Missouri River
Standard Operating Procedures
For Fish Sampling and Data Collection

Volume 1.5

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This document has been collaboratively developed by the "Pallid Sturgeon Population Assessment Team". This Team is comprised of biologists and scientists possessing a diverse range of expertise to develop these sampling and data collection standard procedures.

The following agencies and offices have contributed to the development of this guiding document for the Pallid Sturgeon Population Assessment Project. This document provides the procedures that are also required for other projects collecting fisheries data such as the Habitat Assessment and Monitoring Project and the Chute Monitoring Project. The Montana Fish, Wildlife and Parks (Fort Peck, MT), the South Dakota Game, Fish and Parks (Chamberlain, Pierre & Yankton, SD), the Nebraska Game and Parks Commission (Lincoln, NE), the University of Nebraska (Lincoln, NE), the Iowa Department of Natural Resources (Lake View, IA), the Missouri Department of Conservation (Jefferson City, St. Joseph & Chillicothe, MO), the U.S. Geological Survey-Columbia Environmental Research Center (Columbia, MO and Fort Peck, MT), the U.S. Fish and Wildlife Service offices, specifically, the Missouri River Fish and Wildlife Management Assistance Office (Region 6-Bismarck, ND), the Great Plains Fish and Wildlife Management Assistance Office (Region 6-Pierre, SD) and the Columbia National Fish and Wildlife Conservation Office (Region 3-Columbia, MO) have all played active roles in the development of the program. Individual team members and their respective agency affiliations are listed in Appendix L.

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HABITAT CLASSIFICATION

General information: A three tiered hierarchical habitat classification system (Macrohabitat, Mesohabitat and Microhabitat) allows for both general and specific categorization for sampling to serve the needs for biological and physical data collection efforts.

I. Continuous Macrohabitats: Habitats found in every bend**.** See Figure A1 for organizational chart of macrohabitats and mesohabitats for the Missouri River.

- **A. Main Channel Crossover (CHXO):** The channel crossover area is defined as the inflection point of the thalweg where the thalweg crosses from one concave side of the river to the other concave side of the river.
  1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
  2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole >1.2 meters deep.
  3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the thalweg and the 1.2-meter depth interval in the channelized river and lies between the maximum depth and 1.2-meter depth in the unchannelized river.
  4. **Thalweg (TLWG):** The main channel between the channel borders in the channelized river conveying the majority of the flow. This portion of the channel usually lies adjacent to, and includes, the deepest part of the main channel.

- **B. Main Channel Outside Bend (OSB):** The outside bend of the river is the concave side of a river bend.
  1. **Bars (BARS):** Sand bar/shallow shoreline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
  2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters.
  3. **Channel border (CHNB):** The channel border in the channelized river lies between the toe and the thalweg, and in the unchannelized river, it lies between the toe and the maximum depth.
  4. **Thalweg (TLWG):** The main channel between the channel borders conveying the majority of the flow. This portion of the channel usually lies adjacent to, and includes, the deepest part of the main channel.

C. **Main Channel Inside Bend (ISB):** The inside bend is the convex side of a river bend.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles or other obstructions that have formed a scour hole >1.2 meters.
3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the thalweg and the 1.2-meter depth interval in the channelized river and lies between the maximum depth and 1.2-meter depth in the unchannelized river.

II. Discrete Macrohabitats: Habitats that may not be found in every bend, but are unique enough to be recognized independently.

A. **Secondary Channel-Non Connected (SCN)**: Secondary channel non-connected channels are channels that are blocked at one end.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediatelydownstream from sandbars, dikes, snag-piles or other obstructions that have formed a scour hole >1.2 meters.
3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the thalweg and the 1.2-meter depth interval in the channelized river and lies between the maximum depth and 1.2-meter depth in the unchannelized river. This is a former/abandoned channel (> 1.2 m depth) no longer connected to the current main channel.

B. **Secondary Channel-Connected (Large) (SCCL):** Secondary connected channel are open on both ends and have flowing water but carry less flow than the main channel. A large secondary channel-connected is defined based on the ability to deploy gears (i.e. trammel nets, trawls) and a water depth of $\geq$ 1.2 meters.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.
3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the thalweg and the 1.2-meter depth interval in the channelized river and lies between

the maximum depth and 1.2-meter depth in the unchannelized river.

4. **Thalweg (TLWG):** The main channel between the channel borders within a secondary channel. This portion of the channel usually lies adjacent to, and includes, the deepest part of the main channel.
5. **Island Tip (ITIP):** The island tip is the area immediately downstream of a bar or island where two channels converge and water depth is > 1.2 meters.

C. Secondary Channel-Connected (Small) (SCCS): Secondary connected channels are open on both ends and have flowing water but carry less flow than the main channel. A small secondary channel-connected is defined based on the **inability** to deploy gears (i.e. trammel nets, trawls) or a water depth of < 1.2 meters.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters.
3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the thalweg and the 1.2-meter depth interval in the channelized river and lies between the maximum depth and 1.2-meter depth in the unchannelized river.
4. **Thalweg (TLWG):** The main channel between the channel borders within a secondary channel. This portion of the channel usually lies adjacent to, and includes, the deepest part of the main channel.
5. **Island Tip (ITIP):** The island tip is the area immediately downstream of a bar or island where two channels converge and water depth is > 1.2 meters.

D. Tributary Small Mouth (TRMS): Small tributary mouths are associated with tributaries with an average annual discharge less than 20 meter^3/second (m^3/s) and at least 6 meters wide and contain water at the time of sampling. The sampling area extends 300 meters upstream into the tributary from the junction of the main channel and the tributary (see Figure A2).

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.

2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.
3. **Channel border (CHNB):** The channel border in the channelized river lies between the toe and the thalweg and in the unchannelized lies between the toe and the maximum depth.
4. **Thalweg (TLWG):** The main channel between the channel borders conveying the majority of the flow. This portion of the channel usually lies adjacent to, and includes, the deepest part of the main channel.

E. Tributary Large Mouth (TRML): Large tributary mouths are associated with tributaries that have an average annual discharge exceeding 20 m^3/s. The sampling area extends 300 meters upstream into the tributary from the junction of the main channel and the tributary (see Figure A2).

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.
3. **Channel border (CHNB):** The channel border in the channelized river lies between the toe and the thalweg and in the unchannelized lies between the toe and the maximum depth.
4. **Thalweg (TLWG):** The main channel between the channel borders conveying the majority of the flow. This portion of the channel usually lies adjacent to, and includes, the deepest part of the main channel.

F. Tributary Confluence (CONF): This is the area extending downstream up to a bend in length from the junction of the tributary and the river where the tributary has an influence on the physical features (i.e., sandbars, temperature, turbidity, velocity) of the river.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.
3. **Channel border (CHNB):** The channel border in the channelized river lies between the toe and the thalweg and in the unchannelized lies between the toe and the maximum depth.
4. **Thalweg (TLWG):** The main channel between the channel borders conveying the majority of the flow. This portion of the

channel usually lies adjacent to, and includes, the deepest part of the main channel.

G. Deranged (DRNG): An area of the river (typically associated with the unchannelized sections) where the river transitions from a series of multiples channels into a meandering or braided channel.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.
3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the maximum depth and 1.2-meter depth in the unchannelized river.
4. **Island Tip (ITIP):** The island tip is the area immediately downstream of a bar or island where two channels converge and water depth is > 1.2 meters.

H. Braided Channel (BRAD): An area of the river (typically associated with the unchannelized sections) that contains multiple smaller channels and is lacking a readily identifiable main channel.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.
3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the maximum depth and 1.2-meter depth in the unchannelized river.
4. **Island Tip (ITIP):** The island tip is the area immediately downstream of a bar or island where two channels converge and water depth is > 1.2 meters.

I. Dendritic (DEND): An area of the river (typically associated with the unchannelized sections) where the river transitions from meandering or braided channel to more of a treelike pattern with multiple channels.

1. **Bars (BARS):** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.
2. **Pools (POOL):** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles, or other obstructions that have formed a scour hole > 1.2 meters deep.

3. **Channel border (CHNB):** The channel border mesohabitat lies along a bankline or a sandbar area between the maximum depth and 1.2-meter depth in the unchannelized river.
4. **Island Tip (ITIP):** The island tip is the area immediately downstream of a bar or island where two channels converge and water depth is > 1.2 meters.

J. Wild (WILD): All Wild categories include habitats not covered in the previous habitat descriptions.

1. **All mesohabitats**
   - a. **BARS**
   - b. **POOL**
   - c. **CHNB**
   - d. **TLWG**
2. **Dam Tailwaters (DTWT)**
3. **Other** (see comments section of datasheet)

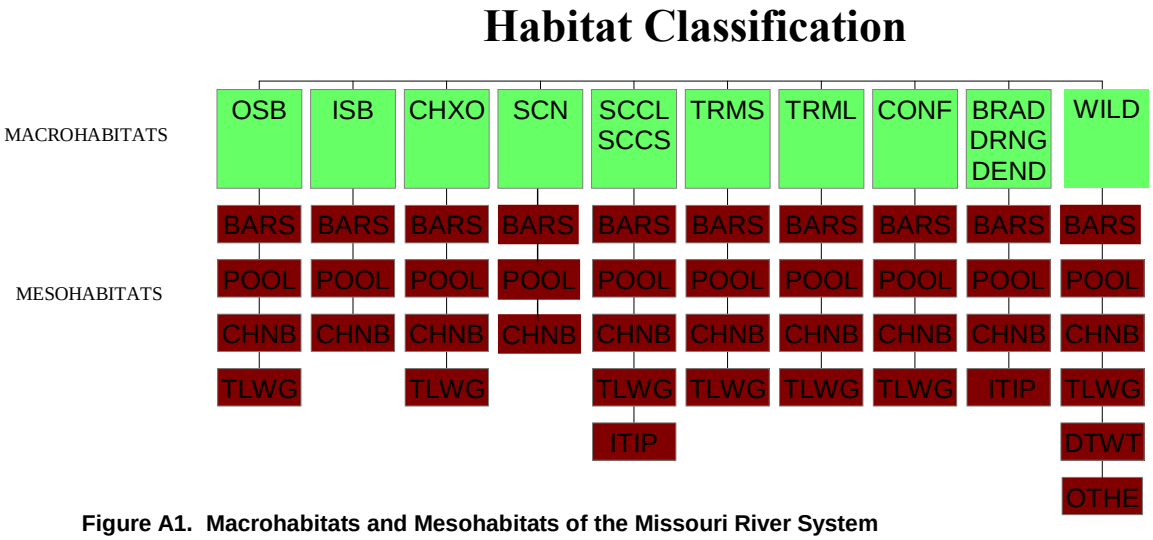

Figure A1. Macrohabitats and Mesohabitats of the Missouri River System

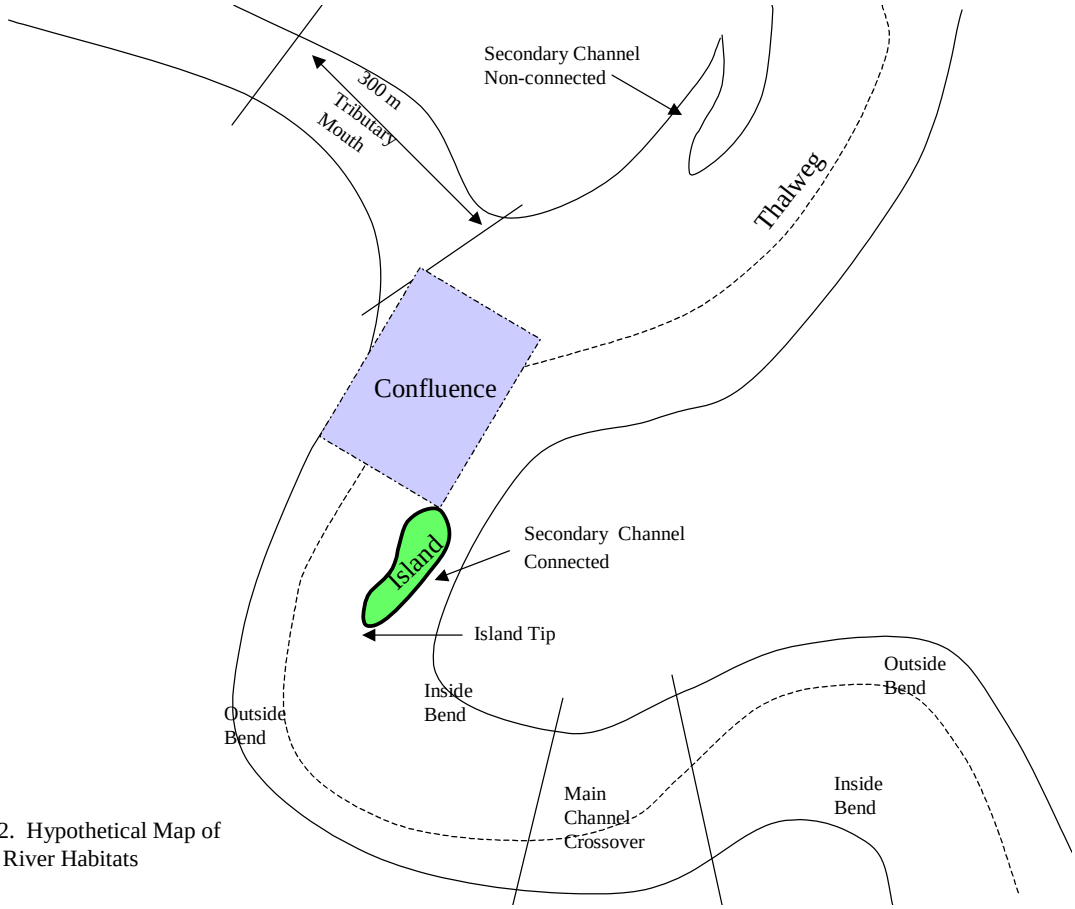

Figure A2. Hypothetical Map of Missouri River Habitats

Microhabitat Codes (March 20, 2006)

Microhabitat coding is required downstream of Ponca (RM 750) for all sampling activities and will remain optional upstream of RM 750.

Microhabitat Descriptions

The left three digits will describe the general area of the set. In most cases on the lower river, this will describe the dike, pool, point bar, complex at the sampling site. The right three digits will describe where in the complex the sampling took place.

L DIKE = 1 - Dikes shaped like an L with the shorter arm extending to the bank and the longer arm parallel with the current.

Dry = 1 – Entire structure is exposed (above water). Notches may be flowing.
Partial = 2- Structure is just at or slightly above water level. May be used to describe a dike where half is submerged.
Overflowing = 3- completely submerged (overtopped with water).

Unnotched = 1 No modifications or notches
Bank Notch = 2 Notch where the dike and high bank meet.
Top Notch = 3 Notch on the short arm (perpendicular with the current) away from the bank (at or near the middle of the short arm).
Side Notch= 4 Notch on the long arm (parallel with the channel current) away from the bank (at or near the middle of the short arm.
Top and Side Notch= 5 (Two notches) Notch on the short arm (perpendicular with the current) away from the bank (at or near the middle of the short arm) and a notch on the long arm (parallel with the channel current).
Bank, Top, and Side Notch = 6 (three notches) Notch where the dike and high bank meet, notch on the short arm (perpendicular with the current) away from the bank (at or near the middle of the short arm) and a notch on the long arm (parallel with the channel current).
Bank & Top Notch = 7 Notch where the dike and high bank meet and a notch on the short arm (perpendicular with the current) away from the bank (at or near the middle of the short arm).
Bank & Side Notch = 8 Notch where the dike and high bank meet and notch on the long arm (parallel with the channel current).
Notch (undefined) = 9 A notch that does not fit any of the above descriptions

WING DIKE = 2 - A straight dike that is perpendicular to the main channel current.

Dry = 1 – Entire structure is exposed (above water). Notches may be flowing..
Partial = 2- Structure is just at or slightly above water level. May be used to describe a dike where half is submerged.
Overflowing = 3- completely submerged (overtopped with water).

Unnotched = 1 No modifications or notches
Bank Notch = 2 Notch where the dike and high bank meet.
Top Notch = 3 Notch on the short arm (perpendicular with the current) away from the bank (at or near the middle of the short arm) away from the bank (at or near the middle of the short arm).
Bank & Top Notch = 7 Notch where the dike and high bank meet and a notch on the short arm (perpendicular with the current) away from the bank (at or near the middle of the short arm).

Notch (undefined) = 9 A notch that does not fit any of the above descriptions

KICKER DIKE = 3 - These are ends of revetments that extend into the river channel parallel to the main current allowing pools to form on the back side

Dry = 1 – Entire structure is exposed (above water). Notches may be flowing.
Partial = 2- Structure is just at or slightly above water level. May be used to describe a dike where half is submerged.
Overflowing = 3- completely submerged (overtopped with water).

Unnotched = 1 No modifications or notches
Bank Notch = 2 Notch where the dike and high bank meet.
Side Notch= 4 Notch on the long arm (parallel with the channel current).
Bank & Side Notch = 8 Notch where the dike and high bank meet and notch on the long arm (parallel with the channel current).
Notch (undefined) = 9 A notch that does not fit any of the above descriptions

ROOTLESS DIKE = 4 - Dike where the landward portion of the rock structure is not connected to shore. The dike is separated by water by a distance greater than the length of the dike. Not to be confused with a wing dike with a bank notch where submerged rock (sill) connects the dike to the bank.

Dry = 1 – Entire structure is exposed (above water). Notches may be flowing.
Partial = 2- Structure is just at or slightly above water level. May be used to describe a dike where half is submerged.
Overflowing = 3- completely submerged (overtopped with water).

