OKLAHOMA CONSERVATION COMMISSION
WATER QUALITY DIVISION

STANDARD OPERATING PROCEDURE

FISH COLLECTION
(Seining and Electrofishing)

1.0 PROCEDURAL SECTION

1.1 Scope and Application[7],[8]

Fish assemblage monitoring is an integral component of the Oklahoma Conservation Commission's Water Quality program. Assessment of the fish assemblage measures the structure and function of the ichthyofaunal community to evaluate the integrity of a stream. Sampling occurs during the summer period, as defined below, with care to avoid collection in waters with sensitive species or species of concern earlier than June 1.

1.2 Summary of Method

The collection of fish follows a modified version of the EPA Rapid Bioassessment Protocol V (EPA, 1999) supplemented by other documents. Specific techniques for, and relative advantages of seining and electrofishing vary considerably according to stream type and conductivity. The specifics are discussed in detail in Fisheries Techniques (edited by L.A. Nielsen and D.L. Johnson and published by the American Fisheries Society 1983).

The collection of fish involves the use of two collection methods, seining and electroshocking. The combination of methods was selected in order to produce a representative fish collection. Variations of habitat, type of fish, and water chemistry dictate the use of different collection techniques. In general, each stream is sampled for a distance of 400 m. Both techniques are used at each site when practical, in attempt to reduce gear bias or selectivity to the extent possible. Occasionally site conditions will limit the effectiveness of one form of sampling or the other, to the point of rendering them impractical or unsafe. These judgments will be determined by the crew chief or the crew member most experienced with the site.

Seining can be broadly defined as the use of a net, manually pulled through the water, in attempt to encircle and capture fish. Seine height is dictated by water depth, and length is determined by width of the water being sampled. If possible, the seine should be 15-25% longer than the width of the waterbody being sampled and about 25% higher than the depth of the water. The seine is hauled with the current because fish tend to orient towards the current.

Electrofishing can be defined as the use of electrical current passed through the water, in a controlled manner, in an attempt to momentarily stun fish, rendering them easy to capture. Electrofishing can be accomplished using three different methods and equipment types: (1) backpack shocker, (2) tote barge, or (3) boat shocker. The backpack shocker is the primary means of electrofishing and consists of a trailing stainless steel cable electrode and ring electrode mounted on the end of a fiberglass pole. The ring should be substituted with a diamond shaped array when sampling in waters of higher conductivity (>1000 µS/cm). The shocking team consists of at least two people. One carries and operates the shocker while the other(s) net stunned fish. The shocker is most useful where a seine cannot be used effectively in areas such as brush piles, root wads, and cobble substrates. The forward electrode is gradually passed back and forth as the team walks downstream. As fish are stunned, they usually roll over and become more visible, allowing the netters to see and capture them.

In waters of high conductivity (> 1000 µS/cm) the effectiveness of electroshocking declines. Under these conditions, electrofishing may be limited to targeted shocking in shallow habitat that is not possible to seine. At high conductivity levels it is up to the discretion of the crew leader, whether electrofishing is effective. The backpack shocker is rated for use up to 2150 µS/cm, and should not be used at higher conductivity levels. The backpack system's level of power and size of field is designed for and works well in narrow (<15 meter wide) streams with short wadeable pools and numerous riffles. Stream channels that are wider, with longer pools and fewer and shorter riffles that still meet wadeable criteria, require a larger electrical field and more power than can be supplied by a backpack shocker. Additionally, if 30-40% percent of the reach to be sampled is greater than the depth of the shortest crew member's elbow, an alternate shocking technique should be used.

In deep or wide streams where backpack shocking is impractical, the OCC employs the use of a tote barge. The barge system is powered by a 5500 watt (10horsepower) generator and is housed in a 4x5'x12"plastic tub. The barge allows for reasonable mobility of the large (>100lb) generator. The system includes a handheld anode pole, identical in scope and design to that described for the backpack system, but connected by a 50' cable. The cathode consists of an electrically connected aluminum grid system mounted to the bottom of the barge (below waterline). A pull rope is attached to the front of the barge to allow the team to pull the barge across short riffles and other obstacles when necessary. The increased power of the larger generator not only enables the crew to improve its efficiency in open water but is also helpful in mitigating the effects of increased conductivity

[7] Text taken directly or in part from "Rapid Bioassessment Protocols for Use in Wadeable Stream and Rivers, 2nd Edition", US EPA 841-B-99-002 July 1999

[8] Text taken directly or in part from Dan Butler, Senior Biologist, Oklahoma Conservation Commission (2000)

when encountered. Due to safety concerns the barge team should include an additional crew member responsible for overseeing the safety of the crew and monitoring the control box (and the emergency shut-off switch)

Occasionally, fish surveys must be completed on stream reaches that offer very limited wading potential. When presented with this obstacle, we employ the use of a boat mounted electrofishing system. The system includes a 3250 watt generator, a single bow mounted anode pole/array, and a control. The aluminum boat hull, which houses the electrofishing system, acts as the cathode. The boat is equipped with a raised deck and safety rail. The primary netter(s) position themselves on the deck. The current is activated when one of the netters stands on a pressure activated switch, completing the circuit. The boat is propelled by a small outboard motor. The navigator maneuvers the boat in a way that positions the anode in or near habitat. When riffles or other areas of shallow water are encountered, the system comes equipped with a junction box, which allows the user to quickly convert from a bow mounted anode to a handheld anode attached by a 50' cable. This enables a crew, wearing chest waders, to use the boat in a very similar manner as the tote barge. Electroshocking from a boat requires at least three crew members.

