CHAPTER 6.
ELECTROFISHING ASSESSMENT PROTOCOL FOR FISH ASSEMBLAGES IN GREAT LAKE COASTAL WETLANDS

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I. PURPOSE

To describe methods for sampling fish assemblages in Great Lake coastal wetlands using DC electrofishing equipment for the purpose of developing biological criteria and assessing water quality. This method is based on Wang et al. (1998), Simon (1998), and Thoma (1999).

II SCOPE/LIMITATIONS

This procedure applies to all sites that will be sampled for fish communities for developing biological criteria and for an integrated assessment of water quality. Data for this analysis will include collecting data on fish community composition, species richness, CPUE, and DELT anomalies.

III GENERAL INFORMATION

The methods described in this assessment are to be applied to all wetland sites including: 1) randomly selected EMAP sites chosen to help characterize a particular resource or region, 2) reference sites selected to determine the reference condition of a particular region of the state, 3) degraded sites selected to aid in calibrating the Index of Biotic Integrity, 4) problem investigation sites selected to evaluate a specific source of pollution. This method is not to be applied to sites that are determined to be unsampleable based on reasons in Chapter 1. Although the reasons for visiting a particular site may vary, the fish sampling procedures in this document applies to all site types unless otherwise noted. This procedure must be implemented simultaneously with an assessment of habitat (Chapter 2), aquatic plant communities (Chapter 3), macroinvertebrate communities (Chapter 4 & 5), or water chemistry (Chapter 8 & 9).

IV REQUIREMENTS

Personnel conducting this procedure must be capable of operating electrofishing equipment, be certified to operate boats, and be capable of identifying freshwater North American fish species. In addition, the personnel must have excellent map reading skills and demonstrate proficiency in the use of a GPS receiver and an orienteering compass. Because sites may be located miles from the nearest road, it is often necessary to wade through wetlands, canoe or boat, or hike for long distances overland to reach a site. Personnel conducting this procedure must have the physical ability to accomplish this task. The verification form (appendix A) must be used to record pertinent information for each site visit.

A. Qualifications of crew leaders: The crew leader must be a professional aquatic biologist with a minimum of a Bachelor of Science degree in biology with an aquatic entomology, invertebrate zoology, fisheries, or closely related specialization. Additionally, they must have at least six months experience working under a fish biologist in the areas of community sampling methodology and taxonomy.

B. Qualifications of field technicians - interns: A field technician must have at least one year of college education and coursework in environmental and/or biological sciences.

V. RESPONSIBILITIES

A. Field Crew leader: Ensures that data generated under this procedure meets the standards and objectives of the integrated condition monitoring program. Carry out the procedures outlined in the action steps.

B. Technical personnel: Carry out the procedures outlined in the action steps including equipment stocking, calibration 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 of equipment will be conducted according to the guidelines specified in the manufacturers manuals.

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

A. Control of deviations: Deviation shall be sufficiently documented to allow repetition of the activity as actually performed.

B. QC samples:Ten percent of all sites sampled within any given year are resampled as a means of determining sampling error.

C. Verification: The field crew leader will conduct periodic reviews of field personnel to ensure that technical personnel are following the procedures according to this SOP.

VII TRAINING

A. All personnel will receive instruction annually from a trainer designated by the program manager. Major revisions in this procedure will require that all personnel be retrained in the revised procedure by an authorized trainer.

B. The responsibility of the field crew leader includes training activities that will include instruction in the field, as well as, a field test to ensure that personnel can successfully implement this procedure.

VIII. ACTION STEPS

A. Equipment list

Ensure that the following items are present before implementing this procedure.