Unnotched = 1 No modifications or notches
Angled or Parallel = 3 The dike is parallel with the current or at an angle between perpendicular and parallel with the current.
Top Notch = 3 Notch at or near the middle of the dike.

CHEVRON = 5 - A V shaped dike set out in the river channel away from the shoreline that has flow around both sides.

Dry = 1 – Entire structure is exposed (above water). Notches may be flowing.
Partial = 2- Structure is just at or slightly above water level. May be used to describe a dike where half is submerged.
Overflowing = 3- completely submerged (overtopped with water).

Unnotched = 1 No modifications or notches
Notch = 3 Notch in the middle of the chevron where the two arms meet
Notch (undefined) = 9 A notch that does not fit any of the above descriptions

CHANNEL SAND BAR = 6 – Large Inside Bend bars. In most cases, local dikes are absent or do not influence the bar to a large degree.

Dry = 1 – Sand bar is well exposed (above water).
Partial = 2- Sands bar is just at or slightly above water level. Only a small portion of a large bar is exposed.
Overflowing = 3- completely submerged (overtopped with water to be sampled.

Single Lg (large) = 1 A single sand bar that is more than 500 m in length. May or may not have an associated side channel
Single Sm (Small) = 2 A single sand bar that is less than 500 m in length. May or may not have an associated side channel
Braided = 3 A complex of small sand bars with small channels of water intersecting.

BANK LINE = 7–Shore that may consist of revetment, mud or sand. May be vegetated or bare. Not a deposited bar. Not associated with other structures (example; bank in close proximity of a dike).

N/A= 0 Zero for a place holder

Natural = 1 A sloping bank that is not armored consisting of mud, clay, sand or silt. Not steep or sloughing; see #5
Revetted = 2 Bank line that has been armored with quarried rock
Bedrock = 3 Natural out cropping of solid rock. May have some natural occurring chunk rock.
Rail Road (RR) embankment = 4 Revetted bank line associated with rail lines close to the river. Includes ballast rock (the crushed rock placed between the RR ties). Generally, this material is of baseball size or smaller.
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

CHUTE = 8 A large side channel to the main channel. Associated island covered with woody vegetation. Water flowing behind channel bars or dike point bars should not be considered a chute.

Partial = 2 Contains enough water to seine or set minifykes.
Normal = 3 Chute contains enough water to navigate with a power boat
High water = 4 Substantially more water than normal – at or near flood stage
No flow= 5 Chute does not contain flowing water due to low water levels or control structures, though contains standing water that will support fish

Natural = 1 Natural occurring chute. May include control structures.
Pilot <5 years = 2 Engineered pilot chute that is less than 5 years old
Pilot >5 years = 3 Engineered pilot chute that is more than 5 years old
Island Series = 4 Engineered crescent shaped chutes constructed in multiples. Usually associated with the notching of multiple dikes.
Backwater = 5 Areas of still, non flowing water. Associated with island series at low flows.

HIGHLY ENGINEERED = 9 - Dike which has had extensive engineering to create diverse habitat and will not appropriately fit in the above descriptions. Some what of a catch all category for unique habitat manipulations. Text in comments section would be appropriate to capture theses unique situations.

Dry = 1 Entire structure is exposed.
Partial = 2 Structure is just at or slightly above water level. May be used to describe a dike where half is submerged.
Overflowing = 3 Completely submerged may describe dikes or sand bar

<5 years = 2 Structure that is less than 5 years old
>5 years = 3 Structure that is more than 5 years old

Description of the Set Site

These three digits (to the far right) describe where in the structure complex the sampling occurred.

L DIKE

Pool = 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with

Bank Notch = 1 Notch where the dike and high bank meet.
Top Notch = 2 The short arm of the dike (perpendicular to the current), away from the bank.
Side Notch = 3 The long arm of the dike (parallel with the channel current).
Tip = 4 Scour associated with the tip of the dike
No Notch = 5 No modifications or notches
Notch (undefined) = 6 A notch that does not fit any of the above descriptions

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank= 1 Bar that is connected to the bank
Bankside = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike =7 Typically V or U shaped sand bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water

Open water = 3 Areas greater than 1.2 m but not a scour.

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 scour trench directly in front of a dike
Flat = 5 Areas where there is little or no change in depth. Typically large flat areas associated with dikes of a wide spacing.

Bank = 5 The actual bank of the river but not a bar. If set is associated with a bar, than use Bar=2, Bank =1

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red Rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion.
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Banks that have not been modified to be stabilized. Usually composed of sand, silt or mud. May include snags.

Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a Pool and associated Point Bar in a 100 m trawl).

Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike Tip and Open Water = 4
Bank and Open Water = 6
Undefined = 9

WING DIKE

Pool= 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with.

Bank Notch = 1 Notch where the dike and high bank meet.
Top Notch = 2 The short arm of the dike (facing up stream) away from the bank.
Tip = 4 Scour hole associated with the tip of the dike
No Notch = 5 No modifications or notches
Notch (undefined) = 6 A notch that does not fit any of the above descriptions.

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank = 1 Bar that is connected to the bank
Bankside = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike =7 Typically V or U shaped sand bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water

Open water = 3 Areas greater than 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 Deeper water (trench) directly in front of a dike
Flat = 5 Areas where there is little or no change in depth. Typically large flat areas associated with dikes of a wide spacing.

Bank = 5 The actual bank of the river not associated with in close proximity of a bar. If set is associated with a bar, than use Bar=2, Bank =1

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red Rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion.
Pilings = 3 Driven posts associated with pile dikes or revetment
Natural = 4 Banks that have not been modified to be stabilized. Usually composed of sand, silt or mud. May include snags.
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a Pool associated Point Bar in a 100 m trawl)

Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike Tip and Open Water = 4
Bank and Open Water = 6
Undefined = 9

KICKER DIKE

Pool = 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with.

Bank Notch = 1 Notch where the dike and high bank meet.
Side Notch= 3 The long arm of the dike (parallel with the channel current).
Tip = 4 Scour hole associated with the tip of the dike
No notched = 5 No modifications or notches
Notch (undefined) = 6 A notch that does not fit any of the above descriptions.

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank = 1 Bar that is connected to the high bank
Bankside = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike =7 Typically V or U shaped sand bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water

Open water = 3 Areas greater than 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure

Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Flat = 5 Areas where there is little or no change in depth

Bank = 5 The actual bank of the river but not a bar. If set is associated with a bar, than use Bar=2, bank =1

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red Rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion.
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Banks that have not been modified to be stabilized. Usually composed of sand, silt or mud. May include snags.
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a dike hole and associated point bar in a 100 m trawl)
Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike Tip and Open Water = 4
Bank and Open Water = 6
Undefined = 9

ROOTLESS DIKE

Pool = 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with.

Notch = 2 A notch at or near the middle of the dike
No Notch = 5 Area below an unaltered dike
Notch (undefined) = 6 A notch that does not fit any of the above descriptions.
Channel Side Tip = 7 Scour hole created from the channel side arm
Bank Side Tip = 8 Scour hole created by the bank side arm together

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank = 1 Bar that is connected to the bank (See note below at Bank =5)
Bank side = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike =7 Typically V or U shaped sand bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water

Open water = 3 Areas greater than 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 Deeper water (trench) directly in front of a dike
Flat = 5 Areas where there is little or no change in depth

Bank = 5 The actual bank of the river but not a bar. If set is associated with a bar, than use Bar=2, bank =1

** Note: In the case of both Rootless Dikes and Chevrons, these structures do not contact the high bank of the river. The area between the structure and the bank is influenced by the structure, thus placed here.**

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red Rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion.
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Banks that have not been modified to be stabilized. Usually composed of sand, silt or mud. May include snags.
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a dike hole and associated point bar in a 100 m trawl)

Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike Tip and Open Water = 4
Undefined = 9

CHEVRON

Pool = 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with.

No notch = 5 Area below an unaltered dike
Notch (undefined) = 6 A notch that does not fit any of the above descriptions.
Channel side tip = 7 Scour hole created from the channel side arm
Bank Side tip = 8 Scour hole created by the bank side arm
Notch Scour = 9 Scour where the two arms come together

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank = 1 Bar that is connected to the bank (see note below at Bank = 5)
Bank side = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 the top (portion with the highest elevation) of the sand – (sand bar must be submerged)
Dike =7 Typically V or U shaped sand bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water

Open water = 3 Areas greater than 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 Deeper water (trench) directly in front of a dike
Flat = 5 Areas where there is little or no change in depth

Bank = 5 The actual bank of the river but not a bar. If set is associated with a bar, than use Bar=2, bank =1

Note: In the case of both Rootless Dikes and Chevrons, these structures do not contact the high bank of the river. The area between the structure and the bank is influenced by the structure, thus place here.

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red Rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion.
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Banks that have not been modified to be stabilized. Usually composed of sand, silt or mud. May include snags.
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a dike hole and associated point bar in a 100 m trawl)

Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike Tip and Open Water = 4
Undefined = 9

CHANNEL SAND BAR

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths.

Bank = 1 Bar that is connected to the bank
Bank side = 2 Side facing the bank
Channel Side = 3 Side facing the channel
Tail = 4 The most down stream portion
Head = 5 The most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike = 7 Embedded dike- sand bar interface (water less than 1.2 m deep) A minimal portion of the dike is exposed and is not creating a substantial scour of the bar .
Braided = 8 Bar divided by multiple small channels of shallow water
Shoal = 9 A dramatic change in depth. A sand ledge or drop off. In many cases water depth will go from1m to 3-4m abruptly.

Open Water = 3 Area > 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the bar
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the bar
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the bar and not associated with a shore line
Flat = 5 Areas where there is little or no change in depth

Bank = 5 The actual bank of the river but not a bar. If set is associated with a bar, than use Bar=2, bank =1. In the case of a channel bar, this may be appropriate where a channel bar is an island but the bank proper is steep (as in the potential case of a SCCS).

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red Rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion.
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Banks that have not been modified to be stabilized. Usually composed of sand, silt or mud. May include snags.
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud clay sand or silt.

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a dike hole and associated point bar in a 100 m trawl)

Bar and Open Water = 3
Dike and Open Water = 4
Bank and Open Water = 6

Undefined = 9

BANK LINE

Bank = 5 The actual bank of the river but not a bar. Intended for areas away from the influence of dikes and other structures.

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red rock = 2 Quarried red rock/quartz/granite revetment
Pilings = 3 Wooden piles associated with pile dikes.
Natural = 4 Bank that is not armored consisting of mud, clay, sand or silt

Open water = 3 Areas associated with but away from a bank line and greater than 1.2 m

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 scour trench directly in front of a dike
Flat = 5 Areas where there is little or no change in depth

Scallop = 6 Localized erosion of the bank line forming a shallow "pocket" in the bank that may contain a small eddy or reduced water velocity. May be found on both natural and revetted banks.

NA= 0 Place holder

Combined = 7 Sampling that involves more than one microhabitat in close proximity that are sampled together (Example: sample a Pool and associated point bar in a 100 m trawl)

Bank and Open Water = 6
Bank and Scallop = 7
Undefined = 9

CHUTE

Pool = 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with.

Bank Notch = 1 Notch where the dike and high bank meet.
Notch = 2 The short arm of the dike (perpendicular to the current) away from the bank.
Tip = 4 Scour associated with the tip of the dike
No notched = 5 No modifications or notches
Notch (undefined) = 6 A notch that does not fit any of the above descriptions.
Plunge = 7 Pool created by a notch in a closing or grade control structure
Snag = 8 Pool or scour associated with a snag or large woody debris

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank = 1 Bar connected to the shore
Bankside = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike =7 Sand bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water
Island = 9

Open water = 3 Areas greater than 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 Deeper water (trench) directly in front of a dike
Flat = 5 Areas where there is little or no change in depth

Bank = 5 The actual bank of the river but not a bar. If set is associated with a bar, then use Bar=2, Bank=1

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Bank that is not armored consisting of mud, clay, sand or silt
Natural Steep = 5 A step or sloughing bank that is not armored with quarried rock consisting of mud, clay, sand or silt.

Scallop = 6 Localized erosion of the bank line forming a shallow “pocket” in the bank. May be found on both natural and revetted banks.

NA= 0 Place holder

Combined = 7 Sampling that involves more than one habitat in close proximity that are sampled together (Example: sample a dike hole and associated point bar in a 100 m trawl)
Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike tip and Open Water = 4
Bank and Open Water = 6
Bank and Scallop = 7
Undefined = 9

Tie Channel = 8 A small channel that connects the chute to the main river channel. These are not the main channels of the side chute
**An inflow tie channel has water flowing from the main river channel into the chute
Inflow head = 1 Top or main river channel end of the tie channel
Inflow body = 2 Middle of the channel along its length

Inflow confluence = 3 Bottom or lower portion of the tie channel
**An outflow tie channel has water flowing from the chute into the main river channel

Outflow head = 4 Top or chute end of the outflow tie channel
Outflow body = 5 Middle of the channel along its length
Outflow Confluence = 6 Bottom or lower portion of the tie channel
Backwater =7 A non connected tie channel. Standing or non- flowing water

Side Channel Small = 9 This is a side channel within a chute. Some of the larger and older chutes have developed meanders within the chute its self. This is an attempt to capture this
Head = 1 Top or upstream portion
Body = 2 Middle portion
Confluence = 3 Down stream or tail portion

HIGHLY ENGINEERED This is a bit of a catch all category for those areas that just don't seem to fit well in any of the above. Simply, it is a structure or area with multiple manipulations or manipulations that do not fit other categories.

Pool = 1 Areas immediately downstream from dikes, or other obstructions that have formed a scour greater than 1.2 meters in depth. Below is a list of features that the pool (scour) is associated with.

Bank notch = 1 Notch where the dike and high bank meet.
Top Notch= 2 The short arm of the dike (perpendicular to the current) away from the bank.
Side Notch = 3 The long arm of the dike (parallel with the channel current).
Tip = 4 Scour associated with the tip of the dike
No notched = 5 No modifications or notches
Notch (undefined) = 6 A notch that does not fit any of the above descriptions.

Bar = 2 Sand bar/shallow bankline at the terrestrial/aquatic interface area of deposited sediment. There is no depth criteria for these bars which may be found in a range of depths. Point bar is defined as the small island that is typically associated with a navigation structure (down stream of the structure)

Bank = 1 Bar that is connected to the bank
Bankside = 2 Point bar, side facing the bank
Channel Side = 3 Point bar, side facing the channel
Tail = 4 Point bar, the most down stream portion
Head = 5 Point bar, the most up stream portion
Crown =6 The top (portion with the highest elevation) of the bar (sand bar must be submerged to be sampled)
Dike =7 V or U shaped bar in contact with the dike
Braided = 8 Bar divided by multiple small channels of shallow water

Open water = 3 Areas greater than 1.2 m but not a scour

Inside eddy line = 1 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure
Outside eddy line = 2 Sets made away from the shore line and between the high bank and water velocity break from the main channel and the slack water caused by the structure

Eddy line = 3 Water velocity break from the main channel and the slack water caused by the structure and not associated with a shore line
Lip = 4 Deeper water (trench) directly in front of a dike
Flat = 5 Areas where there is little or no change in depth

Bank = 5 The actual bank to the river but not a bar. If set is associated with a bar, then use Bar=2, Bank=1

Revetment = 1 Quarried rock that has been placed to stabilize or prevent erosion.
Red rock = 2 Pink or red quartz or granite that has been placed to stabilize or prevent erosion
Pilings = 3 Driven posts associated with dikes or revetment
Natural = 4 Bank that have not been modified to be stabilized. Usually composed of sand silt or mud. May include snags
Natural Steep =5 A steep or sloughing bank that is not armored with quarried rock consisting of mud, clay, sand or silt

Scallop = 6 Localized erosion of the bank line forming a shallow "pocket" in the bank. May be found on both natural and revetted banks.

NA= 0 Place holder

Combined = 7 Sampling that involves more than one habitat in close proximity that are sampled together (Example: sample a dike hole and associated point bar in a 100 m trawl)
Pool and Bar = 1
Pool and Open Water = 2
Bar and Open Water = 3
Dike Tip and Open Water = 4
Bank and Open Water = 6
Bank and Scallop = 7
Undefined = 9

Third digit of the set site description: Applies to all habitats

Bridge Pilings = 1 Pilings or footings that are associated with a bridge
Cars = 2 Junk car bodies used to armor a bank "Detroit rip rap"
Pilings = 3 Driven posts associated with dikes or revetment
Snags = 4 dead or dying large woody debris that consists of entire or large portions of mature trees
Creek Mouth = 5 An area associated with a creek, seep or other input. This is intended to be for small creeks, seeps, springs that do not meet the criteria as a macro code TRMS.
Submerged Herbaceous Vegetation = 6 Terrestrial herbaceous vegetation that is submerged by higher than normal water levels Example; grass or annual forbs on a submerged sand bar.
Submerged Woody Vegetation = 7 Living woody vegetation that is submerged by higher than normal water levels (not to be confused with Log Pile or Snags) Example; living willows on a submerged sand bar.
Log Pile = 8 Large amounts or piles of woody debris. More than the occasional large tree. Example: Large woody debris pile captured by or on a dike
Other = 9 A catch all category for something you may consider important. Should include a description in the text box as well.