In general, all fish are placed in 10% formalin immediately after capture. However, if larger fish (> 100 g) can be positively identified in the field, they are returned to the water in a location where recapture is unlikely. All large fish released are photographed. A representative photograph is taken when large numbers of one fish species is collected and released. Collected organisms are identified to species by an experienced taxonomist.

1.2.1 Definitions

- Summer Collection Period: **May 15*** to **October 31**
  **waters containing sensitive species or species of concern will not be sampled before June 1 to avoid disruption of spawning*

1.3 Health and Safety Warnings

- Primary responsibility for safety while electroshocking rests with the team leader.
- All crew members should receive training in First Aid and CPR. Electro-fishing units have a high voltage output and may deliver dangerous electrical shock. Electric shock can cause heart fibrillations and/or death.
- While electrofishing, avoid contact with water unless sufficiently insulated against electric shock. Use chest waders with non-slip soles and water-tight rubber gloves that cover to the elbow. If they become wet inside, stop fishing until thoroughly dry.
- Avoid contact with anode at all times. <u>At no time while electrofishing should a crewmember reach into the water for any reason.</u>
- The electrofishing equipment provided is equipped with a 45 degree tilt switch which interrupts the current. Do not make any modifications to the electrofishing unit, which would make it impossible to turn off the electricity.
- General safety guidelines should be observed. If waders or gloves develop leaks, leave the water immediately. Avoid operating electrofishing equipment near people, pets or livestock. Discontinue any activity in streams during thunderstorms or heavy rain. Rest if crew becomes fatigued.
- Decision to use electrofishing equipment will depend on size of site, flow, conductivity and turbidity. If the specific conductivity is below 10 µS or > 1000µs; if the flow is too high; if the site is too deep; if the water is too turbid to assure safe footing or locate stunned fish, the crew may consider using the seine only or determine that site cannot be sampled. <u>This is a safety decision.</u>
- Formalin is a carcinogen and can also cause permanent damage to mucous membranes and eyes. Care must be taken when placing fish in formalin so that the fish does not flop around and splash formalin onto people near the jar. Proper precautions should be taken when handling formalin.
  - Protective gloves and eyewear should be worn
  - Avoid inhalation of vapors
- <u>FAILURE TO OBSERVE SAFETY PROCEDURES WILL RESULT IN DISCIPLINARY ACTIONS INCLUDING PROBATION AND DISMISSAL.</u>

1.4 Cautions

- Do not collect fish without the permission of the Monitoring Coordinator, who will have obtained the appropriate permits.
- Do not sample in waters containing sensitive species or species of concern before June 1 to avoid disruption of spawning.

1.5 Interference

- Seine effectiveness is limited by physical obstructions including rocks, sticks, logs, thick vegetation, or anything that would impede the progress of the net. And can also include extreme (>1.5 m) depth and water velocity (>3fps).
- Backpack shocker effectiveness declines above conductivity levels greater than 1,000 µS/cm, and should not be used above 2,150 µS/cm

- Tote barge and boat shockers allow for sampling at higher conductivity levels, but should not be used in waters with higher conductivity than the manufacturer's specifications.

1.6 Personnel Qualification

Field personal must be trained and evaluated on sample collection techniques. Sample collection is subject to approval by the QA Officer and/or Monitoring Coordinator. Training will be done through dry run exercises in the field to familiarize field personnel with procedures and techniques.

1.7 Apparatus & Materials

Clothing

Rubber Gloves	as many pairs as the shocking crew consists of
Waders	as many pairs as the shocking crew consists of, although everyone is responsible for their own waders
Goggles	for use in mixing formalin

Documentation

Field data sheets	**Sampling Episode Sheet, Site Collection Sheet, Flow Meter Sheet** and **Fish Collection**
Waterproof paper	for labels inside jar
Pencils	labeling
Sharpie® pen	for labeling jar
Extra white paper	used for a background for fish pictures
Clipboard	
Camera	
Tape measure	to record lengths of released fish if desired

Chemicals

10% buffered formalin

Shocker

Smith Root LR24 backpack shocker system OR
Smith and Root VVP tote barge system mounted on 4'X5'X12' plastic tub housing OR
Midwest Lake Electrofishing system mounted on a 4'X12' aluminum boat.