Boat
appropriately rated boat motor
DC electrofishing unit including miscellaneous parts and pieces
3/16 inch mesh dip nets
Two buckets and miscellaneous sorting chambers
Site verification form, previously completed with attached copies of 1: 24,000 USGS topographic maps
Latitude and longitude provided by EPA's EMAP program (for statistically based sites only)
County platt maps
State specific atlas and Gazateer (Delorme)
Aerial photographs
Pencils/Blunt-tipped Sharpies
Permanent/Alcohol proof markers
Labeling tape
Fish sample identification labels
10% formalin, enough to preserve one days worth of samples, ca. 4 L/site
Waterproof notebook
Chest-high waders
Rain-gear
Jars or bottles, in which the sample is to be preserved; preferably non-breakable synthetic,

minimum 1 L capacity ("A" and "B" jars)
Box or crate to store sample bottles
Canoe or stream shocker
GPS receiver, battery, and antenna
Flagging
Cellular telephone
35 mm camera
35 mm slide film

B. Data collection method

The objectives of the coastal wetland project are to develop biological indicators specific to Great Lakes coastal wetland types. The project will (1) document the current conditions of wetland habitat, macroinvertebrates, and fish communities in the Great Lakes nearshore coastal wetlands; (2) test the model developed by U.S. Geological Survey (Wilcox et al. 1999) to predict fish community condition, and (3) develop biological expectations for different wetland types among the various ecoregions.

Fish field sampling methods:

All fish collected will be identified to species, enumerated, examined for external anomalies, and either returned to the lake or preserved as voucher specimens and stored at the Indiana Biological Survey Aquatic Research Center Museum. Weights will be taken on a representative sub-sample if more than 15 individuals of a species are captured. All fish will be weighed if 15 or less individuals of a species are captured. Each site will have a habitat data sheet filled out for it (see Chapter 2).

Electrofishing consistently catches more species and individuals in less time and effort than other sampling methods used. It is the only method that can be used under all habitat conditions thus yielding a database that was easily comparable (in terms of catch/effort) under the variable conditions encountered. Previous Ohio EPA (Thoma 1999) work indicated that night electrofishing would likely capture more species and individuals than day electrofishing. Both day and night collections were made for comparison purposes and are discussed below.

General electrofishing methodologies

A 3.5-5.8-meter modified V-hull john boat will be used for electrofishing in nonwadeable riverine, protected, and open wetlands. For small wadeable riverine wetlands that a boat cannot navigate a back pack Smith-Root electroshocker will be used. Electrical current will be provided by a 3,500-7,000 watt generator and Smith-Root pulsator. Controls will be set on DC current, 60 pulses per second, 240-340 volts, and run at 5 to 6 amps. In low conductivity conditions the voltage will be adjusted in order to maintain 2 to 2.5 amps. Anodes will be either a single or two separately charged 1 m circumference electrospheres while in low conductivity conditions a 20 dropper array will be used. Articulated booms supported by distal floats will be positioned

about 2.1 m in front of the boat (3 m total length). If two anodes are used, one is positioned to the port and one to the starboard side at angles of approximately 20 degrees from the center line. This will result in the two electrospheres being 4.3 m apart when deployed. The articulation of the booms will allowed movement horizontally and vertically. Horizontal movement allows the booms to flex if an obstacle (especially a submerged one) is encountered and vertical movement allows the electrosphere to ride with the wave action. Swells or small waves less than 0.6 m cause non articulated booms to rise up and pull the anodes from the water thus interrupting the current flow and allowing fish to escape. The placement of a flotation device at the distal end of the boom kept the electrosphere under the waters surface at the proper depth of a few centimeters as the mechanism rode up and down. Sampling will not be conducted under wave conditions of 0.6 m or more.

Each sampling site for protected and open wetlands will be 500 meters long and the method will be deployed in water depths less than 1 meter. A set sampling time will not be used and time may vary between 1,800-5,000 seconds and will be dependent on habitat complexity. The greater the number of fish to be captured in the zone and the greater the complexity of the shore line the longer it will take to complete the sample. A crew of two individuals will be used in all electrofishing efforts. During sampling one individual will be positioned on the bow of the boat with a dip net and serve as the principal collector of fish captured in the electrical field while the second person will operate the outboard motor, pulsator controls (and spot lights at night), and collect any fish that surface at the back of the boat. All fish will be placed in livewells supplied with fresh water from a pump. Common carp will be placed in their own livewell to avoid excess oxygen consumption and the death of small fish that otherwise would frequently be trapped in common carp mouths and crushed.

