current velocity on outside bends will require the boat operator to use a relatively high throttle to move slowly upstream. Following electrofishing, the distance of each 10-min subsample should be measured (m). Catch per effort will be expressed as number of fish collected per min of electrofishing

D. ISB - STPS

1. Three to four electrofishing runs lasting not more than 5 minutes will be performed. Each run will be labeled as (a), (b), (c), or (d) (Figure 3.). The exact number of runs will depend on whether the river is at high or low flows. High and low flows are defined as covering the top of the wing dike.
    a. Run (a) will start at the most downstream point in the habitat. This area is usually a depositional bar at low flows and will most likely be sampled with a seine. However, at high flows this habitat may become a steep shoreline. The electrofishing boat will proceed upstream along the shoreline, shocking until the habitat has been completely sampled or 5 minutes is reached, which ever comes first.
    b. Run (b) will cover the scoured shoreline immediately downstream from the dike. Electrofishing will proceed upstream until the area has been sampled or 5 minutes have elapsed.
    c. Run (c) will cover the downstream end of the wing dike and proceed from the shoreline out to the tip of the dike or until 2.5 minutes have elapsed.
    d. Run (d) will cover the upstream side of the dike. The area will be shocked until the end of the dike is reached or 2.5 minutes have elapsed.
    e. In the case of high river flows, (c) and (d) runs will be combined. Electrofishing will be conducted along the entire dike area or until 5

minutes have elapsed. Field personnel should try to perform two passes across the dike to cover both upstream and downstream areas.

f. Catch will be recorded as number of fish collected per minute of electrofishing

E. SCC - DEEP:

The electrofishing sample consists of two - 10 min subsamples. One subsample will be collected along each shoreline at the midpoint of the SCC - DEEP. Electrofishing will be started and proceed upstream adjacent to the bank for 10 min (600 sec). After 10 min, electrofishing commences on the opposite bank and proceeds downstream for 10 min. Fish from each bank will be enumerated separately. Power should be continuously applied during electrofishing on each bank, but stopped when moving from one bank to the other. A coin toss will be used to determine the starting bank.

The boat operator should maneuver the boat as close to the bank as possible and try to maintain the boat parallel to the bank. In extremely shallow areas where boat movement is hindered, the operator should maneuver the boat perpendicular to the bank and sweep the shallow areas with the electrode. Movement of the boat during electrofishing should be pulsed, such that the boat never completely stops moving in the direction of sampling unless the boat becomes stuck or entangled in brush or trees. After electrofishing, the distance electrofished on each bank should be measured (m). Catch per effort will be expressed as number of fish collected per min of electrofishing.

F. SCN:

The standard electrofishing sample consists of two - 10 min subsamples; however, physical habitat conditions of the SCN may limit the applicability of the standard procedure (discussed below). Starting at the point where the SCN bank joins the main river, electrofishing will be started and proceed upstream adjacent to the bank for 10 min (600 sec). After 10 min, electrofishing commences on the opposite bank and proceeds downstream for 10 min. Fish from each bank will be enumerated separately. Power should be continuously applied during electrofishing on each bank, but stopped when moving from one bank to the other. A coin toss will be used to determine the starting bank.

The boat operator should maneuver the boat as close to the bank as possible and try to maintain the boat parallel to the bank. In extremely shallow areas where boat movement is hindered, the operator should maneuver the boat perpendicular to the bank and sweep the shallow areas with the electrode. Movement of the boat during electrofishing should be pulsed, such that the boat never completely stops moving in the direction of sampling unless the boat becomes stuck or entangled in brush or trees. After electrofishing, the distance electrofished on each bank should be measured (m). Catch per effort will be expressed as number of fish collected per min of electrofishing.

The standard electrofishing protocol may not be applicable in the event that: 1) the mouth

of the SCN is too small or too shallow to allow boat passage into the SCN, 2) the SCN is too shallow to allow boat movement (depth determined by boat operator), or 3) depth in only a portion of the SCN facilitates boat movement. In the case of (1) or (2) above, the crew leader should forego electrofishing in the SCN, and note the reason in the data sheet comment section. Under case (3), electrofishing should be conducted for as long as the depth permits boat movement. Time and distance electrofished should be recorded on the data sheet, and noted in the comment section.

z: In the event that there is not sufficient habitat length to complete all of the required electrofishing subsamples of specified duration (A-D above), the project leader may shorten the length of habitat electrofished as well as the sample duration. However, the same number of subsamples must be electrofished. For example, if an OSB is too short to allow for three 10-min electrofishing subsamples, then the project leader could collect three subsamples, each of which has a duration of 5 min. For each subsample, record the start and stop times, and note in the comment section the reason for the shortened sample duration.