Nets

4 x 10, 6 x 10, 4 x 20, and 6 x 20 seines and any other seines that are preferred by the crew leader. All seines should be ¼ inch mesh.
Dip nets to collect shocked fish

Containers

Wide mouth 1-gallon jars, at least 4 per site
1 or 2 liter graduated cylinder for mixing 10% formalin (37% formaldehyde)
Whirl-Paks for putting special fish in

Instruments

DO meter
pH meter
Conductivity meter
Turbidity meter
Alkalinity test kit
Flow meter

1.8 Instrument/Method Calibration

Refer to the appropriate SOP and/or owner’s manual.

1.9 Preparation

- A representative stream reach is selected and measured such that primary physical features are included in the reach (riffles, runs, and pools)

- To the extent possible, the reach should be located away from the influences of major tributaries and bridge/road crossings. Bridges or road crossings may be unavoidable due to stream depth, access restrictions and/or tributary location. Best professional judgment may be necessary to locate the most representative stream reach, and any deviation from an ideal reach should be documented.
- In general, each stream is sampled for a distance of 400 m.

Seining

- Seine height is dictated by water depth, and length is determined by width of the water being sampled. If possible, the seine should be 15-25% longer than the width of the waterbody being sampled and about 25% higher than the depth of the water. The amount of obstructions in the stream will often preclude the use of longer seines however. When this situation occurs, the crew leader will decide on the most effective combination of seines. OCC utilizes 4 and 6 foot seines in 10, 20, and 30-foot lengths. This will allow the center of the net to form a bag behind the operators where the fish are more likely to stay in the net. The seine is hauled with the current because fish tend to orient towards the current.

Electrofishing

- The shocker is most useful where a seine cannot be used effectively in areas such as brush piles, rootwads, and cobble substrates.
- The choice of electrofishing method and equipment will depend on the stream to be sampled.
    1. For narrow (<15 meter wide) streams with short wadeable pools and numerous riffles, the backpack shocker is most appropriate. The shocker consists of a trailing stainless steel cable electrode and either a ring or diamond electrode mounted on the end of a fiberglass pole. In waters of extremely low conductivity (<40 uS) the ring should be used. In waters of high conductivity (>1000 uS) only the diamond should be used. In very deep water where the ring seems to be ineffective the diamond electrode may offer better results. The shocking team consists of at least two people. One carries and operates the shocker while the other(s) net stunned fish.
    2. In deep or wide streams where backpack shocking is impractical, the OCC employs the use of a tote barge. The system includes a handheld anode pole, identical in scope and design to that described for the backpack system, but connected by a 50’ cable. The cathode consists of an electrically connected aluminum grid system mounted to the bottom of the barge (below waterline). A pull rope is attached to the front of the barge to allow the team to pull the barge across short riffles and other obstacles when necessary. Tote barge electrofishing requires at least three crew members.
    3. In stream reaches that offer very limited wading potential, the boat mounted electrofishing system will be used. The system includes a single bow mounted anode pole/array. The aluminum boat hull, which houses the electrofishing system, acts as the cathode. When riffles or other areas of shallow water are encountered, the system comes equipped with a junction box, which allows the user to quickly convert from a bow mounted anode to a handheld anode attached by a 50’ cable. This enables a crew, wearing chest waders, to use the boat in a very similar manner as the tote barge. Boat electrofishing requires at least three crew members. In waters of high conductivity (>1000 µS/cm) electroshocking effectiveness declines, due to the highly conductive nature of the water. Under these conditions, it is up to the discretion of the crew leader if electrofishing is suitable. Electrofishing will not be completed at conductivity levels greater than the manufacturer's recommendation for the equipment.

1.10 Sample Collection

Seining

1. The seine should be manually pulled through the water. Since fish tend to orient towards the current, the direction of the seine haul should generally be with (in the same direction of) the current.
2. The lead line should be kept on the bottom, and in front of the float line.
3. If there are many obstructions on the bottom, the lead line will become caught or bounce and most fish will escape underneath the bottom of the net. If this happens use a smaller net that allows you to avoid obstructions or go to electroshocking.
4. The brailes of the net should be used to disturb the area under any undercut banks or beds of macrophytes near the edge, in order to scare fish hiding under cover out towards the middle of the net.
5. Under ideal conditions the net should be pulled through the water in the manner described above for about 10 meters and dragged out of the water on a gradually sloping pre-selected beach. The person pulling the seine on the side of the stream opposite the beach should swing ahead of the other person so that the seine is pulled out on the beach stretched over the same distance it was stretched in the stream.

6. If the stream does not have gradually sloping banks, the dip method should be used. This method consists of sweeping around and through the area to be sampled, keeping a wide bag and moving the lead line as much under the undercut bank as possible. Use the brailes to probe repeatedly as far as possible into the undercut area working towards each other until the brailes overlap. The seine should then be swiftly stretched and lifted vertically from the water. An alternative method of retrieving fish under these conditions is to slowly turn the brailes to wind the net up once they have overlapped to form an enclosure. This may entangle the fish with the net and allow them to be lifted out of the water with the rolled up net.