The anode and cathode array deployments used in this study will be different from those used in previous sampling efforts. Anodes will be either a single or two separately charged electrospheres, 1 m in circumference, and constructed with 2 stainless steel bowls bolted together. The anodes will be suspended 5 cm below the surface, 2.1 m in front of the boat on articulated booms, one to each side. Two sets of cathodes, each set to be used at different depths, will be used. All had electrified portions 1.6 m in length. The cathode sets were designed to be deployed with the electrified surface at a maximum of 1.8 m and 3 m. Cathodes, 1.8 m long, will be used under all conditions where bottom depths are 2.5 m or less and 3 m cathodes will be used in depths greater than 3 m. Cathodes will be deployed from the sides of the boat at mid-ship, four on each side.

Sampling in wetland areas will be conducted when winds are generally from off shore and wave action is 0.6 m or less. Winds resulting in waves greater than 0.6 m prevent effective sampling. If winds are from the southwest, zones will be sampled from the west to the east. If winds are from the south east, zones will be sampled from the east to the west. This will allow the boat and stunned fish to move with the shoreline currents. After periods of sustained on-shore winds and heavy wave action, sampling will be avoided to allow for stabilization.

Day Sampling Methods

All habitat types will be sampled with day electrofishing. For the most part, the sampling techniques employed were the same as those used in Ohio EPA stream sampling efforts (Ohio EPA 1988) except for the following differences; electrosphere anodes, cathode array and depth, three person sampling crew (as described above), and site selection based on habitat type.

Night Sampling Methods

All night collections will be made at least 30 minutes after sunset and before 5:00 AM. Above surface lights will be used during night sampling. Six 12-volt tractor flood lights will be mounted on the bow 1 m above the water. Four 12-volt tractor flood lights mounted at the stern, 1 m above the surface, two on each side of the boat will illuminate the sides of the boat aft of the bow. One light will be directed forward and the other perpendicular to the side. A hand held spot light will be used to search for stunned fish outside these illuminated areas (especially behind the boat) and to scan the shoreline. When sampling is completed, four 12-volt tractor flood lights mounted on a transverse beam at the stern of the boat and directed at the sample processing area were used to process the sample. All lights will be powered by 12-volt, deep cycle marine batteries during sample processing and while sampling, powered by the electrofishing generator.

B.1 **General sampling procedures** - Mean wetland width (MWW) is used to define the length of the station in riverine wetlands, the distance from the station to unusual features or disturbances (e.g., bridges, etc.), and for protected wetlands the maximum length and width will determine the number of 500 m zones that will need to be sampled.

If the water level appears to be substantially (> 0.15 m) above normal, sampling should not occur (see Station Summary). Fish Habitat Evaluation, for determination of water levels) and will require a revisit of the site when appropriate conditions exist. Once the MWW for a station has been determined, this value is used for all future sampling, including future years when riparian land use or other factors may have changed the actual site width.

Sampling stations distances for riverine wetlands are **35 times** the MWW in length. The **minimum sampling distance for riverine wetlands is 150 m while the maximum length is 500 m**. This length is based on the distance necessary to capture most species present and is based on a desire to sample >3 habitat cycles. In **protected wetlands, the sample distance is 500 m and the number of zones will be based on the open wetted surface area** of the wetland.

Each station starts and ends at the prescribed distance from the X-point irrespective of placement. Thus, **stations can only be moved 26 m** to avoid the influence of a beaver dam, dry site condition, or an impoundment. Stations can be somewhat less than 35 times the MWW in length. EMAP instructions suggest that a minimum of 50% of the stream width must be sampled for a site to be considered valid. Stations should not contain permanent tributaries or hydraulic

controls (e.g., dams, old bridges abutements). Habitat should be sampled each time fish are sampled. Sampling of fish is done in the same site reach that is sampled for habitat.

Fish community composition and species relative abundance are estimated over the entire length of each station using catch-per-unit of effort (CPUE) sampling procedures. A single electrofishing run is made from the downstream to upstream end of the station in riverine wetlands. In protected wetlands, fish runs are started at the farthest point from the place the boat is launched and is targeted along natural shorelines with the greatest habitat diversity. No block nets are used. All fish (> 25 mm in total length) observed are collected. At the end of the pass, minimum and maximum length and batch weight are measured for all species encountered. Number and aggregate weight of adults and young-of-the-year are recorded separately for all fish species. Fish specimens less than 25 mm TL should not be counted in the number of specimens but listed separately.