Table A1. Six Digit Numeric Microhabitat Coding System

MICROHABITATS

DESCRIBE HABITAT 20-Mar-06 0 = NOT DESCRIBED OR PLACE HOLDER		DIKE TYPE	**DESCRIBE SET SITE** 0 = NOT DESCRIBED OR PLACE HOLDER		
L DIKE = 1	DRY = 1	UNNOTCHED = 1	POOL= 1	BANK NOTCH= 1	BRIDGE PILINGS = 1
	PARTIAL = 2	BANK NOTCH = 2		TOP NOTCH= 2	CARS = 2
	OVERFLOWING = 3	TOP NOTCH = 3		SIDE NOTCH= 3	PILINGS = 3
		SIDE NOTCH = 4		TIP = 4	SNAGS = 4
		TOP,SIDE NOTCH = 5		NO NOTCH = 5	CREEK MOUTH = 5
		BANK,TOP & SIDE NOTCH = 6		NOTCH (UNDEFINED) = 6	SUB HERB VEG =6
		BANK & TOP NOTCH = 7			SUB WOODY VEG = 7
		BANK & SIDE NOTCH = 8	BAR = 2	BANK = 1	LOG PILE = 8
		NOTCH (UNDEFINED) = 9		BANK SIDE = 2	OTHER = 9
				CHANNEL SIDE = 3	
				TAIL = 4	
				HEAD= 5	
				CROWN =6	
				DIKE=7	
				BRAIDED = 8	
			OPEN WATER = 3	INSIDE EDDY = 1	
				OUT SIDE EDDY = 2	
				EDDY LINE = 3	
				LIP = 4	
				FLAT =5	
			BANK = 5	REVETMENT = 1	
				RED ROCK = 2	
				PILINGS = 3	
				NATURAL= 4	
				NATURAL STEEP = 5	
			COMBINED= 7	POOL AND BAR =1	
				POOL AND OPEN WATER = 2	
				BAR AND OPEN WATER = 3	
				DIKE TIP AND OPEN WATER = 4	
				BANK AND OPEN WATER = 6	
				UNDEFINED = 9	
WING DIKE = 2	DRY = 1	UNNOTCHED = 1	POOL = 1	BANK NOTCH= 1	BRIDGE PILINGS = 1
	PARTIAL = 2	BANK NOTCH = 2		TOP NOTCH= 2	CARS = 2
	OVERFLOWING = 3	TOP NOTCH= 3		TIP = 4	PILINGS = 3
		BANK AND TOP N. = 7		NO NOTCH = 5	SNAGS = 4
		NOTCH (UNDEFINED) = 9		NOTCH (UNDEFINED) = 6	CREEK MOUTH = 5

					SUB HERB VEG =6
					SUB WOODY VEG = 7
			BAR = 2	BANK = 1	LOG PILE = 8
				BANK SIDE = 2	OTHER = 9
				CHANNEL SIDE = 3	
				TAIL = 4	
				HEAD= 5	
				CROWN=6	
				DIKE=7	
				BRAIDED = 8	
			OPEN WATER = 3	INSIDE EDDY = 1	
				OUT SIDE EDDY = 2	
				EDDY LINE = 3	
				LIP = 4	
				FLAT = 5	
			BANK = 5	REVETMENT = 1	
				RED ROCK = 2	
				PILINGS = 3	
				NATURAL 4	
				NATURAL STEEP = 5	
			COMBINED= 7	POOL AND BAR =1	
				POOL AND OPEN WATER = 2	
				BAR AND OPEN WATER = 3	
				DIKE TIP AND OPEN WATER = 4	
				BANK AND OPEN WATER = 6	
				UNDEFINED = 9	
KICKER DIKE = 3	DRY = 1	UNNOTCHED = 1	POOL = 1	BANK NOTCH= 1	BRIDGE PILINGS = 1
	PARTIAL = 2	BANK NOTCH = 2		SIDE NOTCH= 3	CARS = 2
	OVERFLOWING = 3	SIDE NOTCH = 4		TIP = 4	PILINGS = 3
		BANK AND SIDE N.= 8		NO NOTCH = 5	SNAGS = 4
		NOTCH (UNDEFINED) = 9		NOTCH (UNDEFINED) = 6	CREEK MOUTH = 5
					SUB HERB VEG =6
					SUB WOODY VEG = 7
			BAR = 2	BANK = 1	LOG PILE = 8
				BANK SIDE = 2	OTHER = 9
				CHANNEL SIDE = 3	
				TAIL = 4	
				HEAD= 5	
				CROWN = 6	
				DIKE=7	
				BRAIDED = 8	
			OPEN WATER = 3	INSIDE EDDY = 1	
				OUT SIDE EDDY = 2	
				EDDY LINE = 3	

				FLAT = 5	
			BANK = 5	REVETMENT = 1 REDROCK = 2 PILINGS = 3 NATURAL 4 NATURAL STEEP = 5	
			COMBINED= 7	POOL AND BAR =1 POOL AND OPEN WATER = 2 BAR AND OPEN WATER = 3 DIKE TIP AND OPEN WATER = 4 BANK AND OPEN WATER = 6 UNDEFINED = 9	
ROOTLESS = 4	DRY = 1 PARTIAL = 2 OVERFLOWING = 3	UNNOTCHED = 1 ANGELED OR PARALLEL =2 TOP NOTCH = 3	POOL = 1	TOP = 2 NO NOTCH = 5 NOTCH (UNDEFINED) = 6 CHANNEL SIDE TIP = 7 BANK SIDE TIP = 8	BRIDGE PILINGS = 1 CARS = 2 PILINGS = 3 SNAGS = 4 CREEK MOUTH = 5 SUB HERB VEG =6 SUB WOODY VEG = 7 LOG PILE = 8 OTHER = 9
			BAR = 2	BANK = 1 BANK SIDE = 2 CHANNEL SIDE = 3 TAIL = 4 HEAD = 5 CROWN = 6 DIKE=7 BRAIDED = 8	
			OPEN WATER = 3	INSIDE EDDY = 1 OUT SIDE EDDY = 2 EDDY LINE = 3 LIP = 4 FLAT = 5	
			BANK =5	REVETMENT = 1 REDROCK = 2 PILINGS = 3 NATURAL 4 NATURAL STEEP = 5	
			COMBINED= 7	POOL AND BAR =1 POOL AND OPEN WATER = 2 BAR AND OPEN WATER = 3 DIKE TIP AND OPEN WATER = 4 UNDEFINED = 9	

CHEVRON = 5	DRY = 1	UNNOTCHED = 1	POOL = 1	NO NOTCH = 5	BRIDGE PILINGS = 1
	PARTIAL = 2	TOP NOTCH = 3		NOTCH (UNDEFINED) = 6	CARS = 2
	OVERFLOWING = 3	NOTCH (UNDEFINED) = 9		CHANNEL SIDE TIP = 7	PILINGS = 3
				BANK SIDE TIP = 8	SNAGS = 4
				NOTCH SCOUR = 9	CREEK MOUTH = 5
					SUB HERB VEG =6
			BAR = 2	BANK = 1	SUB WOODY VEG = 7
				BANK SIDE = 2	LOG PILE = 8
				CHANNEL SIDE = 3	OTHER = 9
				TAIL = 4	
				HEAD = 5	
				CROWN =6	
				DIKE=7	
				BRAIDED = 8	
			OPEN WATER = 3	INSIDE EDDY = 1	
				OUT SIDE EDDY = 2	
				EDDY LINE = 3	
				LIP = 4	
				FLAT = 5	
			BANK = 5	REVETMENT = 1	
				REDROCK = 2	
				PILINGS = 3	
				NATURAL 4	
				NATURAL STEEP = 5	
			COMBINED= 7	POOL AND BAR =1	
				POOLAND OPEN WATER = 2	
				BAR AND OPEN WATER = 3	
				DIKE TIP AND OPEN WATER = 4	
				UNDEFINED = 9	
CHANNEL SAND BAR = 6	DRY = 1	SINGLE LG =1	BAR = 2	BANK = 1	BRIDGE PILINGS = 1
	PARTIAL = 2	SINGLE SM = 2		BANK SIDE = 2	CARS = 2
	OVERFLOWING = 3	BRAIDED = 3		CHANNEL SIDE = 3	PILINGS = 3
				TAIL = 4	SNAGS = 4
				HEAD = 5	CREEK MOUTH = 5
				CROWN =6	SUB HERB VEG =6
				DIKE=7	SUB WOODY VEG = 7
				BRAIDED = 8	LOG PILE = 8
				SHOAL=9	OTHER = 9

			OPEN WATER = 3	INSIDE EDDY = 1 OUT SIDE EDDY = 2 EDDY LINE = 3 FLAT = 5	
			BANK =5	REVETMENT = 1 REDROCK = 2 PILINGS = 3 NATURAL 4 NATURAL STEEP = 5	
			COMBINED= 7	BAR AND OPEN WATER = 3 DIKE AND OPEN WATER BANK AND OPEN WATER = 6 UNDEFINED = 9	
BANK LINE = 7	CODE =0	NATURAL = 1 REVETTED = 2 BEDROCK = 3 RR EMBANKMENT = 4 NATURAL STEEP =5	BANK = 5	REVETMENT = 1 REDROCK = 2 PILINGS = 3 NATURAL 4	BRIDGE PILINGS = 1 CARS = 2 PILINGS = 3 SNAGS = 4 CREEK MOUTH = 5 SUB HERB VEG =6 SUB WOODY VEG = 7 LOG PILE = 8 OTHER = 9
			OPEN WATER = 3	INSIDE EDDY = 1 OUT SIDE EDDY = 2 EDDY LINE = 3 LIP = 4 FLAT = 5	
			SCALLOP = 6	NA = 0	
			COMBINED= 7	BANK AND OPEN WATER = 6 BANK AND SCALLOP = 7 UNDEFINED = 9	
CHUTE = 8	PARTIAL = 2 OVERFLOWING = 3 HIGH WATER = 4 NO FLOW = 5	NATURAL = 1 PILOT, <5 YEARS = 2 PILOT > 5 YEARS = 3 ISLAND SERIES = 4 BACK WATER = 5	POOL= 1	BANK NOTCH= 1 NOTCH = 2 TIP = 4 NO NOTCH = 5 NOTCH (UNDEFINED) = 6 PLUNGE = 7 SNAG = 8	BRIDGE PILINGS = 1 CARS = 2 PILINGS = 3 SNAGS = 4 CREEK. MOUTH = 5 SUB HERB VEG =6 SUB WOODY VEG = 7 LOG PILE = 8 OTHER = 9
			BAR = 2	BANK = 1 BANK SIDE = 2 CHANNEL SIDE = 3 TAIL = 4	

				HEAD= 5 CROWN =6 DIKE = 7 BRAIDED = 8 ISLAND = 9	
			OPEN WATER = 3	INSIDE EDDY = 1 OUT SIDE EDDY = 2 EDDY LINE = 3 LIP = 4 FLAT = 5	
			BANK = 5	REVETMENT = 1 REDROCK = 2 PILINGS = 3 NATURAL = 4 NATURAL STEEP = 5	
			SCALLOP = 6	NA = 0	
			COMBINED= 7	POOLAND BAR =1 POOL AND OPEN WATER = 2 BAR AND OPEN WATER = 3 DIKE TIP AND OPEN WATER = 4 BANK AND OPEN WATER = 6 BANK AND SCALLOP = 7 UNDEFINED = 9	
			TIE CHANNEL =8	INFLOW HEAD = 1 INFLOW BODY = 2 INFLOW CONFLUENCE = 3 OUTFLOW HEAD = 4 OUTFLOW BODY = 5 OUTFLOW CONFLUENCE = 6 BACKWATER = 7	
			SIDE CHNL SMALL = 9	HEAD = 1 BODY = 2 CONFLUENCE = 3	
HIGHLY ENGENEERED = 9	DRY = 1 PARTIAL = 2 OVERFLOWING = 3	PILOT, <5 YEARS = 2 PILOT > 5 YEARS = 3	POOL = 1	BANK NOTCH= 1 TOP NOTCH = 2 SIDE NOTCH = 3 TIP = 4 NO NOTCH = 5 NOTCH (UNDEFINED) = 6	BRIDGE PILINGS = 1 CARS = 2 PILINGS = 3 SNAGS = 4 CREEK. MOUTH = 5 SUB HERB VEG =6 SUB WOODY VEG = 7

BAR = 2	BANK = 1	LOG PILE = 8
	BANK SIDE = 2	OTHER = 9
	CHANNEL SIDE = 3	
	TAIL = 4	
	HEAD= 5	
	CROWN =6	
	DIKE=7	
	BRAIDED = 8	
OPEN WATER = 3	INSIDE EDDY = 1	
	OUT SIDE EDDY = 2	
	EDDY LINE = 3	
	LIP = 4	
	FLAT = 5	
BANK = 5	REVETMENT = 1	
	REDROCK = 2	
	PILINGS = 3	
	NATURAL = 4	
	NATURAL STEEP = 5	
SCALLOP = 6	NA = 0	
COMBINED= 7	POOL AND BAR =1	
	POOL AND OPEN WATER = 2	
	BAR AND OPEN WATER = 3	
	DIKE TIP AND OPEN WATER =4	
	BANK AND OPEN WATER = 6	
	BANK AND SCALLOP = 7	
	UNDEFINED = 9	

PALLID STURGEON
POPULATION ASSESSMENT PROGRAM
FOR THE
MISSOURI RIVER

APPENDIX B

STANDARD OPERATING
PROCEDURES
FOR SAMPLING GEARS

GILL NETS

Gill nets and other forms of entangling nets are an accepted practice in fish collection. Standard operating procedures will generally follow those outlined by Hubert (1996). Specific procedures for the Pallid Sturgeon Population Assessment Program for the Missouri River are detailed below. The purpose of gill netting is to provide length, frequency, distribution, catch per unit effort (CPUE) for all sturgeon species, and fish community representation.

I. Materials and Methods

A. Equipment
   1. Length: 100-foot increments up to 200-foot max.
   2. Height: 8 feet
   3. Panels: 4 (100-foot nets) or 8 (200–foot nets) – 25-foot segments
   4. Mesh sizes: 1.5 inch, 2.0 inch, 3.0 inch, and 4.0 inch (square/bar mesh)
   5. Netting: multifilament
   6. Twine Size: #104 multifilament for 1.5-inch and 2-inch mesh; #139 multifilament for 3-inch and 4-inch mesh
   7. Float Line: braided poly-foam core, 0.5-inch diameter
   8. Lead Line: 9/32 inch (50 lb./600 feet)
   9. Anchors: Weight appropriately for flow conditions within macrohabitat.
   10. Floats: Attach floats to retrieval line allowing adequate slack for depth and flow conditions in the macrohabitat. Label both floats with appropriate identification in accordance with local law enforcement regulations.

II. Habitats

When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the size of the bend.

A. POOL Mesohabitats
   1. Position: Immediately behind wing dikes, sand bars (emergent or submerged), snag piles, or other obstruction forming a pool
   2. Orientation: Parallel to bank and/or flow.

B. Channel Border Mesohabitats
   1. Position: Within channel border.
   2. Orientation: Gill nets should be set parallel to flow.

C. Island Tips
   1. Position: Tip of island in >1.2 meters of water
   2. Orientation: Parallel with flow

D. Secondary Non-Connected Channel
   1. Position: Within the first 100 meters of the mouth
   2. Orientation: perpendicular to the bankline

E. Small Tributary Mouth
   1. Position: Within the first 100 meters of the mouth
   2. Orientation: Perpendicular to the bankline

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III. Methods/Procedure

A. Deployment

1. Record start time (military time) to the nearest minute.
2. Collect GPS latitude/longitude (decimal form). Start GPS latitude/longitude will be in conjunction with the end of the net that is first out of the boat. Recorded as Start latitude/longitude on the data sheet.
3. Start time will be recorded when the net is set and stop time will be recorded when the net is retrieved the following day.
4. The day the net was set will be recorded on the data sheet.
5. Depth will be collected at both ends and the midpoint of the net and recorded on the data sheet.
6. Duration of deployment:

   a. Gill nets are set in the afternoon prior to sunset and pulled the following day after sunrise (net-night) for a maximum set time of 24 hours.

      1. If for whatever reason (weather, breakdown, etc.), a gill net set exceeds the 24 hour maximum soak time, a notation must be made in the comments section of the data sheet. CPUE is fish/net-night therefore; the data will still be used.

   b. Net set duration shall not be less than 12 hours nor exceed 24 hours and will only be set when water temperatures are < 55 degrees Fahrenheit (12.8˚C) with the exception of secondary non-connected channels and small tributary mouths.

   c. If a situation arises that does not allow for meeting the prescribed set times, the net should be set for as long as possible during normal working hours. A description of why the netting protocol was altered should be included in the comments section of the data sheet.

4. Consider only depths > 1.2 meters as effective sample sites.
5. When setting a net against a bank, set it away from the bank until a depth of at least 1.2 meters is available.
6. If the macrohabitat does not provide at least 100 ft. of continuous depths greater than 1.2 meters, then randomly select another site.
7. The standard unit of gill netting effort will be the 100-foot net. This will be the equivalent of 1 net-night for each day the net is set out. The 200-foot gill nets will be counted as 2 net-nights.
8. CPUE will be reported as fish/net-night.
9. Gill net panels will be numbered 1-4 (100-foot net) or 1-8 (200-foot net). The end of the net beginning with the 1.5-inch mesh will always be identified as panel 1 and the end of the net with the 4-inch mesh will always be identified as either panel 4 (100-foot net) or panel 8 (200-foot net).
10. The panel first out (when set) of the boat will be selected randomly and the gear code will be identified by the following codes. The appropriate 4-digit code will be recorded on the data sheet within the gear field. A 5 digit code may be used if gill nets are drifted

rather than set as a passive gear. Refer to data sheet instructions for additional codes.

a. GN14: 100-foot net, with the 1.5-inch mesh panel set first.
b. GN41: 100-foot net, with the 4-inch mesh panel set first.
c. GN18: 200-foot net, with the 1.5-inch mesh panel set first.
d. GN81: 200-foot net, with the 4-inch mesh panel set first.