Shocking

1. Before operating or assisting with the shocker, READ AND UNDERSTAND THE MANUALS for the generator and the shocker. Starting procedures, safety procedures and troubleshooting are well documented in these manuals and are not spelled out in this text. The manuals can be obtained from the equipment file in the main office.
2. Collection begins at a shallow riffle or other physical barrier at the downstream limit of the reach, and terminates at a similar barrier at the upstream end of the reach.
3. In general, fish collection procedures commence at the downstream barrier and proceeds in an upstream direction; however, this is up to the discretion of the Crew Leader.
4. A minimum of two people is required for electrofishing.
5. The forward electrode should be gradually passed back and forth over the stream width, including brush piles and root wads. As fish are stunned, they will usually roll over and become more visible, allowing the netter(s) to see and capture them.
6. In very dense brush or root cover, fish often sense the presence of the team before they are close enough to be stunned and then retreat so deeply into cover that it is impossible to net them when they are stunned. It is often better in situations such as these to insert the electrode into the brush before it is turned on, give the fish a minute or so to get used to the new situation and then turn the current on. Many fish will be much closer to the edge of brush pile when they are stunned in this manner.

1.11 Sample Handling & Preservation

1. Fish collected by seining and electroshocking should be kept in separate jars and labeled as to what method was used to capture them. This will make the methods independent if desired for analysis.
2. Label each jug. Using a permanent marker, write the date, WBID #, collection time, stream name, number of jars composing one sample, county, legal location, and crew leader's name on the lid and side of the jug. In general all fish should be placed in 10% formalin immediately after capture. There are a few exceptions made for larger fish (>100 gms or 0.25 lbs), which can be positively identified in the field.
    a. If all team members agree on the identification of such a fish, it can be returned to the water far enough away that recapture is unlikely.
    b. All large fish released must be documented on the **Fish Collection Sheet**. This includes fish such as gars, all types of carpsuckers, black bass, any white bass in water where yellow bass or striped/white hybrids may be found, all buffalo, all redhorse, and any other unusual fish. Please note**,** the golden and black redhorse cannot be told apart without counting lateral line scales and pelvic rays. Unless this information is recorded on the **Fish Collection Sheet**, the fish must be brought in for identification, or recorded as *Moxostoma* sp. Similar notes must be taken when releasing other fish that can be difficult to tell apart in the field such as the river and shorthead redhorses or any of the buffalos.
    c. All large fish released must be photographed. It is important to take photos and label them so that they will be identifiable 5 to 7 years from now. Be sure to follow the Photodocumentation SOP. The photos are data, and should be labeled as to the ID of the fish in the picture, the date, WBID #, site time, stream name, county, and legal location of the site. One copy should be kept in the Crew Leader's files, and one should be forwarded to the Data Manager. In addition, note the photos on the **Fish Collection Sheet**.
3. When preserving fish much larger than 0.3 to 5 kg (0.5 to 10 lbs), the fish should be sliced open along the lower rib in order to allow the formalin to penetrate the body cavity fast enough to prevent decay. A slit through the ribs is preferred to a belly slit to facilitate counting belly scales in the lab.
4. Formalin is a carcinogen and can also cause permanent damage to mucous membranes and eyes. Care must be taken when placing fish in formalin so that the fish does not flop around and splash formalin onto people near the jar. The fish should be put into the jar with the lid tilted open away from the operator so that the lid shields the face and body of the operator. Flood any skin exposed to formalin with plenty of water as soon as possible. If it gets in your eyes, flood the eyes with water immediately and go to the doctor immediately after that.
5. Fill out a **Chain of Custody Form**.
6. The Crew Leader is responsible for transferring the samples to the Fish Sample Custodian.

1.12 Sample Preparation and Analysis

Not applicable

1.13 Troubleshooting

Consult owners' manuals and/or the Environmental Monitoring Coordinator

1.14 Data Acquisition, Calculation & Data Reduction

Not applicable

1.15 Computer Hardware & Software

Not applicable

1.16 Data Management & Records Management

1.16.1 Field Notation

All measurements and observations made at each site should be recorded on the **Site Collection Sheet** (see **SOP Appendix: Data Sheets**); include all physical and chemical information including DO for runs, riffles, pool top, and pool bottom—when available. Data should be recorded following procedures outlined in the **Procedure for Completing Field Data Sheets SOP**. A **Flow Meter Data Sheet** (see **SOP Appendix: Data Sheets**) should also be filled out; see the Flow Measurement for Wadeable Streams SOP. It is mandatory to follow the procedures outlined in the Photodocumentation SOP. Please note photos on the appropriate field sheets.

1.16.2 Fish Collection Sheet:

All observations should be recorded on the **Fish Collection Sheet** (see **SOP Appendix: Data Sheets**).

The following bullets will describe how the **Fish Collection Sheet** should be completed.