References:

Burkhardt, R.W. and S. Gutreuter. 1995. Improving electrofishing catch consistency by standardizing power. North American Journal of Fisheries Management 15:375-381.

Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long term Resource monitoring program procedure: Fish monitoring. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P002-1. 42 pp. + Appendixes A-J.

Reynolds, J. B. 1983. Electrofishing. Pages 147-163 *in* L. A. Nielsen and D. L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland.

VVP-15 Instruction Manual

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Table 1. Voltage gradient mapping data sheet.

	Distance from sphere or boat															
Location	1	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
Sphere front																
Sphere right																
Sphere left																
Sphere back																
Boat front																
Boat middle																
Boat back																

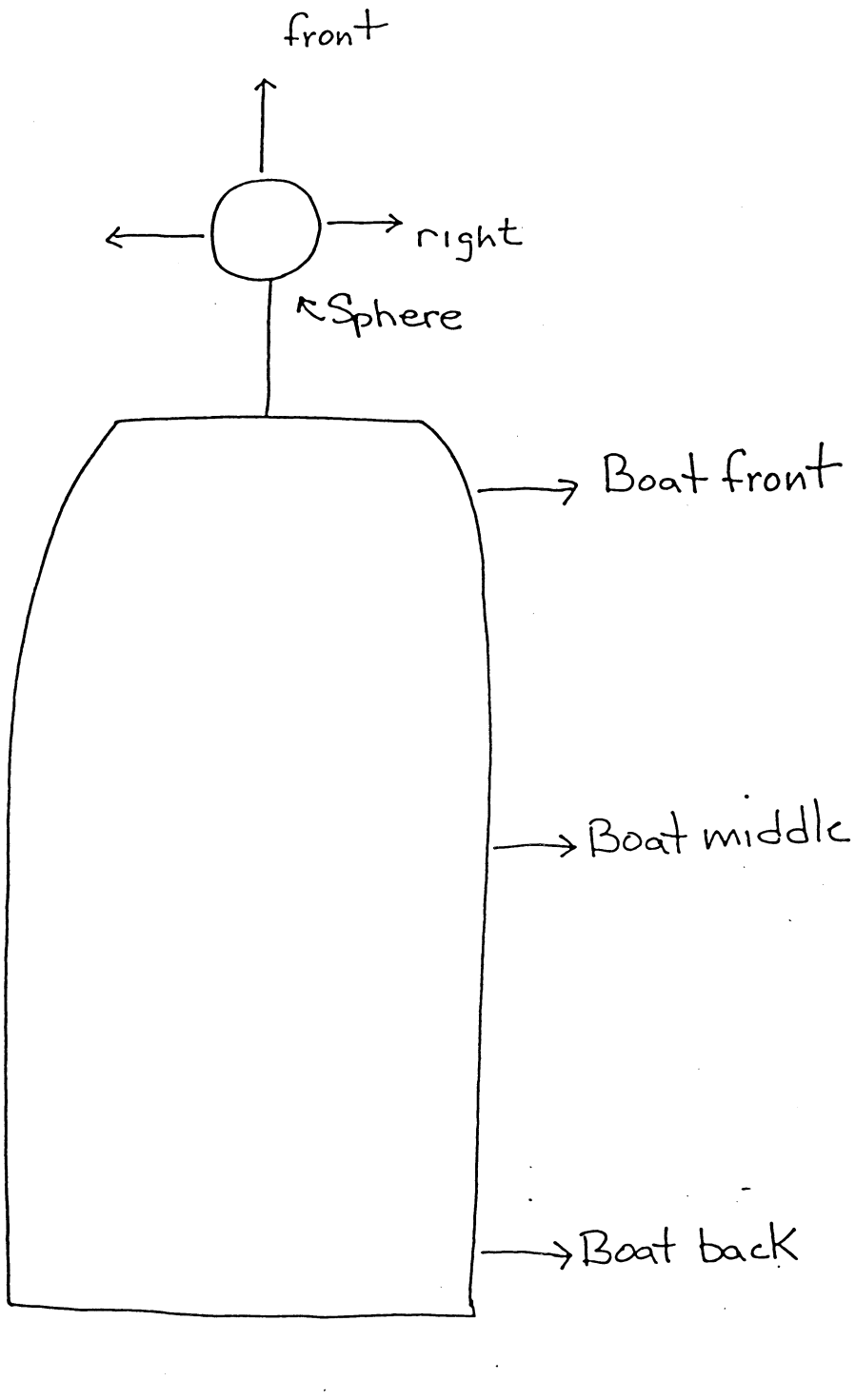

Figure 1. Reference locations for voltage gradient (V/cm) mapping.