Regardless of how the gill net is set, panels 1 & 5 will always be the 1.5 inch mesh, panels 2 & 6 will always be the 2 inch mesh, panels 3 & 7 will always be the 3 inch mesh and panels 4 & 8 will always be the 4 inch mesh.

11. Set net at the appropriate location by slowly drifting downstream or by maneuvering across the channel and letting the net out slowly.
12. Be sure the net deploys evenly and is taut.
13. Tangles and twists must be removed, if present.
14. For the Sturgeon Season, gill-netting effort will be distributed proportionately between available mesohabitats.

B. Net Retrieval and Fish Processing

1. Record the time retrieval is completed (Stop time).
2. The net should be retrieved from the front of the boat.
3. Remove the fish from the net as they come out of the water, if possible. Record the panel number collecting each fish.
4. Species, length, and weight data should be collected for target specimens (see Appendix C and Appendix J for description of protocol for subsampling shovelnose sturgeon weights). Species and length collected for non-target species.
5. Deceased species should be properly disposed of according to the individual State protocol.
6. If more than one quarter of any one panel is lost or destroyed during retrieval, then the panel will be considered a loss. Repeat the procedure in the same macrohabitat adjusting for possible snags or strong flows.

IV. Net Repair and Maintenance

A. Never use a gill net when more than 25% of any one panel has been destroyed or made ineffective.

B. Do not attempt major repairs on the boat. Have extra nets on hand allowing repairs to be made later.

C. Repair

1. If a net is damaged within the range of repair, do so using standard net repair procedures (Gebhards 1983).
2. Order extra spools of twine along with your nets for this purpose.

D. Care

1. Allow the nets time to dry before folding and storing.
2. Store in a manner that will allow easy future deployment.

V. Aquatic Nuisance Species Prevention – To prevent the spread of aquatic nuisance species (primarily aquatic plants):

A. Nets used in bodies of water with known infestations of the exotic plants must only be used in waters known to contain those same plant species; or

B. Air-dried for at least 5 days prior to their next use.

VI. References

Gebhards, S.V. 1983. Appendix-repairing nets. Pages 112-122 in L.A. Neilsen.

Hubert, W.A. 1996. Passive capture techniques. Pages 157-181 in B.R. Murphy and D.W. Willis [eds]. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

Prepared by:
Cliff Stone
South Dakota Game, Fish and Parks

TRAMMEL NETS

Trammel nets have three panels of netting that are suspended from a float line and a single lead line. The two outer panels are a larger mesh than the inner panel. The inner panel is deeper than the outer panels and hangs loosely between the outer panels. Fish are either gilled in the mesh or become bagged in the smaller mesh. Trammel nets are more selective for fish with rough surfaces. Trammel nets, generally, are less injurious to fish than gill nets. The same biases exist with trammel nets as with gill nets; however, trammel nets are less size selective (Nielsen and Johnson 1983).

I. Materials/Specifications

A. Trammel nets will be made of multifilament nylon netting with the inner wall 8 feet deep (2.4 m) and outer wall 6 feet (1.8 m) deep, 125 feet (38.1 m) long with 1-inch (2.5 cm) bar mesh for the inner panel of #139 twine, 8-inch (20.3 cm) bar mesh for the outer panel of #9 twine, with 3/8-inch (9.5 mm) to ½- inch (12.7 mm) foam floatline, and 50-pound (13.6 kg) lead line. Gear type designation recorded as TN on the data sheet.

B. A second trammel net with identical specifications (except length will be 50 feet rather than 125 feet) to those listed in "A" above may be used in secondary connected channels where the width of the channel does not allow drifting of the larger net. This gear will be recorded as TN50 on the data sheet. This net should only be deployed in place of the 125-foot net when width of the habitat selected is limiting, thus precluding the setting of the 125-foot trammel net.

C. Additional sash weights may be required, and the weights should be between 113 and 227 grams (0.25-0.50 lbs) with attachment rings.

D. Snap link carabineers (available at most local hardware stores) will be used to connect the sash weights to the trammel net lead line.

E. Two inflatable buoys with 23 to 33 cm diameters (9"-13") can be ordered from Memphis Net & Twine Co.

F. A holding tank on the boat is required for the fish captured by the trammel net until the fish are processed and released.

II. Habitats Trammel Nets will be used to sample

A. Trammel nets will be drifted in channel border mesohabitats.

B. When collecting sub-samples within a given habitat, the sub-samples should be collected at **proportionate** intervals representative of the size of the bend.

III. Methods/Procedure

A. Attach floats to net. Bullet or ball floats and 9 to 15 m (30 to 50 feet) of 3/8-inch (9.5 mm) to ½-inch (12.7 mm) float rope will be attached to each end of the float line with carabineers. One end will be attached to the boat or held and the other end will be allowed to float. Additional line is used to visualize net location and maneuver the net in water with various water velocities such as outside bends and inside bends. One end of the net can be released and the opposing line retrieved to maneuver the net from the other end.

B. Depth and velocity are critical factors affecting the efficiency of the net relative to maintaining good contact with the river bottom. The standard trammel drift should be based on a net that is fishing throughout deployment. For a trammel net, this includes the net maintaining contact with the river bottom and drifting slightly slower than the current velocity.

1. Evaluation criteria to determine how the net is fishing includes:

    a. Net should be drifting slower than the current if fishing properly due to resistance of net maintaining contact with the substrate.

    b. No debris in net upon retrieval may be an indicator that the net is not maintaining contact with the substrate.

    c. Absence of benthic species, but presence of other species such as goldeye.

    d. Net is twisting or the net does not descend properly due to high flow turning the net

    e. Float line is observed at the surface during deployment due to excessive tension applied by boat operator pulling net. Float line should not be pulled taut during deployment.

C. If it is determined that the net is not fishing properly, add sash weights to remedy problem. Sash weights will be added as needed to keep the net on the bottom and perpendicular to current while still allowing the net to drift. Sash weights between 0.25 (113 g) and 0.50 pound (227 g) should be evenly distributed along the length of the net and attached with snap link carabineers to the lead line. Start adding weights with one on each end and one in the middle with additional weight added as needed.

D. Trammel nets will be deployed from the bow of the boat as the boat moves in reverse. The net will be drifted perpendicular to the current. In areas of swift velocities, the net should be deployed by starting in the swiftest velocities and backing the boat into slower velocities to maintain better boat control and maintain a perpendicular set as described above. For example, when drifting trammel nets between wing dike tips, the boat operator should initiate the drift by backing away from the thalwag toward the dike tips. If needed, the net may be pulled slightly to maintain a perpendicular set, but too much tension will pull the net up off the river bottom and result in the net not fishing effectively.

E. The net can be retrieved into the boat over the side or the bow. A net tub filled with water should be used to hold fish until they are worked up. Entangled fish will be held in water as the fisheries crew picks fish out.

Once fish are removed, they will be placed in a holding tank before weighing and measuring.

F. Each sub-sample drift will be 300 meters long or less (minimum 75m with the exception of pools, where the minimum distance is 25m). Distance will be quantified for data recording purposes by using GPS. The standardized GPS unit for this project has a built-in distance feature to quantify distance between waypoints. For drifting sets, CPUE shall be reported as fish/100 meter (linear meters) of the drifted area.

G. Start time will be recorded to the nearest minute in military time of day. Time will start when the entire net is fully deployed from the boat.

H. Start GPS location will be recorded at the point at which the net is fully deployed from the boat. Stop time is not required for active gears.

I. Depth will be collected at the start, midpoint and stop locations of the drift.

J. Velocities must provide a drifting net that will meet the minimum drift distance of 75 meters in 5 minutes or less. If this cannot be achieved, it will be determined that velocities are not adequate for proper deployment and function of trammel net drifting under the current conditions.

K. Whenever a pallid sturgeon is collected, two additional sub-samples will be collected in this exact location. These additional passes (sub-samples) will be recorded in accordance with the data sheet instructions.

L. Snagged nets will be divided into two categories; resample or complete. Each sub-sample drift will be 300 meters long or less (minimum 75m with the exception of pools where the minimum distance is 25m). If a net drifts less than 75 meters in any mesohabitat, excluding pools, the sample must not be counted. Nets that are snagged after the first 75 meters will be counted and distance drifted will be recorded based on the use of the GPS unit. The fish will be used for CPUE calculations with all required information recorded.

M. Trammel netting can be dangerous, and there are some precautions that can be taken to minimize this danger. Caution is required when removing a net from a snag to prevent sinking the boat. The boat should never have the stern forced against the current when pulling a net from a snag as water may wash into the boat sinking it. Position and hold the bow upstream while using forward thrust to free the net. Never try to free the net using reverse gear with the stern positioned upstream. Do not pull so hard as to force the bow into the water. If a net is snagged and will not pop loose after repeated attempts to pull it free, cut the net. When cutting the net hold onto both ends of the net if possible so most of the net can be retrieved. Occasionally enough net can be retrieved to rebuild the net by splicing ends.

IV. Repair Materials and Methods

A. Twine for inner panel and outer panel, #139 and #9 nylon twines.
B. Small netting needle and large netting needle
C. An area to hang net during the repair.
D. Outer panels should be repaired with #9 twine following procedures outlined by Stacy V. Gebhards in the Fisheries Techniques book, Chapter 6 Appendix (Nielsen and Johnson 1983). Outer panels should be rebuilt rather than replaced. The inner panel, which is made of 1-inch mesh and of greater depth than the outer panel, can be repaired by simply trimming the broken mesh fringes and sewing the tear together with #139 twine. If the hole is small, reconstruction is possible with weaving, if one would like to take the time to do so. Cut nets can be sewn together if both ends of the net were retrieved. A net with more than 25 percent damage must be repaired before reusing.

Prepared by:
Dave Fuller
Montana Fish, Wildlife and Parks

OTTER TRAWL

The otter trawl is a bag-shaped net which is dragged along the bottom or through the water column to collect fish by straining them from the water. It is normally towed by one or two powered vessels and may be designed as a bottom, midwater, or surface sampler. The opening of the trawl is maintained by outward forces generated by water pressure and bottom friction against door-shaped boards towed at an angle to the net direction.

I. Materials/Specifications

A. Trawl Specifications (OT16)

1. Width = 16 feet (4.8m) or 22 feet (6.7m)
2. Height = 36 inches (0.91 m) or 48 inches (1.21 m)
3. Length = 25 feet (7.6 m) or 29 feet (8.8 m)
4. Inner mesh size = 1/4in (0.63 mm)
5. Outer chafing mesh size = 1–1/2-inch stretch (38 mm)
6. Cod-end opening = 16 inches (0.4m)
7. Trawl doors = 30 inches x 15 inches (Standard Doors for OT16 and OT01)

B. Design for 16-foot Trawl

1. Width = 16 feet Skate Balloon Trawl Minimum Lift
2. Height = #9 x 1-1/2 inches- str. polyethylene (PE) netting for body
3. Length = #18 x 1-1/2 inches str. PE cod end
4. Inner mesh size = 110 mesh around cod end x 80 md
5. Outer mesh size = 200 mesh deep body
6. Cod end opening = 60 md wings
7. Lead line = 20- foot rope x 1/8-inch galvanized loop chain, 16 links to the foot
8. Galvanized rings for lazy line and galvanized rings for the cod end ties
9. 4-foot tie legs with thimbles and shackles
10. ¼-inch raschel-treated polyester (not nylon) liner with galvanized steel insert and removable sleeve for interchanging liner. (250 denier for strength)
11. Liner has 2-inch sleeve sewn along top section for insertion of hoop
12. 30 x 15 2-inch offset style doors
13. 3/4-inch marine plywood x 2-inch x ½-inch heavy steel runners, steel tow brackets on back of door on both top and bottom
14. 26 feet of 1/8-inch galvanized tickler chain and shackles
15. 10 pounds of split leads for weight adjustments
16. Two 100-foot towlines, PE x 3/8-inch diameter

II. Habitats to be sampled using the Otter Trawl

A. Trawls (sub-samples) will be deployed in island tip and channel border mesohabitats.

B. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the size of the bend.

III. Methods/Procedure: Bow Trawling

A. Determine the need for additional weight. Proper deployment of the trawl should be based on the trawl maintaining good contact with the river bottom.

1. Each day, prior to deploying the trawl, the skids on the trawl doors should either be painted or marked from front to back to evaluate the performance of the trawl doors in maintaining the appropriate contact with the river bottom.

    a. If the doors are riding on the front or back, corrective adjustments should be made in accordance with Small Skiff Trawling 2005 trawling manual (4th Edition) page 27 by Greg Faulkner.

    b. In some cases, additional weight must be added to the bottom line of the trawl. Typically, 2 ounce split lead sinkers spaced 24 inches or inverted "V" chain suffices.

2. In addition to the initial evaluation of performance of the doors, when moving into deeper waters or swifter currents, the skids should be remarked to evaluate the performance under these different conditions.

3. **The standard is that the net is fishing as uniformly as possible under these varying conditions (remaining in contact with the substrate).**

4. In addition to maintaining good contact with the substrate, the doors should open uniformly. If the doors do not open uniformly, there may be a twist in the line or other entanglement in the trawl and attachments that are preventing the trawl to fish properly.

B. What to look for to determine if the trawl is fishing properly.

1. Proper wear on the skids, no "Toe-ing" or "Heeling" or no evidence of wear indicating that you are not on the bottom.
2. No fish being caught
3. Presence of detritus, gravel, or other materials typically expected in the trawl.
4. Other

C. Trawls should be made downstream to minimize the effect of "stalling" the net. The length of the trawl period is determined by the macrohabitat being sampled. The net should be deployed at the start of the macrohabitat and pulled before a different macrohabitat is encountered. The range of depth throughout the trawl period should be recorded (start, midpoint, and stop locations). When possible the boat operator should try to maintain a constant depth to eliminate variability within the sample.

D. Attach the trawl to two attachment hard-points at the base of the electrofishing rack with 3/8-inch (1 cm) braided nylon rope. Use 60 feet (18.2 m) of rope for depths 10 feet (3.31 m) or less and 100 feet (30.3 m) of rope for depths greater than 10 feet (3.3 m). 30- x 15-inch trawl doors should be used. A large float should be attached to the cod end with a floatable rope at least 3/8-inch thick. The rope should be twice as long as the maximum depth to be sampled. In the event the trawl has to be disconnected from the boat, the float will mark the location of the trawl, facilitating recovery. A 5/16- or 3/8-inch chain 3 to 4 feet long can be attached to the cod end to prevent the current from rolling the net when it is deployed.

E. To define the reach to be sampled, GPS readings should be taken at the point the trawl is estimated to reach the bottom and at the point the trawl will collapse or no longer be actively pulled by the boat. Start time will also be recorded in military time in conjunction with the timing of the start GPS reading. No stop time is required for active gears. The driver must compensate for the length of the rope when marking coordinates. This can be done by designating landmarks on the bank where the net will be deployed and retrieved and marking the waypoints at those land marks. CPUE shall be reported as fish/100 meters (linear meters).

F. Depth will be collected at the start, midpoint and stop locations of the area trawled.

G. The boat operator must allow time for deployment before the habitat is reached. Deployment begins by throwing the floating buoy upstream as the boat begins to accelerate downstream slightly faster than the current.

H. As the boat accelerates, two persons start throwing the trawl off the bow starting at the cod end. The force of the water should pull out the slack of the net leaving the two persons holding one otter-board. Care must be taken to ensure the leads to the otter boards are not twisted before placing them in the water. The driver should quickly reverse the boat when the otter boards are dropped to take out the slack in the line. If too much time is taken getting out the slack the current will push the net into the otter-boards while it is resting on the bottom. Tension applied on the ropes by persons deploying the net will also minimize net entanglement.

I. Once the ropes are completely out, considerable resistance will be felt as the trawl contacts the bottom. Boat speed is then adjusted to keep the unit moving slightly faster that the velocity of the river. Too much speed will result in the net stalling (water does not filter through the net and pushes fish out). Too little speed will result in the net collapsing or allowing time for fish escapement.

J. Before net retrieval takes place, the driver should increase the tension on the net by increasing the motor rpm's. This will "load" the net, forcing fish stuck in the webbing to flush down to the bag.

K. Net retrieval is done by quickly pulling in the tow-ropes as the driver maintains pressure. Before the trawl reaches the boat, the boat operator begins to back up to avoid the trawl getting under the boat and being entangled in the prop or drawn into the jet unit.

L. The two trawl operators lift the otter-boards followed by the net into the boat. The cod end is untied and fish are put into a container of water.

M. The fish are then processed.

N. Whenever a pallid sturgeon is collected, two additional sub-samples will be collected in this exact location. These additional passes will be recorded in the sub-sample side box.