DATA SHEET HEADER INFORMATION:

- SITE NAME: Record the stream name from the USGS 7-1/2' map name. If a county map, soil map, or other map has a different name, the USGS 7-1/2' map takes precedence. If a stream is unnamed on the USGS map, but named on another map, use that name, but write the name of the map in parentheses beside the stream name.
- WBID #: Record the Water Body Identification number.
- LEAD INVESTIGATOR: Record the name of the person responsible for data custody and reporting
- DATE: Record the date in MM/DD/YY format.
- TIME: Record the site time in military format. The "site time" is when initial activities began at the site and should be the same on all forms associated with the site.

COLLECTION INFORMATION:

For each collection method used, fill in the appropriate specifications. For the backpack, tote barge and boat-mounted shockers, indicate:

- SHOCKING TIME Record the amount of time spent shocking in seconds
- VOLT/AMPS Record the voltage and amperage on the shocker
- PULSES/SECOND Record the pulses per second setting on the shocker (measure of wave frequency)
- %DUTY CYCLE % of on time; product of pulse width and frequency (the actual time the current is being delivered)
- REACH LENGTH Length of stream used in the fish collection

For the boat-mounted shocker only, also indicate:

- LOW RANGE or HIGH RANGE
- HANDHELD or UMBRELLA ARRAY PROBE.

If a seine is used, indicate:

- SEINING TIME Record the amount of time spent seining in minutes
- SEINE TYPE/SIZE Record the size and type of seines used

FISH IDENTIFIED & RELEASED:

- SPECIES Record the genus and species of the fish released or the common name if the species can be definitely identified later based on that common name

- COUNT — Record the number of individual organisms released
  - SHOCK — Number released during the shocking effort
  - SEINE — Number released during the seining effort
- COMMENTS — Record any information that was used to help in the identification process
- PHOTO ID # — Record the identification number that corresponds to OCCWQ photo tracking system. It is mandatory to follow the procedure outlined in the Photo-documentation SOP.

1.16.2 Habitat Form

At all sites where fish are collected, a stream habitat evaluation must be performed. It does not have to be done on the same day as the fish are collected, but should be done before major floods change the habitat. Refer to the Habitat Assessment SOP.

1.16.3 Chain of Custody Procedure

Collection of fish requires the use of a Chain of Custody form (COC). . The handling of COC should follow the procedures described in the **Chain of Custody and Sample Labeling SOP**. The manifest is routed as follows:

1. Fish samples are collected in the field and the COC is completed and signed by the field personnel involved with collection.
2. Samples are submitted to the Fish Data Custodian and the person receiving the samples signs the COC.
3. Processed samples are sent to the taxonomist for identification. The taxonomist must sign the COC.
4. After identification, taxonomic identification sheets will be forwarded with a copy of the signed COC to the Data Manager. The COC form returned from the laboratory will include the laboratory tracking or log number(s) used to reference the identification sheet.

2.0 QA/QC SECTION

2.1 Training

Training of field personnel will be done through dry run exercises in the laboratory and field to familiarize them with instrument operation, use, calibration and maintenance. All samplers should read Fisheries Techniques (edited by L.A. Nielsen and D.L. Johnson and published by the American Fisheries Society 1983) prior to collecting fish. All operators are required to become familiar with the SOP documents. Prior to solo sample collection, field personnel are evaluated in a field setting for proper use of equipment and sample collection protocol. Annual field audits are performed on sample collectors following procedures outlined in the **Quality Management Plan**.

2.2 Maintenance

- Maintain the shocking equipment per the owner's manual instructions
- Seines should be stored dry and tangle-free

2.3 QC Procedures

At least one temporal replicate sample should be collected per fish crew leader.. Replicate samples should be completed at the same reach as the original collection. When practicable, replicate samples should be taken during the same season and hydrologic period (i.e., not across major seasonal change such that rainfall and temperature are significantly different between the samples). Replicate sampling within four weeks is preferred.

3.0 REFERENCES

EPA, (1999) Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd Edition, EPA 841-B-99-002, Office of Water, Washington, D.C.

Butler, D., (1999) Personal Communication, Senior Biologist, Oklahoma Conservation Commission, Oklahoma City, OK.

Nielsen, L.A. and D.L. Johnson, (1983) Fisheries Techniques, American Fisheries Society.

4.0 APPENDIX A

STANDARD OPERATING PROCEDURE
Field Summary

- Summer Collection Period: **May 15*** to **October 31**
  **waters containing sensitive species or species of concern will not be sampled before June 1 to avoid disruption of spawning*