For fish species that are > 25 mm TL, but are too hard to identify accurately, place these specimens in the "B" or unknown jar for the site. Only fish that were batch weighed and counted are to be vouchered in the "A" jar. Inspect all fish for deformities, eroded fins, lesions, and tumors (DELT).

Fish should be handled carefully to minimize mortality. After processing, fish are released alive into the station reach. For any species that cannot be identified with 100% certainty in the field, preserve the fish in the "B" jar and bring it back to the laboratory to be identified. See Table 2 for for species of fish and number of individuals that need to be preserved.

B.2. **Fish Community Evaluation** - Data sheets used in the Fish Community Evaluation include the **Station Summary** and **Catch Summary** data sheets. Both sheets apply to the whole station. There is a single **Station Summary** sheet per station and one or more of the catch summary sheets depending on the number and diversity of fish captured. Guidelines for filling out each sheet and examples of blank and completed sheets are provided on the following pages.

C. **STATION SUMMARY DATA SHEET**

This sheet summarizes the location, sampling characteristics, and gear used for the station. Some of the data on this form are derived from maps or from other data sheets. The location information should be identical to that collected during the Habitat Evaluation (see chapter 2). The variables on this sheet follows:

C.1. LOCATION ----------

1) Site name: The name of the wetland as shown on the most recent USGS 7.5" topographic map. The name used here should be identical to that used on the other data sheets and to that used for all other stations on the same wetland. Make sure that the spelling of the name is accurate and include all parts of the wetland name (e.g., West Branch, Middle Fork, River,

Creek, Lake) to avoid confusion. Other commonly used names for the wetland can be written here in parentheses (Herdendorf et al. 1981).

2) Waterbody ID code (Wisconsin sites only) - a unique seven-digit number that identifies each wetland; all streams, rivers, and lakes in Wisconsin have an assigned number. These numbers are available from the WDNR Master Waterbody File. For wetlands in other states, substitute Herdendorf et al.'s (1981) wetland number. As with Site name, waterbody ID code should be the same for all stations on a stream.

3) Station number - The station number must correspond to the station number assigned for the site by EMAP.

4) Date - Fill in the date when the fish community data were collected for the station. To avoid confusion use the YYMMDD format (e.g. 000706 equals 6 July 2000).

5) Starting location - A precise verbal description of the point on the stream where the fish sampling began (i.e., the downstream edge of the station). The description should include the exact distance and direction from the start to a "permanent" such as a bridge, building, or road marker. Avoid using landmarks that might be lost during future years (e.g., don't use tree or fence lines). Make the description as specific and precise as possible so that someone visiting the station for the first time can easily find the starting point. Installation of a permanent stake to mark the downstream end of the station is desireable if conditions permit. Be sure to confer with the landowner if the stake could interfere with the normal use of that area. **For example, West Branch Dunes Creek, 0.75 mi u/s SR 49 bridge, 2 mi N Chesterton, Nowhere Twp,**

6) Township, Range, Section, 1/16 Section, 1/4 Section - Legal description for the X-point of the station within the Public Lands System. These can be determined from recent USGS 7.5" topographic maps or a detailed county map. On a topographic map, a "land locator" template is useful for determining the 1/16 and 1/4 sections, indicate by a compass direction (NW, NE, SW, or SE). Note that for the Great Lakes all Townships are "N" (north), but Range can be either "E" or "W" (east or west). Make sure that the appropriate letter is included for both Township and Range.

7) 7.5" Quad Name - The name of the most recent USGS 7.5" topographic map on which the station is found.

9) County - The name of the county the station is located.

C.2. SAMPLING DESCRIPTION ----------

1) Sampling type - The type of fish sampling done at a station. Check the appropriate category. Generally, during this project a single pass catch-per-unit-of-effort (CPUE) sampling is done. In special cases, other types of sampling such as "depletion" or "mark-recapture" may also be done at a station.

2) Station length - The length following the riverine wetland channel of the station. This length is based on 35 times the average stream width. For protected wetlands the number of stations should be recorded here since all stations are 500 m. Measure with a tape measure to the nearest 0.1 m.