O. Snagged trawls will be divided into two categories; resample or complete. Each sub-sample trawl will be 300 meters long or less (minimum 75m with the exception of pools which the minimum distance is 25m). If a trawl becomes snagged prior to completing 75 meters in any mesohabitat excluding pools, the sample must not be counted. Trawls that are snagged after the first 75 meters may be counted at the crew leader's discretion which will be based on whether the snag came free quickly in which fish escapement is not and issue versus a more challenging snag which may likely result in fish escapement before the gear is retrieved. Distance will be recorded in either case, based on the use of the GPS unit. The fish will be used for CPUE calculations, with all required information recorded unless the Crew Leader feels the deployment was compromised (loss of fish via escapement). In this situation, when a net does not fish properly, but catches fish, MNCF will be recorded in utility box 5 and the actual fish species codes will be recorded on the back of the standard data sheet. All nets classified as MNCF will be eliminated from CPUE calculations for reports.

P. In the event that the trawl becomes snagged, take up the slack in the lines until the boat is over or beside the net. Tie down the ropes and use the boat to pull upstream. If the net remains snagged try to retrieve the otter boards, detach the boards from the net then pull from the cod end of the net using the floating buoy. If the trawl does not come out easily, fish are likely to escape and the trawl should be redone. If the net has turned over, do not count the run. Target species captured from aborted runs may still be processed for age and growth data, but should not be used for CPUE calculations.

Q. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the size of the bend.

IV. Methods/Procedure Additional information specific to Stern Trawling (Follow guidelines for Bow Trawling except for additional information provided below).

A. Only specially designed boats should be used for stern trawling. Hydraulic winches spooled with at least 3/8-inch braided Dacron (Sampson Tenex) should be used to deploy and retrieve nets.

B. The trawl is deployed by pushing it off the back deck while moving downstream. Care should be taken to ensure the otter boards are not twisted before they enter the water. When tension on the net begins to open it up, the driver should increase the speed while the winch operator lets out enough cable (60 to 120 feet) so that the trawl will open fully and remain in contact with the channel bottom.

C. Retrieval is done by the boat operator while continuing forward (downstream). As the net approaches the boat, the driver reengages the engine and goes forward so that the net is trailing just behind the boat. After the winch operator pulls the otter-boards up to the blocks, the deck hands should pull the net onto the deck.

D. In the event of a snag, the driver should back the boat upstream into the net while the winch operator takes up the slack. The driver should back over the net while the winch is used to pull the net up. If this maneuver fails, sufficient line should be spooled out on the deck to allow the driver to safely turn the boat upstream. The boat is then used to pull back upstream on the net. If this again fails to break the net loose, the otter-boards should be detached and the float buoy line should be tied to the boat and pulled upstream.

V. References

Hayes, M.L. 1989. Active Fish Capture Methods. Pages130-133 in L.A. Nielsen and D.L. Johnson {eds}. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

Prepared by:
Wyatt Doyle
USFWS; Columbia Fishery Resource Office

MINI-FYKE NETS

Small Wisconsin-type fyke nets, or mini-fyke nets, are used to sample small fishes, including young-of-the-year (YOY), in shallow water habitats with low velocities. Mini-fyke net specifications are similar to those used by Long Term Resource Monitoring Program (Gutreuter et al. 1995). The net consists of three sections: the lead, the frame, and the cab.

I. Specifications

A. Mini-fyke nets consist of a lead, two rectangular steel frames, and two circular hoops.

B. The net contains 1/8 inch (3 mm) "ace" type nylon mesh, coated with green latex net dip (plasti-net). Other net protective treatments are acceptable.

C. Lead: The lead is 14.8 feet (4.5 m) long and 2 feet (0.6 m) high. Sponge floats (man-made, 14oz., tan) are used on the floatline and bulleted lead is used on the leadline.

D. Frame: There are 2 rectangular frames, both 3.9 feet (1.2 m) wide and 2 feet (0.6 m) high. Frames are made of black oil-tempered spring-steel ¼ inch (0.63 cm). From the first frame, two mesh wings extend to the middle of the second frame so that there is a 2 inch (5 cm) vertical gap between each wing. The lead extends and bisects the two frames.

E. Cab: The cab consists of two spring-steel hoops that are 2 feet (0.6 m) in diameter (When fully extended the frame and the cab are 9.8 feet (3 m) long).

F. Throat: The throat is attached to the first hoop. Aperture diameter of the throat is 2 inches (5 cm) and is fixed using a stainless-steel ring.

G. A drawstring, 5.9 feet (1.8 m) in length made of asphalt-coated nylon cord .17 inch (4.4 mm) is attached to the cod end.

H. A piece of nylon string can be attached to the cod end and tied to prevent escapement of fish.

I. A "sock" may be incorporated in the upper portion of the net to allow turtles a pocket to breath.

J. A zipper may also be incorporated in the top of the net to aid the removal of larger turtles.

K. Mini-fyke nets may be dipped or black coated.

II. Habitats

A. Mini-fyke sampling is conducted in bar mesohabitats.

III. Procedure

A. Mini-fyke nets are set in the afternoon prior to sunset and pulled the following day after sunrise (net-night) for a maximum set time of 24 hours.

B. Mini-fyke nets are standard gear to be deployed in bars, secondary non-connected channels, and small tributary mouths.

C. The lead is staked with a T-bar (re-enforcement rod) on shore at the waterline. In areas with little or no current, the mini-fyke is set

perpendicular to shore. In swifter currents the net is set slightly downstream. The cod end is weighted or staked. In swifter currents the frame may be weighted with window weights or flat railroad weights to insure the net does not flip over.

D. Mini-fyke nets are set so that the top of the cab is near or just above the water surface. The intent of this setting technique is to allow turtles an air pocket to breath to minimize the potential for mortality of turtles species captured in the mini-fyke nets.

E. The lower end of the throat of the net must be completely submerged.

F. CPUE is expressed as number of fish/night.

G. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the bend.

H. GPS location is to be taken at the cab of the net. Start time is recorded when the net is deployed. Stop time is recorded when the net is pulled.

I. A Distance measurement must be collected for each gear deployment. This measurement is taken from the junction of the lead and cab and measured perpendicular to the shore. These distance measurements are taken in centimeters. Refer to figure F4 for clarification.

IV. References

Gutreuter, S., R. Burkhardt, and K. Lubinski. 1995. Long Term Resource Monitoring
Program Procedures: Fish Monitoring. National Biological Service, Environmental Technical Center, Onalaska, Wisconsin. July 1995. EMTC95-P002-1. 42pp.+Appendices.

Prepared by:
Louise Mauldin
USFWS (Columbia Fishery Resource Office)

TROTLINE

Trotlines are a passive method of sampling consisting of multiple baited hooks which are attached to a long fishing line. The line is held stationary in the current by attaching anchors to both ends. Trotlines should not be confused with setlines/banklines, which typically only use one anchor with two to three hooks attached to a single line. All trotline activities must conform to the Biological Procedures and Protocols for Researchers and Managers Handling Pallid Sturgeon.

I. Specifications

A. Main line length: The standard unit of trotline effort (i.e., minimum level) will be a 105 ft. main line length for all segments. The level of effort (hooks and lines) can be doubled per deployment (205 ft. main line length). This allows 5 ft. of rope between the anchor and the first hook and an additional 5 ft. between last hook and the down river anchor. Rope diameter and type is determined by crew leader. Rope of differing diameters can be used depending on preferred method of deployment.

B. Hook size: 3/0 Eagle Claw Circle Sea (model # L198F-3/0) must be used. Hook size is recorded in the panel/hook column.

Hook Style	Abbreviation
Circle hooks	C

C. Dropper Length: Hooks should be tied to leaders that are 18 inches in length. Each leader is fastened to the main line using trotline snaps or net clips (Figures B3 and B4).

D. Hook / Leader Spacing: Leaders must be spaced five feet.

E. Number of hooks per line: The standardized number of hooks per line is dependent on the main line length, but is 20 hooks per 100 feet of main line (0.2 hooks per foot). It is required when setting a trotline to record the number of hooks in UTILITY BOX 2 (U2). When retrieving the trotline, the number of hooks that fished is recorded in the DISTANCE box on the front of the data sheet. Therefore, the number of hooks that "failed" can be easily calculated. Trotlines should represent a single microhabitat.

Main Line Length (ft)	Line Length Abbreviation	# of Hooks	# of Hooks per ft. of line length
105	1	20	0.20
205	2	40	0.20

F. Bait: Night crawlers.

Bait Type	Abbreviation
Worm or Crawler	W

G. Floats: Attach floats to retrieval line allowing adequate slack for depth and flow conditions. Label all floats with appropriate identification in accordance with local law enforcement regulations. Optional use of a float line for the retrieval line is recommended in case the float is detached due to debris or local anglers.

II. **Procedure:** Trotlines will be deployed for a maximum soak time of 24 hours in all segments. Segments 1-4 will also evaluate timed trotline sets of less than 8 hours.

A. The gear code for standard trotlines is TLC☐. The open ☐ indicates the main line length abbreviation. For example, a 205' trotline set using 40 circle hooks baited with worms would have a GEAR CODE of **TLC2**. The number of hooks (40) would be recorded in the DISTANCE box and W would be recorded in the BAIT column on the back page of the data sheet. The timed trotline sets in Segments 1-4 will be used to evaluate bait retention and catch of target species (e.g., pallid and shovelnose sturgeon) for shorter duration sets and will be coded as TLC☐T-E. Hook type, bait, and main line length are the same as standard trotline sets.

B. Catch per Unit Effort will be reported as fish/ 20 hook night.

C. GPS coordinates are collected at the upstream end of the trotline or the end of the trotline closest to the shoreline for trotlines set perpendicular to flow.

D. Start time is recorded when the trotline is deployed and stop time is recorded when the trotline is retrieved.

E. Depth will be collected at the beginning, middle and end of the trotline and recorded on line 1, 2 and 3, respectively. There are no depth restrictions for this gear.

F. Subsamples should be randomly placed throughout a bend, with at least one subsample per available macro / meso combination. (e.g. CHXO / BARS, OSB / POOL, ISB / CHNB, etc, etc, etc) and a minimum of 8 subsamples per bend.

G. The presence of distended mouth in shovelnose and pallid sturgeon will be recorded as the letter "D" in the Otolith box on the field data sheet.

Wild Trot Line Protocols

I. Specifications

A. Main line length: Length must be in 105 ft. intervals with a maximum of 905 ft. This allows 5 ft. of rope between the anchor and the first hook and an additional 5 ft. between last hook and the down river anchor. Rope diameter and type is determined by crew leader. Rope of differing diameters can be used depending on preferred method of deployment

B. Hook size: Circle and octopus hooks in sizes up to 14/0 and 3/0 O'Shaughnessy hooks may be used. Each trotline must use the same hook and bait throughout the line. Hook size is recorded in the panel/hook column.

Hook Style	Abbreviation
Circle hooks	C
O'Shaughnessy hooks	S
Octopus hooks	O

Hook Size	Code	Hook Size	Code
1/0	10	1	01
2/0	20	2	02
3/0	30	3	03
4/0	40	4	04
5/0	50	5	05
6/0	60	6	06
7/0	70	7	07
8/0	80	8	08
9/0	90	9	09
10/0	99		
11/0	11		
12/0	12		
13/0	13		
14/0	14		

C. Dropper Length: Hooks should be tied to leaders that are a minimum of 12 inches and a maximum of 24 inches in length. Each leader is fastened to the main line using trotline snaps or net clips (Figures B3 and B4).

D. Hook / Leader Spacing: Leaders must be spaced safely at crew leaders discretion.

E. Number of hooks per line: The maximum and minimum number of hooks per line is dependent on the main line length. It is required when setting a trotline to record the number of hooks in UTILITY BOX 2 (U2). When retrieving the trotline, the number of hooks that fished is recorded in the DISTANCE box on the front of the data sheet. Therefore, the number of hooks that "failed" can be easily calculated. Trotlines should represent a single microhabitat.

Main Line Length	Line Length Abbreviation	Min. # of Hooks	Max. # of Hooks
105	1	10	40
205	2	20	80
305	3	30	120
405	4	40	160
505	5	50	200
605	6	60	240
705	7	70	280
805	8	80	320
905	9	90	360

F. Bait: Bait type should be specified on the back of the data sheet in the bait column. New bait codes should be filtered through the database manager so multiple baits don't get the same letter code.

Bait Type	Abbreviation
Worm or Crawler	W
Leech	L
Fish	F
Cut Bait	C

G. Floats: Attach floats to retrieval line allowing adequate slack for depth and flow conditions. Label all floats with appropriate identification in accordance with local law enforcement regulations. Optional use of a float line for the retrieval line is recommended in case the float is detached due to debris or local anglers.

II. Procedure: Trotlines will be deployed for a maximum soak time of 24 hours.

A. The gear code for trotlines is TL☐☐-W. The first open ☐ indicates the hook style and the second open ☐ indicates the main line length abbreviation. For example, a 205' trotline set using 40 circle hooks baited with worms would have a GEAR CODE of **TLC2**. The number of hooks (40) would be recorded in the DISTANCE box and W would be recorded in the BAIT column on the back side of the data sheet. Timed trotline sets in Segments 1-4 that are not used for evaluation purposes will be coded as TLC☐T-W. Hook type, bait, and main line length for these timed sets are the same as standard trotline sets.

B. Catch per Unit Effort will be reported as fish/hook night.

C. GPS coordinates are collected at the upstream end of the trotline or the end of the trotline closest to the shoreline for trotlines set perpendicular to flow.

D. Start time is recorded when the trotline is deployed and stop time is recorded when the trotline is retrieved. Habitat parameters are not required unless a pallid sturgeon is collected.

E. Depth will be collected at the beginning, middle and end of the trotline and recorded on lines 1, 2 and 3, respectively.

Deployment Methods: There are currently several methods of deployment. Some methods offer a greater safety mechanism or time saving techniques and their use may depend on the experience of the crew and water conditions in which lines must be set (depth and velocity). Trotlines should be secured to anchors or other fixed objects.

Method 1. Trotlines are deployed by attaching the main line to a float. The float is let out of the stern of the boat. While the line is floating downstream the leaders (pre-baited) are attached to the main line. After the entire main line is deployed with baited hooks an anchor is attached. After the anchor is set on the bottom, the boat is repositioned to retrieve the downstream float. The float is now taken off and replaced by an additional weight, thereby anchoring the main line at both ends. It is important to attach a float to both the upstream and downstream anchors to aid in retrieval.

Method 2. Trotlines can be deployed using a hose reel mounted to the boat by a length of board set across a protective rail on the boat. Lines are spooled onto the reel ahead of time. When setting the gear, the lead end of the line is anchored and set out until bottom contact is achieved; clip hooks can then be attached to the main line off the FRONT of the boat by one crew member while another crew member lets out the line on the spool. Finally, an anchor is put on the end of the line with a buoy attached to it for retrieval. This method ensures a break system and maximizes safety of the crew in hazardous conditions. The line is retrieved

by picking up the buoy end of the line and taking the fish or hooks off the line while another crew member spools the line back on the reel with a crank. Smaller diameter rope is preferred with this method, since handling is minimized and more rope can be spooled on the reel.

Method 3. This method involves "jump boxes" that have pre-set leaders 10 feet apart and are baited ahead of time. The lines can be set as in method 1 or set out of the front of the boat with an anchor on the front of the line. The hooks come off the box as the boat is reversed downstream. A final anchor and float are added to the end of the line. This type of line can also be set off the back of the boat as described in method 1, but drop weights cannot be added. This line is typically 1/8 inch in diameter.

Method 4. This method is similar to method 2 except that a hose reel is not used. An anchor is set off the front end of the rope and clips with hooks are attached throughout the length of the rope. When lines longer than 200 feet are used, an additional anchor is added every 200 feet to keep the line on the bottom and in place. A final anchor is placed at the end of the line with a buoy. When retrieving the line, one crew member takes the hooks off while coiling the rope in a bucket tub; multiple lines can be separated by boards in the container. While ¼ inch lines are sufficient for this method, slightly larger rope makes handling easier. With this method and with method 2, lines can be retrieved off the side of the boat minimizing the opportunity for the fish to escape when being pulled out of the water.

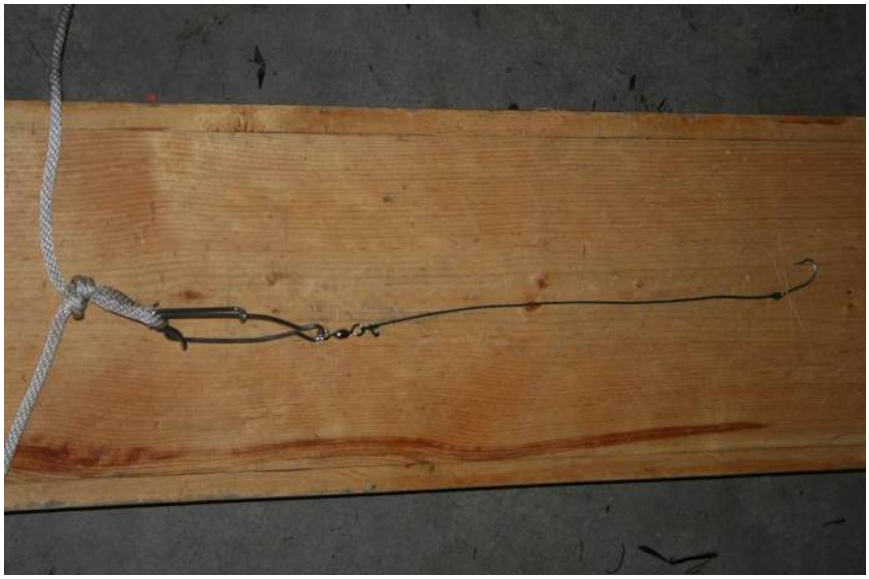

Figure B3. Close up of Trotline snaps connecting to the main on an overhand knot.