Health and Safety Warnings

- Primary responsibility for safety while electroshocking rests with the team leader.
- All crew members should receive training in First Aid and CPR. Electro-fishing units have a high voltage output and may deliver dangerous electrical shock. Electric shock can cause heart fibrillations and/or death.
- While electrofishing, avoid contact with water unless sufficiently insulated against electric shock. Use chest waders with non-slip soles and water-tight rubber gloves that cover to the elbow. If they become wet inside, stop fishing until thoroughly dry.
- Avoid contact with anode at all times. <u>At no time while electrofishing should a crewmember reach into the water for any reason.</u>
- The electrofishing equipment provided is equipped with a 45 degree tilt switch which interrupts the current. Do not make any modifications to the electrofishing unit, which would make it impossible to turn off the electricity.
- General safety guidelines should be observed. If waders or gloves develop leaks, leave the water immediately. Avoid operating electrofishing equipment near people, pets or livestock. Discontinue any activity in streams during thunderstorms or heavy rain. Rest if crew becomes fatigued.
- Decision to use electrofishing equipment will depend on size of site, flow, conductivity and turbidity. If the specific conductivity is below 10 µS or > 1000µs; if the flow is too high; if the site is too deep; if the water is too turbid to assure safe footing or locate stunned fish, the crew may consider using the seine only or determine that site cannot be sampled. <u>This is a safety decision.</u>
- Formalin is a carcinogen and can also cause permanent damage to mucous membranes and eyes. Care must be taken when placing fish in formalin so that the fish does not flop around and splash formalin onto people near the jar. Proper precautions should be taken when handling formalin.
  - Protective gloves and eyewear should be worn
  - Avoid inhalation of vapors
- <u>FAILURE TO OBSERVE SAFETY PROCEDURES WILL RESULT IN DISCIPLINARY ACTIONS INCLUDING PROBATION AND DISMISSAL.</u>

Cautions

- Do not collect fish without the permission of the Monitoring Coordinator.
- Do not sample in waters containing sensitive species or species of concern before June 1 to avoid disruption of spawning.

Interference

- Seine effectiveness is limited by physical obstructions including rocks, sticks, logs, thick vegetation, or anything that would impede the progress of the net. And can also include extreme (>1.5 m) depth and water velocity (>3fps).
- Backpack shocker effectiveness declines above conductivity levels greater than 1,000 µS/cm, and should not be used above 2,150 µS/cm
- Tote barge and boat shockers allow for sampling at higher conductivity levels, but should not be used in waters with higher conductivity than the manufacturer's specifications..

Personnel Qualification

Field personal must be trained and evaluated on sample collection techniques. Sample collection is subject to approval by the QA Officer and/or the Environmental Monitoring Coordinator. Training will be done through dry run exercises in the field to familiarize field personnel with procedures and techniques.

Apparatus & Materials

Clothing

Rubber Gloves	as many pairs as the shocking crew consists of
Waders	as many pairs as the shocking crew consists of, although everyone is responsible for their own waders

Goggles	for use in mixing formalin

Documentation

Field data sheets	**Sampling Episode Sheet, Site Collection Sheet, Flow Meter Sheet** and **Fish Collection Sheet**
Waterproof paper	for labels inside jar
Pencils	labeling
Sharpie pen	for labeling jar
Extra white paper	used for a background for fish pictures
Clipboard	
Camera	
Tape measure	to record lengths of released fish if desired

Chemicals

Gasoline/oil mix for generator
Extra two stroke oil
10% buffered formalin

Shocker

Smith Root LR24 backpack shocker system OR
Smith and Root VVP tote barge system mounted on 4'X5'X12' plastic tub housing OR
Midwest Lake Electrofishing system mounted on a 4'X12' aluminum boat.

Nets

4 x 10, 6 x 10, 4 x 20, and 6 x 20 seines and any other seines that are preferred by the crew leader. All seines should be ¼ inch mesh.
Dip nets to collect shocked fish

Containers

Wide mouth 1-gallon jars, at least 4 per site
1 or 2 liter graduated cylinder for mixing 10% formalin (37% formaldehyde)
Whirl-Paks for putting special fish in

Instruments

Multimeter (DO, Conductivity, pH)
Turbidity meter
Alkalinity test kit
Flow meter

Preparation

- A representative stream reach is selected and measured such that primary physical features are included in the reach (riffles, runs, and pools).
- To the extent possible, the reach should be located away from the influences of major tributaries and bridge/road crossings. Bridges or road crossings may be unavoidable due to stream depth, access restrictions and/or tributary location. Best professional judgment may be necessary to locate the most representative reach, and any deviation from an ideal reach should be documented.
- In general, each stream is sampled for a distance of 400 m.

Seining

- Seine height is dictated by water depth, and length is determined by width of the water being sampled. If possible, the seine should be 15-25% longer than the width of the waterbody being sampled and about 25% higher than the depth of the water. The amount of obstructions in the stream will often preclude the use of longer seines however. When this situation occurs, the crew leader will decide on the most effective combination of seines. OCC utilizes 4 and 6 foot seines in 10, 20, and 30-

foot lengths. This will allow the center of the net to form a bag behind the operators where the fish are more likely to stay in the net. The seine is hauled with the current because fish tend to orient towards the current.