3) Number of passes - The total number of times a shocker is passed through the station during fish sampling. Normally, for "CPUE" sampling there will only be one upstream pass in riverine wetlands, and for protected wetlands a total of 1800 seconds of sampling is required which may result in multiple passes.

4) Time - The time range during which the sampling was completed. "Start" refers to the time when the first shocking pass was started, and "finish" refers to the time when the last shocking pass was completed. Use military time to the nearest minute.

5) Type of pass - A description of the direction of sampling through the station during a pass. "Upstream only" refers to a pass that begins at the downstream end of the station, proceeds upstream, and then ends at the upstream end of the station. This is the type of pass used for "CPUE" riverine wetland sampling. "Upstream, then downstream" refers to a pass that begins at the downstream end of the station, proceeds upstream to the upstream end of the station, and then proceeds back downstream to the downstream end of the station. This is the type of pass used for protected and open wetlands and constitutes a single pass.

C.3. GEAR DESCRIPTION ----------

1) Gear - A description of the number and type of electroshockers used in sampling. Specify the number of each type of gear that applies. Sampling will normally involve boat mounted electroshockers for most wetland types or a backpack electroshocker for smaller riverine wetlands.

2) Number of anodes per unit - The number of anodes per shocker. Normally there is one for backpacks and either one or two for boat electroshockers.

a) **For backpacks and stream shockers** -

3a) Anode size - The length of the long axis of the anode (the diamond-shaped or circular stainless steel tip on the hand-held probe), measured with a tape measure to the nearest 0.001 m. If multiple anodes are used on a shocker, they must all have the same anode size, shape, and material thickness. Anode size can be changed (by replacing the tip with a larger tip, or covering part of the tip with electrical tape or raising a ball out of the water) if necessary to maintain a relatively constant voltage and amerage.

4a) Anode material thickness - The thickness (diameter) of the metal used to form the tip of the anode. Measure with calipers or a ruler to the nearest 0.001 m..

5a) Anode shape - The general shape of the metal tip of the anode.

b. For Boat-Mounted shockers

3b) Anode length: The length of the exposed metal portion of either the cylindrical dropper(s) that come off of the boom or the diameter of the metal ball that dangles into the water. Measure with a tape measure to the nearest 0.01 m.

4b) Anode diameter The outside diameter of the exposed metal portion of the droppers on the front boom. Measure with calipers or a ruler to the nearest 0.001 m.

5b) Number of front droppers - The number of individual droppers on the front boom.

C.4 METER READINGS ----------

1) Type of electrofishing current - The type of electrical current (AC, DC, or pulsed DC) that the shocker emits into the water (this will often be different from that emitted by the generator in the shocker). Check the appropriate category.

2) Electroshocker control box meter reading - The typical output readings (i.e., not the extreme high or low readings) observed during sampling. Note the units of amperage and voltage for the meters when recording the meter values. Effort should be made to keep readings fairly constant during shocking within a station, between stations, within a wetland site, and among samples of the same wetland over time. Preliminary sampling just downstream of the station may be necessary to determine the output readings associated with the most effective shocking. As a rule, try to keep the voltage above 150 V and average amperage above 2 A. Voltage can be adjusted by changing the number and surface area of anodes (see below), and amperage can be adjusted by increasing generator output (adjusting generator throttle, using a boost switch if present, or using a generator with a different power rating). For AC or pulsed DC, some control box output ammeters read peak rather than average amperage; if this is the case, this should be noted on the sheet. Peak amperage approximates four times average amperage. If output meters are not present or are broken, note this on the sheet. Always try to use electroshockers with functioning output meters.

If Pulsed DC - This refers to two important variables, “pulse rate” and “duty cycle”, of pulsed DC current. Some shockers allow values for these variables to be varied, whereas others have a single fixed value for each parameter. If values can be changed, they should be set to the appropriate level at the beginning of sampling and not changed during sampling. This may require preliminary sampling just outside the station to determine the values where shocking is most effective. The same values should be used for all sampling within a station, between stations within a wetland, and among samples for the same station over time. Sampling fo many species is most effective and least harmful at pulse rates of 40-80 per second and at duty cycles of 10-20%.