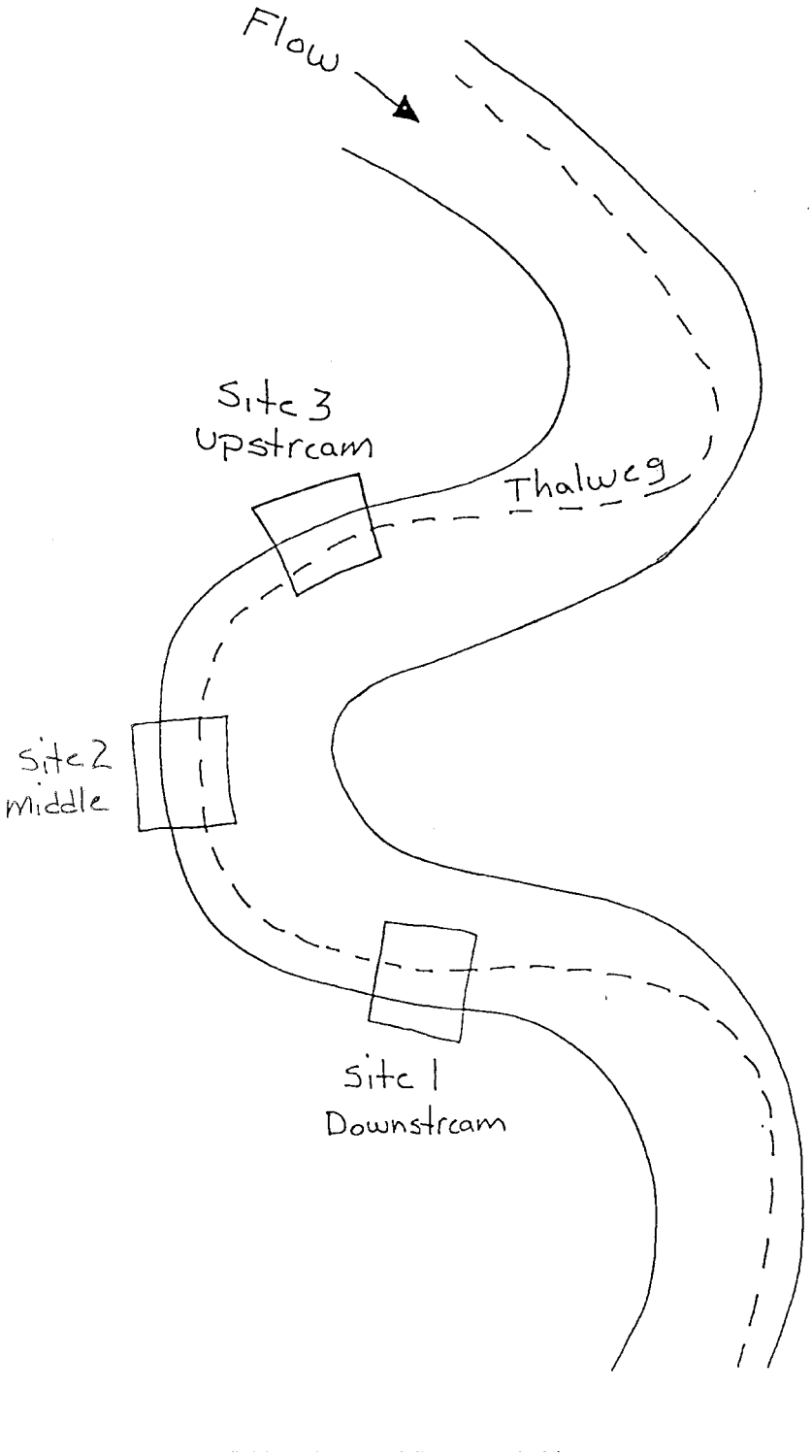

Figure 2. Electrofishing sites on OSB macrohabitats