Electrofishing

- The shocker is most useful where a seine cannot be used effectively in areas such as brush piles, rootwads, and cobble substrates.
- The choice of electrofishing method and equipment will depend on the stream to be sampled.
    1. For narrow (<15 meter wide) streams with short wadeable pools and numerous riffles, the backpack shocker is most appropriate. The shocker consists of a trailing stainless steel cable electrode and either a ring or diamond electrode mounted on the end of a fiberglass pole. In waters of extremely low conductivity (<40 uS) the ring should be used. In waters of high conductivity (>1000 uS) only the diamond should be used. In very deep water where the ring seems to be ineffective the diamond electrode may offer better results. The shocking team consists of at least two people. One carries and operates the shocker while the other(s) net stunned fish.
    2. In deep or wide streams where backpack shocking is impractical, the OCC employs the use of a tote barge. The system includes a handheld anode pole, identical in scope and design to that described for the backpack system, but connected by a 50' cable. The cathode consists of an electrically connected aluminum grid system mounted to the bottom of the barge (below waterline). A pull rope is attached to the front of the barge to allow the team to pull the barge across short riffles and other obstacles when necessary. Tote barge electrofishing requires at least three crew members.
    3. In stream reaches that offer very limited wading potential, the boat mounted electrofishing system will be used. The system includes a single bow mounted anode pole/array. The aluminum boat hull, which houses the electrofishing system, acts as the cathode. When riffles or other areas of shallow water are encountered, the system comes equipped with a junction box, which allows the user to quickly convert from a bow mounted anode to a handheld anode attached by a 50' cable. This enables a crew, wearing chest waders, to use the boat in a very similar manner as the tote barge. Boat electrofishing requires at least three crew members.
- In waters of high conductivity (>1000 µS/cm) electroshocking effectiveness declines, due to the highly conductive nature of the water. Under these conditions, it is up to the discretion of the crew leader if electrofishing is suitable. Electrofishing will not be completed at conductivity levels greater than the manufacturer's recommendation for the equipment.

Sample Collection

Seining

- The seine should be manually pulled through the water. Since fish tend to orient towards to current, the direction of the seine haul should generally be with (in the same direction of) the current.
- The lead line should be kept on the bottom, and in front of the float line.
- If there are many obstructions on the bottom, the lead line will become caught or bounce, and most fish will escape underneath the bottom of the net. If this happens use a smaller net that allows you to avoid obstructions or go to electroshocking.
- The brailes of the net should be used to disturb the area under any undercut banks or beds of macrophytes near the edge, in order to scare fish hiding under cover out towards the middle of the net.
- Under ideal conditions the net should be pulled through the water in the manner described above for about 10 meters and dragged out of the water on a gradually sloping pre-selected beach. The person pulling the seine on the side of the stream opposite the beach should swing ahead of the other person so that the seine is pulled out on the beach stretched over the same distance it was stretched in the stream.
- If the stream does not have gradually sloping banks, the dip method should be used. This method consists of sweeping around and through the area to be sampled, keeping a wide bag and moving the lead line as much under the undercut bank as possible. Use the brailes to probe repeatedly as far as possible into the undercut area working towards each other until the brailes overlap. The seine should then be swiftly stretched and lifted vertically from the water. An alternative method of retrieving fish under these conditions is to slowly turn the brailes to wind the net up once they have overlapped to form an enclosure. This may entangle the fish with the net and allow them to be lifted out of the water with the rolled up net.

Shocking

- Before operating or assisting with the shocker, READ AND UNDERSTAND THE MANUALS for the generator and the shocker. Starting procedures, safety procedures and troubleshooting are well documented in these manuals and are not spelled out in this text. The manuals can be obtained from the equipment file in the main office.
- Collection begins at a shallow riffle or other physical barrier at the downstream limit of the reach, and terminates at a similar barrier at the upstream end of the reach.

- In general, fish collection procedures commence at the downstream barrier and proceeds in an upstream direction; however, this is up to the discretion of the Crew Leader.
- A minimum of two people is required for electrofishing.
- The forward electrode should be gradually passed back and forth over the stream width, including brush piles and root wads. As fish are stunned, they will usually roll over and become more visible, allowing the netter(s) to see and capture them.
- In very dense brush or root cover, fish often sense the presence of the team before they are close enough to be stunned and then retreat so deeply into cover that it is impossible to net them when they are stunned. It is often better in situations such as these to insert the electrode into the brush before it is turned on, give the fish a minute or so to get used to the new situation and then turn the current on. Many fish will be much closer to the edge of brush pile when they are stunned in this manner.