COMMENTS/NOTES: Any and all information that appear relevant to the fish community survey but is not recorded anywhere else on the data sheet should be noted. This information should include weather, water, habitat conditions (e.g., glare, wind, precipitation, water clarity, unusually deep or shallow areas) and gear performance (e.g., problems with generators or meters) that influenced sampling effectiveness. Any evidence of fish kills (i.e., dead fish in the water or on the bank) or angler use of the stream (e.g., hooks and lines caught in bushes; evidence of cleaned fish on the bank; footprints from waders) should also be noted. Don't hesitate to make comments, if in doubt – write it down!

D. CATCH SUMMARY DATA SHEET

This data sheet is for summarizing and recording the numbers and aggregate weights by species, of fish captured during each sampling pass. The parameters on this sheet are as follows:

1) Site Name – Same as for **Station Summary** data sheet.

2) Station Number – Same as for **Station Summary** data sheet.

3) Date – Same as for **Station Summary** data sheet.

4) Pass number – The pass that this data sheet refers to is determined by the visit to the station.

5) Pass direction - Record the direction of the pass (either upstream or downstream) used to capture the fish recorded on this data sheet. For CPUE sampling, only upstream is used for riverine wetlands, while upstream then downstream is used for protected and open wetlands.

6) Time - The starting and ending time of the actual fish shocking for the pass should be recorded. If the shocking time is interrupted (e.g., to work up fish when the holding tank is too full, or due to equipment failure, etc.) the time of the interruption should be noted as the End time; the actual shocking was resumed and finally ended should be recorded in the parentheses. Elapsed shocking time (in minutes) should be recorded after Total.

D.1 CATCH SUMMARY ----------

This section of the data sheet is used to summarize the identity, total number, total weight, number of fish with deformities, eroded fins, lesions, and tumors (DELT), number of handling mortalities, the number of voucher specimens retained, and the numbr of marked or recaptured fish for each species captured. For species that are individually measured, transcribe these totals from the Individual Fish data sheet.

1) Species - The identity of each species captured during the pass. Only accepted American Fisheries Society common names should be used (see Robins et al. 1991; "Common and Scientific Names of Fishes from the United States and Canada. AFS Special Publication Number 20"). Use of abbreviations is prohibited. If a species cannot be identified with 100% certainty

then preserve **all unknowns in the "B" jar** for later complete identifications; **do not count and weigh any individuals in the "B" jar.**

NOTE

"A" jars contains vouchered specimens (generally 2-3 individuals), while the "B" jar contain the unknowns. The "A" jar should be identified, batch weighed, and have minimum and maximum lengths recorded. The "B" jar does not require any data collection.

2) Species Code - The species code is provided in Table 1. These three digit codes must be entered into this field for data entry.

3) Number caught - The total number of individuals of each species captured during the pass.

4) Weight - The total wet weight (g) of all individuals of the same fish species captured during the pass. Weigh to the nearest 0.1 g or to the nearest 1% of total weight, whichever is larger. For example, for a species with an aggregate weight of about 8 g, weigh to the nearest 0.1 g; for a species with an aggregate weight of about 60 g, weight to the nearest 1 g; for a species with an aggregate weight of about 250 g, weigh to the nearest 3 g; for a species with an aggregate weight of about 1450 g, weigh to the nearest 15 g; and so on. Weigh groups of fish in a calibrated net of palstic bag using an appropriately sized balance or scale (gross weight), and don't forget to subtract the weight of the net or bag (tare weight) to get the actual weight of the fish (FINAL weight).

NOTE

The Final Weight of each fish species is based on wet weight. Weigh to the nearest 0.1 or 1% of body weight, whichever is larger.

5) Number of DELT - The total number of fish of a species that have deformities, eroded fins or scales, lesions, or tumors ("DELT"). Only obvious deformities, eroded fins or scales, lesions, and tumors observed on live fish should be counted. Electroshocking (usually AC current only) sometimes causes wounds or burns; do not count these as DELT. Record each type of DELT separately under the appropriate column. Indicate if light <20% of body (L) or heavy > 20% of body (H) or if multiple types of DELT (M).

NOTE

Deformities (D), Eroded Fins (E), Lesions (L), and Tumors (T) need to be tallied separately. The magnitude of the DELT anomaly should be noted as light < 20% of body (L) or heavy > 20% of body (H), or if multiple types of DELT (M).