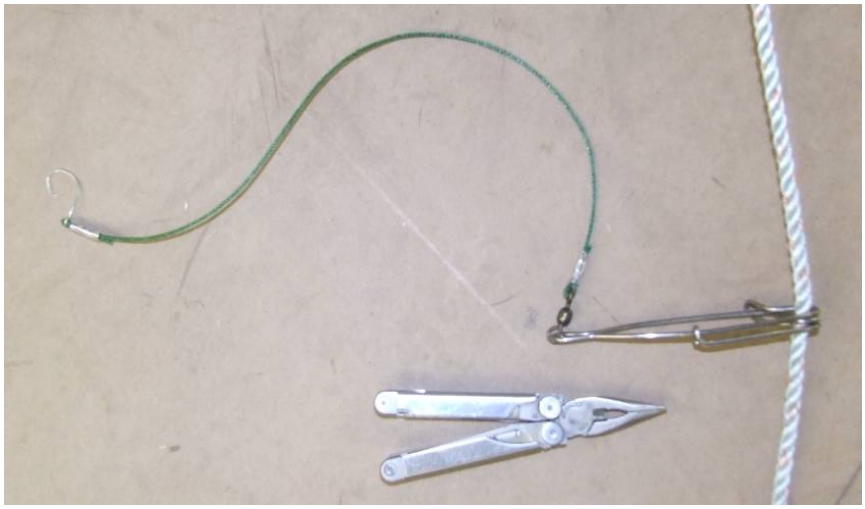

Figure B4. Large clip with tuna leader on lead core long line rope.

Prepared by:
Kirk Steffensen
Nebraska Game and Parks Commission (Lincoln, NE)

CRAZY NETS

Gill nets and other forms of entangling nets are an accepted practice in fish collection. A crazy net is a modified gill net that has the float and lead line hobbled, or tied, together. This design had been adapted from law enforcement descriptions of illegal gear used by commercial fisherman in the caviar trade. Crazy nets are set perpendicular to the current in channel border habitats. Modified entanglement nets are often used in this fashion to improve catch rates by reducing the size selectivity of larger mesh sizes. Broad cross-sections of habitat can be sampled with this gear type as compared to a traditionally set entanglement gear, as well. By modifying the integrity and orientation of the net, areas known to be used by sturgeon during migration can be sampled more effectively. Any size or type of entanglement net can be modified and set in this fashion. Specific descriptions and procedures for the proposed gear code are detailed below for inclusion in the MO River Standard Operating Procedures for Fish Sampling and Data Collection.

Proposed Code: GNM3C

I. Materials and Methods

A. Equipment

1. Length: 200-feet
2. Height: 8 foot net with lead line and float line hobbled together rendering the net 4' high.
3. Panels: none
4. Mesh size: 3.25 inch
5. Netting: monofilament
6. Twine Size:
7. Float Line: braided poly-foam core, 0.5-inch diameter
8. Lead Line: 3/8 inch
9. Anchors: Three grapple anchors. One at each end of the net and in the center.
10. Floats: Attach floats to retrieval line allowing adequate slack for depth and flow conditions in the macrohabitat. Label both floats with appropriate identification in accordance with local law enforcement regulations.

II. Habitats

When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the size of the bend.

A. Channel Border Mesohabitats

1. Position: Within channel border.
2. Orientation: Crazy nets should be set perpendicular to flow.

III. Methods/Procedure

Because this net is set perpendicular to flow, the net should be laid on the deck of the boat free of tangles to expedite the deployment of the gear and to minimize risk to crew. This net set is subject to bowing in the current, therefore a third anchor is attached to the center of the net. Anchors should be affixed prior to deployment. This net is deployed

very quickly in order to adjust for water velocities and to ensure the set is perpendicular to flow. River conditions should also be monitored closely as the design and orientation of the net make it vulnerable to debris. It is not advisable to set this type of net on rising river conditions.

A. Deployment

1. Record start time (military time) to the nearest minute.
2. Collect GPS latitude/longitude (decimal form). Start GPS latitude/longitude will be in conjunction with the end of the net that is first out of the boat. Recorded as Start latitude/longitude on the data sheet.
3. Start time will be recorded when the net is set and stop time will be recorded when the net is retrieved the following day.
4. The day the net was set will be recorded on the data sheet.
5. Depth will be collected at both ends and the midpoint of the net and recorded on the data sheet.
6. Duration of deployment:
    a. Crazy nets are set in the afternoon prior to sunset and pulled the following day after sunrise (net-night) for a maximum set time of 24 hours.
        1. If for whatever reason (weather, breakdown, etc.), a gill net set exceeds the 24 hour maximum soak time, a notation must be made in the comments section of the data sheet. CPUE is fish/net-night therefore; the data will still be used.
    b. Net set duration shall not be less than 12 hours nor exceed 24 hours and will only be set when water temperatures are < 55 degrees Fahrenheit (12.8°C) with the exception of secondary nonconnected channels and small tributary mouths.
    c. If a situation arises that does not allow for meeting the prescribed set times, the net should be set for as long as possible during normal working hours. A description of why the netting protocol was altered should be included in the comments section of the data sheet.
7. Consider only depths > 1.2 meters as effective sample sites.
8. When setting a net against a bank, set it away from the bank until a depth of at least 1.2 meters is available.
9. If the macrohabitat does not provide at least 100 ft. of continuous depths greater than 1.2 meters, then randomly select another site.
10. The 200-foot gill nets will be counted as 2 net-nights.
11. CPUE will be reported as fish/net-night.
12. Set net at the appropriate location maneuvering quickly across the channel and letting the net out as safely as possible.
13. Be sure the net deploys evenly and is taut.
14. Tangles and twists must be removed, if present.
15. For the Sturgeon Season, wild netting effort will be can be distributed non-randomly between and among available mesohabitats.

B. Net Retrieval and Fish Processing

1. Record the time retrieval is completed (Stop time).
2. The net should be retrieved from the front of the boat.
3. Remove the fish from the net as they come out of the water, if possible.

4. Species, length, and weight data should be collected for target specimens. Species and length collected for non-target species.
5. Deceased species should be properly disposed of according to the individual State protocol. Note any mortalities of large target species on datasheet.

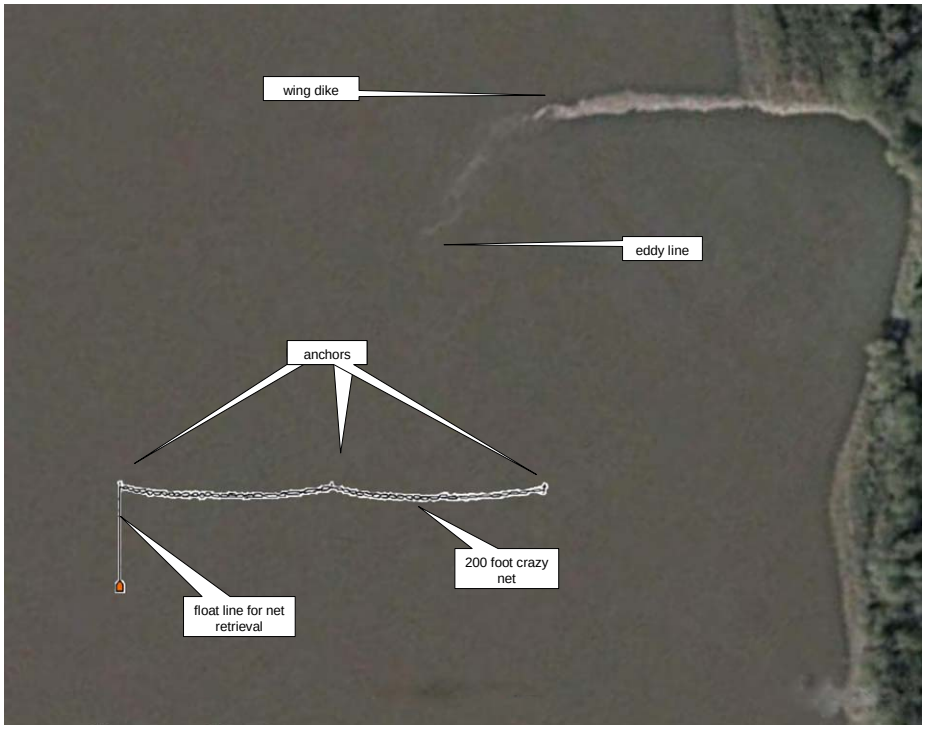

Figure B1. Illustration of a Crazy Net set and anchor locations

Prepared by:
Patty Herman
U.S. Fish & Wildlife Service
Columbia National Fish & Wildlife Conservation Office

PUSH TRAWL

The push trawl is an envelope shaped net that is pushed along the bottom straining fish from shallow water habitats. It is fished in front of a powered boat, pushed downstream and is most effective in water less than 2 meters in depth. The opening of the trawl is maintained by outward forces generated by water pressure and bottom friction against door-shaped boards pushed at an angle to the net direction.

I. Materials/Specifications

N. Trawl Specifications
1. Width = 8 feet (2.4m)
2. Height = 24 inches (0.61 m)
3. Length = 6 feet (1.8m)
4. Mesh size = 3/16in (0.4 mm)
5. Cod-end opening zipper = 16 inches (0.4m)
6. Trawl doors = 30 inches x 15 inches (Standard Doors for OT16 and OT01)

B. Design for 8-foot Push Trawl
1. Width = 8 feet
2. Height =
3. Length =
4. Mesh size =
5. Cod end opening =
6. Lead line =
7. tie legs
8. 30 x 15 2-inch offset style doors
9. 3/4-inch marine plywood x 2-inch x ½-inch heavy steel runners, steel tow brackets on back of door on both top and bottom
10. Two 50-foot towlines, PE x 1/4-inch diameter

II. Habitats to be sampled using the Push Trawl

A. Push Trawls (sub-samples) will be deployed in channel border, pool and natural bank mesohabitats.

B. When collecting sub-samples within a given mesohabitat, the sub-samples should be collected at proportionate intervals representative of the size of the bend and sampling within a single microhabitat.

III. Methods/Procedure: Push Trawling

A. Trawls should be made downstream to maximize catch based on upstream orientation of benthic fishes. The length of the trawl period is determined by the microhabitat being sampled. The net should be deployed within a microhabitat and pulled before a different microhabitat is encountered. Push trawling has shown to collect large numbers of fish. It may not be necessary to sample the entire microhabitat. A minimum trawl length of 15 meters and a maximum distance of 150 meters are recommended. The range of depth throughout the trawl period should be recorded (start, midpoint, and stop locations). When possible the boat operator should try to maintain a constant depth to eliminate variability within the sample.

B. The Push Trawl shall be deployed ahead of the boat by mechanical means using foreword facing outriggers of sufficient length to allow the net to fish ahead of the point where the bow of the boat breaks the water in the shallowest of habitats able to be sampled by said boat (typically 0.5 meters). Foreword facing outriggers will be manufactured specific to each boat and use DC powered winches with a power in and power out options. Rope shall be used instead of cable to attach to the trawl doors (boards) as cable is not as pliable and retains memory of the spool shape. If an additional winch is used to lift the entire frame cable may be used for this application.

O. As deeper water is encountered winches shall be let out allowing the net to fish deeper water. If a slope is encountered it will be necessary to either let rope out of the deeper side or pull rope in from the shallower side allowing the trawl to maintain contact across the bottom of the slope. In habitats deeper than 2 meters stern trawling is recommended.

P. To define the reach to be sampled, GPS readings should be taken at the point the trawl contacts the bottom and an ending point whereby retrieving the trawl has pulled it from the bottom. Start time will be recorded in military time in conjunction with the timing of the start GPS reading. No stop time is required for active gears. CPUE shall be reported as fish/5 meters (linear meters).

Q. Depth will be collected at the start, midpoint and stop locations of the area trawled.

R. The boat operator must allow time for deployment before the habitat is reached. Deployment begins by lowering outriggers and net into the water. As the boards enter the water and spread the net begin letting out the winches until the net contacts the bottom. This can be determined by observing the outriggers and ropes. As the boards ride over the bottom movement and resistance against sand waves and silt will cause the outriggers to move slightly. Electronic depth devices may not be reliable in water less than one meter deep. Sounding using a pole is the preferred method of measuring depth. As depth and slope change adjustments are made to maintain bottom contact

S. Once the ropes are completely out, considerable resistance will be felt as the trawl contacts the bottom. Boat speed is then adjusted to keep the unit moving slightly faster that the velocity of the river. Too much speed will result in the net stalling (water does not filter through the net and pushes fish out). Too little speed will result in the net collapsing or allowing time for fish escapement.

T. Before net retrieval takes place, the driver should decrease the tension on the net by reducing the motor rpm's as the ropes are pulled in. This will maintain equal momentum keeping fish in the net while the trawl is being retrieved.

U. Once the boards are pulled in to the point to clear the front of the boat the outriggers will be raised. If the net is filled with silt the driver can wash the net by driving around with the cod end in the water or the deck hand can repeatedly dip the net to wash out silt.

V. The trawl can now be emptied of fish by unzipping the cod end or turning the net inside out depending on which net is used (zipper cod is preferred) and placing fish into a container of water.

W. The fish are then processed.

X. In the event that the trawl becomes snagged, the winches will be spooled up and the driver will attempt to back upstream to retrieve the net. If this does not work, the boat operator can turn the boat upstream and attempt to push the trawl off of the snag. If this does not work, using a gaff or getting out of the boat to physically untangle the snag may be necessary. Remember you should be trawling in water less than 2 meters. If the trawl does not come out easily, fish are likely to escape and the trawl should be redone. If the net has turned inside out, do not count the run. Target species captured from aborted runs may still be processed for age and growth data, but should not be used for CPUE calculations. Trawls that are snagged after the first 15 meters may be counted at the crew leader's discretion which will be based on whether the snag came free quickly in which fish escapement is not and issue versus a more challenging snag which may likely result in fish escapement before the gear is retrieved. Distance will be recorded in either case, based on the use of the GPS unit. The fish will be used for CPUE calculations, with all required information recorded unless the Crew Leader feels the deployment was compromised (loss of fish via escapement). In this situation, when a net does not fish properly, but catches fish, MNCF will be recorded in utility box 5 and the actual fish species codes will be recorded on the back of the standard data sheet. All nets classified as MNCF will be eliminated from CPUE calculations for reports.

Prepared by:
Jeff Finley
USFWS; Columbia Fishery Resource Office

BEAM TRAWL

The Beam trawl is a bag-shaped net which is dragged along the bottom or through the water column to collect fish by straining them from the water. Beam trawls use rigid frames to hold the mouth of the net open. The most common design consists of two D-shaped, sled-like runners held apart by a beam to which the open end of the net is attached.

I. Materials/Specifications

1. Width = 6.4 feet (2 m)
2. Height = 1.6 feet (0.5 m)
3. Length = 18 feet (5.5 m)
4. Inner mesh size = 1/8 inch (0.3175 cm)
5. Outer mesh size = 1.5 inch (3.81 cm)
6. Cod-end opening = 6.5 inches (16.5 cm)
7. Bottom line = 3/8-inch chain
8. Trawl Frame
9. Boat: Jet with A-frame or boat with front deck rail

II. Habitats

A. Beam trawling may be conducted in pool, channel border, thalweg, and island tip mesohabitats within a variety of macrohabitat types. The beam trawl may also be deployed when conditions allow in large tributary mouths. Beam trawling may be utilized in other habitats included in the Wild category. Trawls of 300 m or less will be conducted at each sampling location in the unchannelized and channelized river. Two trawls will be conducted in all macrohabitats that permit. Trawls should be longitudinal along the macrohabitat if possible (except large tributary mouths where the trawls (sub-samples) are parallel) but may be parallel (side by side) if the macrohabitat is not of sufficient distance.

B. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the bend.

III. Methods/Procedure

A. When trawling with a jet boat with A-frame and hydraulic winch

1. String ¼-inch (0.635 cm) twisted steel cable line from the hydraulic winch through a pulley mounted to center of A frame. Attach cable to bridle of the trawl frame. A float should be attached to the crossbar of the trawl frame running through the net. The rope should be longer than the maximum depth to be sampled. In the event the trawl becomes disconnected from the boat, the float will mark the location of the trawl, facilitating recovery.
2. To quantify distance trawled, the GPS unit should be used to quantify distance between start and stop locations by marking waypoints at these locations. Start time will be recorded in conjunction with the Start GPS. Stop time is not required for active gears. CPUE shall be reported as fish/100 meters (linear

meters).

3. Depth will be collected at the start, midpoint and stop locations of the area trawled.
4. As the boat operator approaches the sampling location, the float and float rope is deployed behind the boat. After the float line is completely extended, the trawl frame is dropped into the water.
5. The net is gradually lowered into the water until it comes into contact with the bottom at the beginning of the sample location. This should be done while maintaining head pressure in the trawl to stop the trawl from flipping, rolling, or overtaking the frame, becoming entangled.
6. When the end of the sample location is reached, the boat operator puts the jet gate into the neutral position and increases the engine speed to supply more power to the winch.
7. The net is then winched in. As the trawl approaches the boat, the boat operator should drive forward; this stretches out the net and avoids entangling the trawl into the jet unit.
8. The trawl is lifted onto the back deck and the contents emptied into a bucket of water.
9. The fish are then processed.
10. Whenever a pallid sturgeon is collected, two additional sub-samples will be collected in this exact location. These additional (Passes) sub-samples will be recorded in the sub-sample side box.
11. Snagged trawls will be divided into two categories; resample or complete. Each sub-sample drift will be 300 meters long or less (minimum 75m with the exception of pools which the minimum distance is 25m). If a trawl becomes snagged prior to completing 75 meters in any mesohabitat excluding pools the sample must not be counted. Trawls that are snagged after the first 75 meters may be counted at the crew leader's discretion which will be based on whether the snag came free quickly in which fish escapement is not and issue versus a more challenging snag which may likely result in fish escapement before the gear is retrieved. Distance will be recorded in either case, based on the use of the GPS unit. The fish will be used for CPUE calculations, with all required information recorded unless the Crew Leader feels the deployment was compromised (loss of fish via escapement). In this situation, when a net does not fish properly, but catches fish, MNCF will be recorded in utility box 5 and the actual fish species codes will be recorded on the back of the standard data sheet. All nets classified as MNCF will be eliminated from CPUE calculations for reports.