Sample Handling & Preservation

- Fish collected by seining and electroshocking should be kept in separate jars and labeled as to what method was used to capture them. This will make the methods independent if desired for analysis.
- Label each jug. Using a permanent marker, write the date, WBID #, collection time, stream name, number of jars composing one sample, county and legal location on the lid and side of the jug.. In general all fish should be placed in 10% formalin immediately after capture. There are a few exceptions made for larger fish (>100 gms or 0.25 lbs), which can be positively identified in the field.
    a. If all team members agree on the identification of such a fish, it can be returned to the water far enough away that recapture is unlikely.
    b. All large fish released must be documented on the **Fish Collection Sheet**. This includes fish such as gars, all types of carpsuckers, black bass, any white bass in water where yellow bass or striped/white hybrids may be found, all buffalo, all redhorse, and any other unusual fish. Please note**,** the golden and black redhorse cannot be told apart without counting lateral line scales and pelvic rays. Unless this information is recorded on the **Fish Collection Sheet**, the fish must be brought in for identification, or recorded as *Moxostoma* sp. Similar notes must be taken when releasing other fish that can be difficult to tell apart in the field such as the river and shorthead redhorses or any of the buffalos.
    c. All large fish released must be photographed on print film. It is important to take photos and label them so that they will be identifiable 5 to 7 years from now. The photos are data, and should be labeled as to the ID of the fish in the picture, the date, WBID #, site time, stream name, county, and legal location of the site. One copy should be kept in the Crew Leader's files, and one should be forwarded to the Data Manager.
- When preserving fish much larger than 0.3 to 5 kg (0.5 to 10 lbs), the fish should be sliced open along the lower rib in order to allow the formalin to penetrate the body cavity fast enough to prevent decay. A slit through the ribs is preferred to a belly slit to facilitate counting belly scales in the lab.
- Formalin is a carcinogen and can also cause permanent damage to mucous membranes and eyes. Care must be taken when placing fish in formalin so that the fish does not flop around and splash formalin onto people near the jar. The fish should be put into the jar with the lid tilted open away from the operator so that the lid shields the face and body of the operator. Flood any skin exposed to formalin with plenty of water as soon as possible. If it gets in your eyes, flood the eyes with water immediately and go to the doctor immediately after that.
- Fill out a Chain of Custody Form.
- The Crew Leader is responsible for transferring the samples to the Fish Sample Custodian.

Data Management & Records Management

Field Notation

All measurements and observations made at each site should be recorded on the **Site Collection Sheet**; include all physical and chemical information including DO for runs, riffles, pool top and pool bottom—when available. A **Flow Meter Data Sheet** should also be filled out. Note all photos on the appropriate sheets. A **Fish Collection Sheet** must be completed as described below:

DATA SHEET HEADER INFORMATION:

- SITE NAME: Record the stream named from the USGS 7-1/2' map name. If a county map, soil map, or other map has a different name, the USGS 7-1/2' map takes precedence. If a stream is unnamed on the USGS map, but named on another map, use that name, but write the name of the map in parentheses beside the stream name.
- WBID #: Record the Water Body Identification number.
- LEAD INVESTIGATOR: Record the name of the person responsible for data custody and reporting

- DATE: Record the site data in MM/DD/YR format.
- TIME: Record the site time in military format. The "site time" is when initial activities began at the site. The site time should be the same on all forms associated with this site.

COLLECTION INFORMATION:

For each collection method used, fill in the appropriate specifications. For the backpack, tote barge, and boat-mounted shockers, indicate:

- SHOCKING TIME Record the amount of time spent shocking in seconds
- VOLT/AMPS Record the voltage and amperage on the shocker
- PULSES/SECOND Record the pulses per second setting on the shocker (measure of wave frequency)
- %DUTY CYCLE % of on time; product of pulse width and frequency (the actual time the current is being delivered)
- REACH LENGTH Length of stream used in the fish collection.

For the boat-mounted shocker only, also indicate:

- LOW RANGE or HIGH RANGE
- HANDHELD or UMBRELLA ARRAY PROBE.

If a seine is used, indicate:

- SEINING TIME Record the amount of time spent seining in minutes
- SEINE TYPE/SIZE Record the size and type of seines used

FISH IDENTIFIED & RELEASED:

- SPECIES Record the genus and species of the fish released or the common name if the species can be definitely identified later based on that common name
- COUNT Record the number of individual organisms released
  - SHOCK number released during the shocking effort
  - SEINE number released during the seining effort
- COMMENTS Record any information that was used to help in the identification process
- PHOTO ID # Record the identification number that corresponds to OCCWQ photo tracking system. It is mandatory to follow the procedure outlined in **Photodocumentation SOP.**

Habitat Form

At all sites where fish are collected, a stream habitat evaluation must be performed. It does not have to be done on the same day as the fish are collected, but should be done before major floods change the habitat. Refer to the **Habitat Assessment SOP**.

Chain of Custody Procedure

Collection of fish requires the use of a Chain of Custody form (COC). The handling of the COC should follow the procedures described in the **Chain of Custody and Sample Labeling SOP**. The manifest is routed as follows:

- Fish samples are collected in the field and the COC is completed and signed by the field personnel involved with collection.
- Samples are submitted to the Fish Data Custodian and the person receiving the samples signs the COC.
- Processed samples are sent to the taxonomist for identification. The taxonomist must sign the COC.
- After identification, taxonomic identification sheets will be forwarded with a copy of the signed COC to the Data Manager. The COC form returned from the laboratory will include the laboratory tracking or log numbers used to reference the identification sheet.