6) Number of vouchers – The total number of individuals of a species that were retained as vouchers. All fish species that can be identified to species with certainty should be preserved in 10% formalin and put in the "A" jar. The total number preserved should be written into this data field (See Table 2 for a list of necessary instructions on preserving fish specimens). All jars should have a double label including an internal tag (fill out REMAP Fish Collection Tag Record) and then a strip of tap should be placed across the top of the jar with the REMAP site number.

NOTE

Double label all jars with an internal "wet" label printed on write-in-rain paper or index weight labels. Place a label tape across the top of the jar and label with the REMAP site number.

Specimens that are too large to preserve, but are documented with a photograph should show important characters. For example, to differentiate between a walleye and a sauger the spinous dorsal fin should be spread to show the mottling in the spinous dorsal fin for sauger and two distal pigment spots in walleye. Multiple specimens can be photographed simultaneously, however, each frame should have the site number included on a 3" x 5" card written with a Sharpie and placed visibly in the frame. Specimens that are photographed should be noted in the comments section of the form indicating the frame number and roll number (e.g., Joe Exl roll 1, frame 24 could be documented as JE 1-24).

Effort should be made to minimize handling mortality such as using a live well, coolers, or quickly sorting fish into wet containers. Keep hands wet or use wet surgical gloves to minimize disruption of mucous layer. Although every effort may be made to return all fish back to the site alive, some mortality is inevitable. Dead fish should be counted and either be preserved or disposed of by burying. DO NOT PUT DEAD FISH INTO THE WETLAND.

NOTE

Vouchers can be specimens or pictures of specimens. Note in the appropriate place how many specimens and in the picture ID field. On the Photo Record Form, note the location and a description of the location. Make sure a card is inserted into the picture frame that shows the REMAP site number.

7) Laboratory check vouchers – When voucher specimens are preserved, verify the Number of Vouchers retained and record a check in the "number" column. If the number preserved (after a lab count) does not match the number vouchers, record the correct number under number vouchers. Verify the identification of vouchers and record a check in the "ID" column. If the field identification (under species) was incorrect, based on a lab examination, change species to the correct identification.

8) Minimum and maximum total length (TL) mm – The distance from the tip of the snout to the posterior tip of the longest caudal (tail) lobe of each individual fish. The caudal lobes should be pinched together slightly when measuring this distance. Measure to the nearest 0.001 m, using a meter stick of meauring board.

9) Picture identification – In this field should be noted the size of the fish photographed and the abbreviated frame reference for site vouchers that are recorded as pictures (e.g., JE1-24).

XI. REQUIRED RECORDS

Station Summary Form

A. The Station Summary Form will be completed during the actual field sampling process. This information will be placed in the biological database.

B. The Station Summary Form should be inserted into a file that was created for each site that includes on the outside of the file the EMAP site number, the site reconnaissance form, photocopy of the 7.5 minute U.S. Geological Survey topographic map (reduced to show perspective of the site), and a copy of the EMAP site location sheet used as a tracing of the X-point.

Catch Summary Form

A. The completely filled out form should include the species name, number, minimum and maximum length, aggregated weight, and presence of DELT anomalies. Wisconsin species code information must be listed on the form for processing.

B. The Photograph Record Form must be included for the groups of samples and identified using the appropriate labeling designation.

X. REFERENCES

Simon, T.P. 1998. Modification of an index of biotic integrity and development of reference condition expectations for dunal, palustrine wetland fish communities along the southern shore of Lake Michigan. Aquatic Ecosystem Health and Management 1:49-62.

Thoma, R. 1999. Biological monitoring and an index of biotic integrity for Lake Erie's nearshore waters. Pp. 417-462. In. T.P. Simon (Ed.). Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities. CRC Press, Boca Raton, FL.

Wang, L., J. Lyons, P. Kanehl, and T.P. Simon. 1998. Fish sampling procedures for Northern

Lakes and Forest Streams. In. T.P. Simon and P.M. Stewart (eds.). Standard Operating Procedures for Development of Watershed Indicators in REMAP: Northern Lakes and Forest Streams. U.S. Environmental Protection Agency, Chicago, Illinois.