B. When trawling from the front deck of boat with rail

1. Attach the trawl to two attachment hardpoints at the base of the electrofishing rack with 3/8–inch (1 cm) braided nylon rope. Use 40 feet (12.2 m) of rope for depths 20 feet (6.1 m) or less and 60 feet (18.2 m) of rope for depths greater than 20 feet (6.1 m). A small float should be attached to the crossbar with a braided nylon

rope. The rope should be longer than the maximum depth to be sampled. In the event the trawl has to be disconnected from the boat, the float will mark the location of the trawl, facilitating recovery.

2. To quantify distance trawled, the GPS unit will be used to measure the distance between start and stop locations using waypoints at these locations.
3. The boat operator then begins to accelerate the boat in reverse at approximately 2000 rpm (varying flow conditions will require different boat speeds).
4. As the boat accelerates, two persons wearing gloves remove the resting trawl from the shocking rack and set only the net portion in the water. Once the net is inflated, the sled frame is gradually lowered into the water until it is submerged. The trawl is then deployed by releasing both ropes at the same rate, while maintaining tension to avoid tipping.
5. Once the ropes are completely out, considerable resistance will be felt as the trawl contacts the bottom. Start and stop time will be recorded as military time of day to the nearest minute. Boat speed is then adjusted to keep the unit moving slightly faster that the velocity of the river.
6. At the completion of the trawl, the boat operator backs off the throttle. When the trawl reaches the boat but is still in the water, the boat operator begins to back up to avoid the trawl being entangled in the prop or drawn into the jet unit.
7. The two trawl operators lift the sled frame and place it on the shocking rack. Trawl contents are then flushed into the cod end of the net. The collection cup is then removed or the end of the net is untied and the contents are emptied into a container of water.
8. The fish are then processed.
9. In the event of a snag, the driver should back the boat upstream into the net while the winch operator takes up the slack. The driver should back over the net while the winch is used to pull the net up. If this maneuver fails, sufficient line should be spooled out on the deck to allow the driver to safely turn the boat upstream. The boat is then used to pull back upstream on the net. If this again fails to break the net loose. The trawl should be detached and the float buoy line should be tied to the boat and pulled upstream.

IV. References

Hayes, M.L. 1989. Active Fish Capture Methods. Pages130-132 in L.A. Nielsen and D.L. Johnson {eds}. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

Prepared by:
Gerald Mestl
Nebraska Game and Parks Commission

LARVAL FISH DRIFT NETTING

I. Materials/Specifications

A. Conical Shape
B. Diameter/length ratio - 1:5
C. Mouth Diameter - 750 mm
D. Mesh - 500 μ
E. Stainless steel net mouth ring
F. Three-point towing bridle
G. Cod end ring
H. Rubber coated hose clamp
I. One liter capacity cod end jar
J. Flow Meters
    1. Mechanical
    2. Six-digit counter

II. Methods/Procedure

A. Drift net samples can be collected weekly from the first week of May through the second week of August. Six samples can be collected at each sampling location per week. The sample location should have a single rather than multiple channels. Each location can be sampled with paired drift nets towed on the surface in the center of the channel, on the left edge of the channel and on the right edge of the channel.

B. When larval sampling with a jet boat with A-frame and hydraulic winch
    1. String ¼-inch (0.635 cm) twisted steel cable from the hydraulic winch through a set of pulleys mounted to the center of A frame. Next run steel cables to opposite corners of the A frame through another pulley and attach to drift net.
    2. Prior to deploying the net, read the number odometer on each drift net and record.
    3. Set nets in water, Start time is recorded when nets begin sampling. Stop time is recorded when sampling ceases.
    4. Release the winch break, deploy nets behind boat until each net is completely under water.
    5. Adjust boat speed as needed to maintain position in relation to bank, obtain GPS reading.
    6. Retrieve nets after set time. The length of time that the nets are deployed depends upon the amount of debris in the water, from just a couple of minutes up to 30 or more.
    7. After the nets are retrieved, record the ending odometer reading from each net and the time in seconds that the nets were sampling.
    8. Wash all organic material into the cod end jar by dunking the nets or using the wash-down hoses.
    9. Empty jar into a labeled polyethylene bag.
    10. Preserve with 10% buffered formalin by volume.

Prepared by:
Gerald Mestl
Nebraska Game and Parks Commission

HOOP NET

A hoop net is a cylindrical or conical net distended by a series of hoops or frames, covered by web netting. The net has one or more internal funnel-shaped throats whose tapered ends are directed inward form the mouth. Hoop nets are commonly used in channel habitats of rivers because they can be set and fished effectively in strong currents without being washed away or becoming clogged with debris.

I. Materials/Specifications

A. Diameter - 4 feet
B. Mesh – 1 1/2 inches
C. Hoops - 7 fiberglass tapered
D. Throats - 2
E. Throat placement - 2nd and 4th hoops
F. Twine size - #15
G. Black netcoat
H. Lead line - 30 or more feet of ≅ 3/8 inch
I. Float line - length double the water depth of ≅ 1/4 inch
J. Floats - white sponge float, 6 inches x 14 inches with agency identification

II. Habitats

A. Hoop nets may be deployed in channel borders (meeting steep bankline microhabitat criteria) and pool mesohabitats within a variety of macrohabitat types.

III. Procedure

A. Hoop nets are set in the afternoon prior to sunset and pulled the following day after sunrise (net-night) for a maximum set time of 24 hours.
B. Hoop nets are set with the current along steep vertical underwater sloping areas where water depth increases by 1.2 meters or more within a 3 meter horizontal distance. Hoop nets can be marked with a float attached to the first hoop.
C. CPUE will be reported as fish/net-night.
D. Tie lead rope of the hoop net to hoop net hook (anchor) or to bankline.
E. Deploy hoop net hook, if used, insuring that hook imbeds into substrate. Hook should be placed or anchored on bank in such a way as to position the net alongside the underwater vertical bankline.
F. Deploy net making sure that the net is not tangled.
G. Record the position of the hoop net mouth using GPS. Start time is recorded when the net is deployed. Stop time is recorded when the nets is pulled. As backup, record description of location of hoop net using local landmarks.
H. Retrieve float and lift net onto front deck of boat.
I. Process the fish.
J. Inspect net for holes prior to redeployment
K. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the bend.

IV. References

Hubert, W.A. 1989. Passive Capture Techniques. Page102 in L.A. Nielsen and D.L. Johnson {eds}. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

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Prepared by:
Gerald Mestl
Nebraska Game and Parks Commission

BAG SEINE

A seine is an active fishing system that traps fish by enclosing or encircling them with a long fencelike wall of webbing. The bag seine is constructed of mesh panels hung from a float line with a weighted leadline attached to its lower edge. Mesh size varies with intended use, but it is generally small relative to the circumference of the fish to avoid "gilling".

I. Specifications

A. Length: 30 feet (9.1 m)
B. Height: 6 feet (1.8 m)
C. Mesh: 1/4-inch (Ace) mesh (approx. 6.4 mm)
D. Bag dimensions: 6 feet x 6 feet x 6 feet
E. Lead line: 65 pound (29.5 kg) lead-core
F. Seines may be dipped or black coated

II. Additional Equipment

A. Field tape (100 m) to measure seining area dimensions
B. Weighed floats (small marker buoys) to mark start and/or stop locations and width between the ends of the seine (rectangular method)
C. Measuring board for fish length (mm) note: whether total, fork, or standard length used
D. Spring scales or portable electronic balance for fish weight determinations in grams.

III. Habitats

A. Seine sampling is conducted in bar mesohabitats.

IV. Procedure

A. Seining locations will include Bars, Secondary Non-Connected Channels, Small Tributary Mouths and Large Tributary Mouths (when conditions allow)
B. Time: Record start time using military time. Stop time is not required for active gears.
C. GPS measurement should be taken at the midpoint of the seine haul regardless of the method used (See Figure B1. Location "W" for each method.
D. The seine should sample for as long as it takes to effectively sample an area > 50 m^2
E. CPUE will be reported as fish/100 m^2
F. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the bend.
G. Indicate seining method (which includes direction) on the datasheet using one of the following designations:
    1. Bag seine quarter arc method (Upstream): BSQU
    2. Bag seine quarter arc method (Downstream): BSQD
    3. Bag seine half arc method (Upstream): BSHU
    4. Bag seine half arc method (Downstream): BSHD

5. Bag seine rectangular method (Upstream): BSRU
6. Bag seine rectangular method (Downstream): BSRD

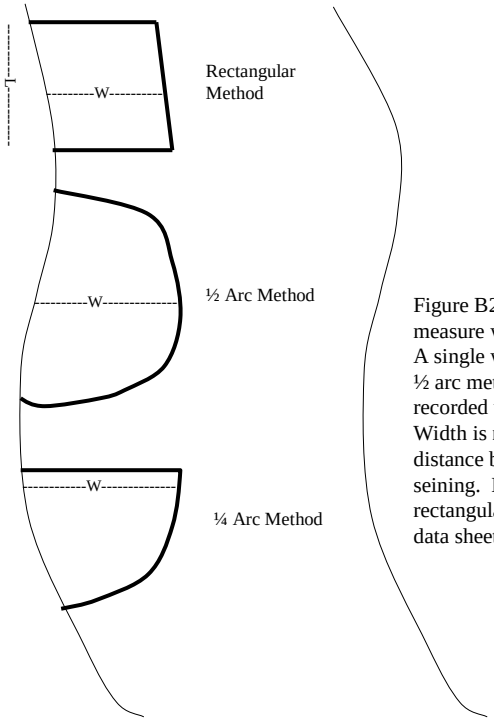

Figure B2. Hypothetical sketch of locations to measure width for the various methods of seining. A single width measurement is necessary for ¼ and ½ arc methods and an average width should be recorded when using the rectangular method. Width is **not** the length of the seine, but the distance between the two ends of the seine while seining. Length of the seine haul for the rectangular method is recorded as distance on the data sheet.

V. Methods

A. The seine should be fully extended when pulled from both ends either parallel to shore, straight into shore, or pulled from one end in a quarter circle (1/4 arc) or semicircle (1/2 arc). The shape of the area swept will vary by the technique used. Straight hauls parallel or perpendicular to shore sweep a rectangular area (L x W) where L = distance (on data sheet) and W = width between persons pulling the seine (which generally is always smaller than the length of the seine and is equal to the distance between the ends of the seine while seining). A quarter arc tow starts with one person anchoring the seine on shore and the other person fully extending the seine (perpendicular to shore) and walking up or downstream in a 90° arc, maintaining a fully stretched seine until nearing the shore. Area swept is a quarter circle: $\frac{1}{4}(\pi r^2)$ where r = distance between persons pulling the seine ("W" in Figure B1).

B. A semicircle tow starts with the seine stretched out on shore, one person anchors the seine on shore while the other person fully extends the seine (parallel to shore), and walks up or downstream in an arc of 180°, maintaining a fully stretched seine until nearing the shore. Area swept is a semicircle: $1/2(\pi r^2)$.

C. A rectangular seine haul starts with one person on the shoreline edge and the other person wading out to either the full extent of the length of the seine or as fully extended as possible depending on the depth encountered. Each person then seines parallel to the shoreline (upstream or downstream). At the end of the seine haul, the person seining in the deeper water moves to the shoreline while maintaining lead-line contact with the river bottom. The fish are worked into the bag and then dumped into a tub of water or worked up directly from the seine.

D. Care must be taken that contact of the lead-line with the river bottom is maintained at all times during the haul and that the float line is not tangled or twisted when the seine is initially stretched out.

E. If the seine is frequently snagged, the sample should be considered lost and a new undisturbed upstream location is selected.

VI. References

Hayes, M.L. 1989. Active Fish Capture Methods. Pages130-132 in L.A. Nielsen and D.L. Johnson {eds}. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

Farrel, J. M. and R. G. Werner. 1999. Distribution, abundance and survival of age-0 muskellunge in Upper St. Lawrence River nursery bays. North American Journal of Fisheries Management 19:310-321.

Johnson, B. L. and C. A. Jennings. 1998. Habitat associations of small fishes around islands in the Upper Mississippi River. North American Journal of Fisheries Management 18: 372-336.

Leslie, J. K. and C. A. Timmins. 1992. Beach seine collections of freshwater larval fish at the shore of lakes. Fisheries (Amsterdam) 15(3):243-251.

Lyons, J. 1986. Capture efficiency of a beach seine for seven freshwater fishes in a north temperate lake. North American Journal of Fisheries Management 6:288-289.

Parsley, M. J., D. E. Palmer, and R. W. Burkardt. 1989. Variations in capture seine efficiency of a beach seine for small fishes. North American Journal of Fisheries Management 9:239-244.

Prepared by:
Wayne Stancill
USFWS (Pierre, SD)

SETLINE/BANKLINE

A passive method of sampling utilizing a baited hook or multiple hooks which are attached to a long fishing line. This line is held stationary by either an anchoring device or adjacent fixed point on land.

I. Specifications (Adults)

A. Line length: Long enough to keep the bait near the river bottom. Length is to be determined by the crew leader.
B. Hook: Circle hooks must be used.
C. Hook size and line appropriate for the size of fish that you are targeting. The hook size should be recorded on the datasheet
D. In the comments section, specify brand of hooks and hook descriptions (e.g., total length)
E. Number of hooks/line: Up to 3 hooks can be used per line.
F. Bait: Bait type should be specified on the data sheet. Refer to data sheet instructions for codes for bait types.

II. Habitats

A. Setlines are a wild gear and may be set in any habitat.

III. Procedure

A. Set lines will be deployed in the afternoon prior to sunset and pulled the following day after sunrise (hook-night) for a maximum set time of 24 hours.
B. There are no standard habitats designated for use of setlines; however, setlines may be used within the Wild designation.
C. CPUE will be reported as fish/hook-night. The number of hooks on a particular set will determine the effort (e.g., a single set with 3 hooks is equivalent to 3 hook-nights).
D. Setting Options: Set lines may be secured to floats, anchors, or other fixed objects. (Anchors with a long rope leading to a float facilitating marking and retrieval with a secondary line (twine) running directly from the anchor with circle hooks).
E. When collecting sub-samples within a given habitat, the sub-samples should be collected at proportionate intervals representative of the bend.
F. GPS and Habitat data collected at the approximate location of the hooks. Start time is recorded when the setlines are deployed and Stop time is recorded when the setlines are retrieved.

Prepared by:
Wayne Stancill
USFWS (Pierre, SD)

FISHING/ANGLING

Angling (hook and line) consists of the deployment of baited hooks via rod and reel. The baited hooks are held stationary in the current by lead weights typically used for sportfishing. This method offers a high degree of flexibility and it is especially effective when sturgeon congregate in small areas that may be difficult to sample with other gears.

I. Specifications

A. Main line: Type (mono or multi filament), strength (test weight), color, etc., are at crew leader's discretion as are rod and reel specifics.

B. Rigging: Crews are allowed flexibility to experiment with different rigging styles. Typical rigs consist of a single hook tied to a leader (8-18" long). The leader is tied to a swivel and clipped to (or threaded through) a lead weight substantial enough to stay stationary on the bottom. Other methods (e.g., jigheads, etc.) may be deployed at the crew leader's discretion.

C. Bait: Bait type should be specified on the back of the data sheet in the bait column. New bait codes should be filtered through the database manager so multiple baits don't get the same letter code.

Bait Type	Abbreviation
Worm or Crawler	W
Leech	L
Fish	F
Cut Bait	C

D. Hook size is not a required field.

E. Deployment: There is no restriction on minimum/maximum distance a bait must be fished from the anchored boat. Baits should be checked often to minimize the effects of small, non-target species.

III. Procedure:

F. The gear code for Fishing/Angling is "FISH". Each time a fish is caught the particular bait is recorded in the "Bait" column on the back of the data sheet. All fish caught shall be recorded (including non-target species).

G. A new data sheet is started each time the boat moves to a new location. There will be one data sheet for the entire boat (rather than for each individual angler) at each location.

H. The number of hooks in the water at a given location will be recorded in the DISTANCE Box (e.g., three anglers in the boat fishing with 1 rod each, and two anglers are rigged with a single hook/line and the third angler is using a two hooks/line. The total hooks would be "4"and this would be recorded in the distance box). If a hook is lost during angling (e.g., snag, line break), it will be immediately replaced and fishing will resume. Sampling effort is represented by the number of hooks multiplied by the minutes of angling.

I. Start time is recorded when the lines-hooks are deployed in a particular location and stop time is recorded when they are retrieved before leaving that **location**. Habitat parameters (turbidity and velocity) are not required unless a pallid sturgeon is collected.

J. GPS coordinates will be collected at the position of the anchored boat. GPS position is recorded in the "Start latitude/longitude" boxes. If significantly different than directly below the boat, depth is measured via sonar in the area the hooks are deployed. This will be recorded in the #2 "Depth" box.