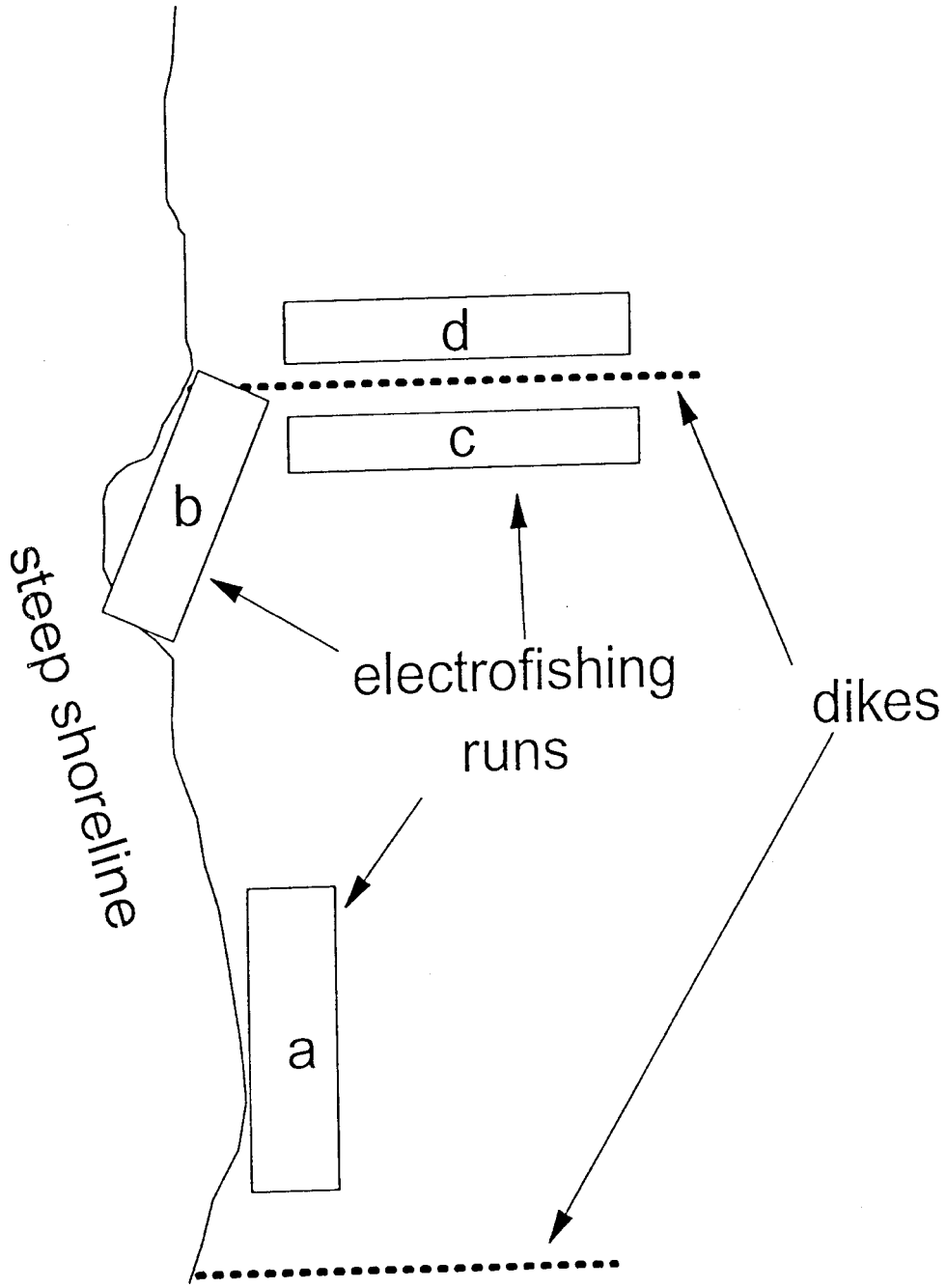

Figure 3. Inside bend electrofishing locations in steep shoreline (i.e., dike) mesohabitats.