K. Habitat codes and visual velocity are recorded in the same as with other gears.

Prepared by:
Sam Stukel
South Dakota Game, Fish and Parks

PALLID STURGEON
POPULATION ASSESSMENT PROGRAM
FOR THE
MISSOURI RIVER

APPENDIX C

STANDARD OPERATING
PROCEDURES
FOR
AGE & GROWTH
GENERAL DATA COLLECTION

AGE/GROWTH AND GENERAL DATA COLLECTION

Information will be collected on all pallid sturgeon and a representative subset of native Missouri River Fishes regarding age, growth and relative weight. Table C1 provides a list of these representative species and guidelines for structures required for aging of each species. Detailed information must be collected for all pallid sturgeon collected in accordance with pallid sturgeon handling protocols.

I. Specifications/General Data Collection

A. Length will be collected on **all** species during both the Sturgeon Sampling and the Fish Community Seasons. For non-target species (not identified in Table C1), the fish will be identified by species and measured.

B. Length and weight data will be collected on pallid sturgeon, shovelnose sturgeon, blue sucker and sauger regardless of season. In segments where gill net catch rates for shovelnose sturgeon are high, crews have the option of subsampling weights to reduce the time spent processing these fish. Shovelnose sturgeon weights will be taken from a subset of the randomly selected bends identified for standardized sampling in the segment. Bends will be selected equally above and below the midpoint of the segment with a target of 400 average-sized adult shovelnose weighed in each season (fall and spring). The average sized adult shovelnose is projected to be between 500 and 700 mm TL. All shovelnose sturgeon captured with gillnets that fall outside this range (<500 mm and >700 mm) must be weighed. All shovelnose sturgeon recaptured with a floy tag must be weighed. All shovelnose sturgeon captured with other gears must be weighed; only shovelnose sturgeon captured in gill nets in the specified adult size range may be subsampled. Shovelnose sturgeon lengths may not be subsampled. In addition to length and weight data, aging structures will be collected on 10 fish per 10 millimeter length class determined by segment, species and date. Refer to Table C2 for outline of age-growth collection time frames by species and segment.

C. When large numbers of target species (i.e., shovelnose sturgeon, blue sucker and sauger) are captured in a single collection, the collection of weight information will be at the crew leader's discretion to minimize impacts to the fish resulting from the stress of holding and handling.

D. ONLY length data will be collected (weight data collection is optional) for the remaining target species (i.e., sturgeon chub, sicklefin chub and speckled chub). The entire fish will still be preserved for aging purposes with targets of 10 fish/10mm length group.

E. For large collections (>25 fish) of single species (of similar size or cohort) when sampling **with trawls or mini-fyke nets** sub-sampling will be used to collect information representative of the sample by taking length data (and weight data if this applies to the shovelnose sturgeon, blue sucker or sauger) on a representative subsample resulting in 25 fish/gear with a maximum of 200 fish/bend. Additional fish of the same species above these requirements will be counted and recorded on the data sheet. **All**

fish will be measured and a weight taken if required by protocols for all other gear types.

F. Age structures will be collected on shovelnose sturgeon (only take fin rays off sturgeon that are obviously large enough to remove the ray (approximately 130mm) larger than 130 mm (fork length).

G. Aging structures, length, and weight data will be collected in the field on sauger, shovelnose sturgeon, and blue sucker by non-lethal methods.

H. Collections of fish that are not needed for the age-growth analysis may be measured and recorded in the field or preserved and processed in the lab. All reasonable efforts should be made to work up fish in the field by non lethal methods rather than preserving large collections for post processing in the lab.

I. All species must be accurately identified. If positive identification cannot be made in the field, it will be necessary to bag, preserve, and identify this specimen in the laboratory to ensure accurate identification.
For all collections, the collecting office is responsible for the accurate identification of each specimen. The fish code list provides some flexibility in recording specimen to more generic categories (e.g. genus level such as *Hybognathus sp*.); however, for the target native species it is required to identify the specimen down to the species level.

J. All length measurements will be recorded in millimeters and weight in grams.

K. Length will be measured and recorded as total length for all species excluding paddlefish and sturgeon species. Total length will be measured from the snout to the longest point on the laterally compressed caudal fin. "Eye to fork length" will be recorded when paddlefish are sampled and "fork length" will be recorded for all sturgeon species.

L. Weight measurements will be collected and recorded in grams. No standard scales have been selected for this project; however, a digital scale with capabilities of precisely measuring to 1/10 of a gram will be required for measuring small fish (< 30 grams). Fish between 30 and 1200 grams will also be measured on a digital scale to the nearest gram. Fish larger than 1200 grams will be measured to the nearest 50 grams (using a digital or dial scale).

M. All fish <30 grams will be weighed in the lab to ensure that the precision of the weight data isn't compromised due to conditions in the field. For sturgeon weighing <30 grams, a weight measurement should not be collected in the field because of the inability to obtain accurate weight information in typical field conditions.

N. Scales will be calibrated (verified) on a weekly basis. A record of this calibration will be maintained and available for quality assurance purposes.

O. The age growth analysis will be divided up between the field stations and kept separate by segment. Verification of age-growth analysis will be determined at a later time.

P. Scale envelopes and/or vials: Information such as segment number, unique identifier (including the year), vial number, species, and page entered on age-growth envelope should all be recorded on the data sheet. Envelopes and vials may be stamped or labeled (pre-printed) with consecutive numbers and segment number prior to field use to save field time processing fish.

Q. Field preservation of chub and minnow species will be the choice of the field crew leader, but must remain consistent for all samples within a given segment.

R. Aging structures will **not** be collected on pallid sturgeon; however, a tissue sample should be collected for genetic analysis on all wild pallid sturgeon (See Appendix D for the Services' Handling Protocols for the pallid sturgeon and then follow guidelines for Genetic Analysis).

Table C1. Representative Native Missouri River Fish Species Included in Age-Growth and Relative Weight Assessment.

Species and Geographic Area of Collection	Time Frame for Collection	Scales	Scale Removal Location	Ray, Spine	Otolith	Number per length group
Sicklefin Chub *Macrhybopsis meeki* Segments 1-3 only	July 1-October 31	Yes: Preserve entire fish	Between lateral line and dorsal fin			10 fish/10 mm length interval
Sturgeon Chub *Macrhybopsis gelida* Segments 1-3 only	July 1-October 31	Yes: Preserve entire fish	Between lateral line and dorsal fin			10 fish/10 mm length interval
Sauger *Sander Canadense* (≥100 mm) No upper size limit All Segments	Year Round	Yes: Collect in the field	Posterior edge of pectoral fin. Minimum of 10 scales/fish	Yes	*Yes, ONLY if specimen is DEAD	10 fish/10 mm length interval. Count starts at the onset of the Sturgeon Season each year
Shovelnose Sturgeon *Scaphirhynchus platorynchus* (≥130 mm) No upper size limit All Segments	Segments 1-4 August 1-Oct. 31 Segments 5-14 Nov. 1-April 30	NA		Left Pectoral Ray including knuckle		10 fish/10 mm length interval

* Otoliths will only be used if the specimen is dead resulting from capture.

II. Procedures: Body Structure Removal

Check the appropriate structure box on the data sheet and record the date the gear was deployed on the scale envelope to ensure this sample can easily be linked back to the database.

A. Scale removal
   1. Ten or more scales are taken from the scaled fish listed in Table C1. Scale removal will follow procedures as described in Jearld 1983.

B. Pectoral fin and dorsal ray removal
   1. The marginal ray of the left pectoral fin from shovelnose sturgeon and blue sucker.
   2. The 2nd and 3rd dorsal rays will be taken from sauger.
   3. The rays are cut parallel and close to the body, while keeping the remaining fin in tact.
   4. The severed fin ray is then separated from the attached fin with a knife, scalpel, or scissors.

C. Otolith Removal
   1. Otolith removal should follow Jearld (1983) or a similar method.

III. Procedures: Sample Storage, Preservative

A. Individual scale, spine, otolith, or fin ray samples are placed in separately numbered scale envelopes or vial with appropriate information (i.e., Date, Field Office, Segment Number, Unique Identifier (including year), Fish ID and Species) for later analysis.

B. For all fish specimen being shipped in a vial, a label should also be included inside the vial to minimize the chances of losing the essential information if the corresponding envelope becomes separated from the vial. Labels should be placed vertically and in front of fish in vial for ease of reading/organizing without removing fish or label from vial.

C. It is critical that formalin concentrations remain close to 10% (i.e. 10% Formalin/90% Water mixture) as too much formalin may damage the specimen to a point where scale samples are destroyed and also too little formalin may not adequately preserve the sample which may also render the specimen useless to meet the processing needs to obtain the age and growth data necessary for the analysis.

IV. Procedures: Shipping

A. Samples shipped in liquid preservative should not be shipped if ambient temperatures could cause samples to freeze.

B. Hand delivery of samples at the annual team meetings should eliminate any chance of samples being destroyed from freezing.

C. Dry samples (e.g., spines, rays and scales from larger target species) may still be shipped since the collection of these samples will continue after the annual meeting and are not influenced by freezing.

D. Samples should be shipped in rigid containers (e.g., glass and plastic with lids-Not Whirlpaks) to protect the integrity of the samples and to minimize chemical leaks.

E. Make sure all lids are tight and that these containers are in packages with packing material to reduce the chances of breakage or chemical leaks which may compromise the sample for further evaluation.

V. Procedures: Preparation of Cyprinid Scales for Analysis Using an Ultrasonic Cleaner (Developed February 2007-Jason Dattilo and Patty Herman, Missouri Department of Conservation)

A. **Materials:**

- Personal Protective Equipment (gloves, eye protection)
- Cole/Parmer Ultrasonic cleaner
- Hardware Cloth Vial Rack
- Alcon Opti-Free® Supra Clens® contact cleaning drops
- AMO™ Complete® Moisture Plus™ Multi-Purpose Contact Solution
- Micro Forceps
- Dissecting Microscope
- Fiber-Optic Light Box
- Fine Forceps
- Probe
- Distilled Water
- Tap Water
- Presto mypod™ Coffee Filters (small)
- Glass Vials (12)
- Rubber Bands
- 1000mL Nalgene Wash Bottles
- Eye droppers
- Frosted microscope slides
- Plain microscope slides
- Paper Towels

B. **Cole-Parmer 8891 Ultrasonic Cleaner Preparation**

1. Fill ultrasonic cleaner reservoir to indicated operating level with warm tap water.
2. Plug unit into a grounded outlet.
3. Turn Power switch to "on" position. The cleaner will perform a 3-second self test. Wait until LED Display shows 05 and the Degas Time Function Indicator is green.
4. Using the Select Option button, scroll to Set Temp option.
   - Push the On/Off button once to turn heat on.
   - Using the Set Display +/- button, set temperature to 30˚C (a 27˚C to 37˚C range is appropriate for this application).

5. Using the Select Option button, scroll to Set Degas min option.
    - Using the Set Display +/- button, set time for 5 minutes (this may be the default setting).
    - Push the On/Off button once to begin the degas process.

6. After degassing, ultrasonic will default to Set Sonics min and LED display will show "60". Push Clear Display once to return counter to zero. Push Set Display button 15 times to program sonics to run for 15 minutes.

!!WARNING!!

- DO NOT place objects on bottom of cleaning tank; use a tray or wire to suspend items. Failure to comply will result in damage to transducer.
- DO NOT allow solution levels to drop below indicated operation level.
- Use only water based solutions.

C. **Ultrasonic Vial Preparation:**

1. Label one set of glass vials 1-6 using a permanent marker or tape. Place the label on the upper half of vial to prevent ultrasonic from "cleaning" the mark off. These are referred to as Ultrasonic Vials. Note: It is important to use glass vials in this step as plastic vials did not seem to conduct ultrasonic waves efficiently and did not produce clean scales.
2. Wrap rubber bands around middle of vial. See Figure C1.
3. Place 15 drops of tap water in each vial (1-6).
4. Add 2 drops of Alcon Opti-Free® Supra Clens® contact cleaning drops to each vial (1-6). See Figure C2.

D. **Scale Removal:**

Personal Protective Equipment (gloves, eye protection) is strongly recommended for these steps.

1. Select fish from specific sampling segment. A Hardware Cloth Vial Rack (HCVR) has been fabricated to allow the processing of 6 fish at one time in the ultrasonic machine. See Figure C3.
2. Label frosted cover slide with Field Station Code, Segment Number, Unique Identification Number, Fish Number and Species Code. Also make a small notation of the corresponding vial number that the fish scales will be placed in. Set aside in clean, dry place. See Figure 4. Note: The corresponding vial number is non-essential information for aging. Write the vial number to the right of the printed "Specimen" label on these slides as this area will be covered with tape.
3. Using forceps, remove fish from Storage Vial.
4. Gently rinse fish with tap water – 1000mL wash bottle is useful for this step.

5. Measure fish and mark appropriate size class and segment number on "tally sheet". Since 10 fish from each size class (mm group) are to be analyzed, tally sheet is used to maintain accurate counts.
6. Place fish on dissecting microscope stage and gently remove scales from rows 2, 3 and 4 above the lateral line at the dorsal fin on left side of fish. Approximately 10 – 15 scales are needed from each fish. If scales are not available from this location on the fish, remove from right side of fish. Lateral line scales cannot be used. The probe and micro forceps are effective tools for gently teasing scales from fish without damage. A fiber optic light box is also useful for this step.
7. Transfer scales to corresponding Ultrasonic Vial (with tap water and contact lens cleaning drops).
8. Place vial in HVCR in ultrasonic cleaner. Use rubber bands to adjust height of Ultrasonic Vial in cleaner. Bottoms of vials should be approximately one inch from bottom of cleaner for optimal results. See Figure C5. Do NOT use lids on vials.
9. Repeat steps 1-8 for each vial.
10. Push On/Off button once to begin cleaning scales.
11. When cleaning cycle is complete, remove Ultrasonic Vial from cleaner, wipe dry with paper towels. View scales through the Ultrasonic Vial under the dissecting scope. Depending on the size and species of fish and/or the preservative used some fish may need to be cleaned longer.
12. IF scales are NOT clean, add 10-15 drops of AMO™ Complete® Moisture Plus™ Multi-Purpose Contact Solution, return the vial to the ultrasonic and repeat cleaning process. Note: Due to preservative types and concentrations some scales did not clean completely and had to be manually cleaned. See Figure C2.

E. **Filter Vial Preparation:**

1. Label the other set of vials 1-6. These are referred to as Filter Vials.
2. Using Presto® mypod™ replacement coffee filters, make Filter Cones. Fold filter papers in quarters and open one layer to form a cone. Place in opening of vial. To settle filters into vial it is helpful to add a drop of water to paper cone. Tiny funnels would be useful for this step, but this method works if these are not available. See Figure C6.
3. Swirl contents of Ultrasonic Vial 1 and pour into Filter Cone 1.
4. Rinse Vial 1 with Distilled Water from 1000mL wash bottle.
5. Swirl and pour Distilled Water rinse into Filter Cone 1.
6. Check Ultrasonic Vial 1 for scales. Repeat rinse step if necessary.
7. Repeat steps 1-6 for each Ultrasonic Vial.
8. Gently lift Filter Cone from Filter Vial 1 and place on paper towels to blot.
9. Carefully unfold Filter Cone and transfer to dissecting scope stage (clear stage plate).

F. **Scale Mounting:**

1. Place a small drop of distilled water on plain microscope slide.
2. Carefully transfer scales to drop of water on slide. The probe and micro forceps are very useful for this step.
3. Arrange ten clean and undamaged scales, ridge side up in a ring on right side of slide. Arrange any/all excess scales in vertical columns of 5 on left side of slide. Note: Due to a misinterpretation of the Standard Operating Protocol, cyprinid scales from 2004, 2005 and 2006 were processed such that cleaned scales were arranged in vertical columns on left side of slide and excess scales were arranged in a ring on right side of slide. It has been determined that digital capturing of these scales is more efficient when cleaned scales are arranged vertical columns. A request to alter the protocol is in review. See Figure C7.
4. While all scales are wet and uncurled, place appropriately labeled frosted cover slide on top and seal with adhesive tape. See Figure C8.
5. Place finished slide in appropriately labeled box. Box should be labeled with Field Station, Segment Number, Species Code and Year.
6. To avoid cross contamination of scales, clean microscope stage, forceps, probes and all other tools before moving to another specimen.

Repeat steps 1-6 for each Filter Cone.

Figure C1. Labeled glass Ultrasonic Vials fitted with rubber bands to adjust position in cleaner.

Figure C2. Contact lens cleaning solutions used for removing tissue from fish scales.

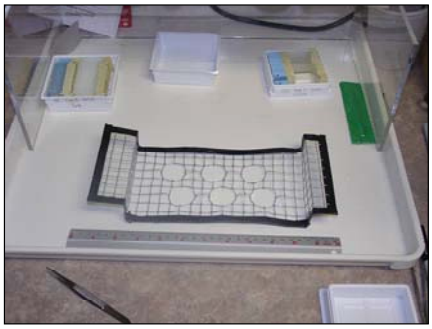

Figure C3. Hardware Cloth Vial Rack. Made specifically to fit ultrasonic and glass vials. Edges taped with electrical tape to prevent damage to cleaner.

Figure C4. Corresponding specimens, frosted coverslides and Filter Cones in Filter Vials.

Figure C5. Ultrasonic cleaner, HCVR and labeled Ultrasonic Vials.

Figure C6. Filters and Filter Cones in labeled Filter Vials.

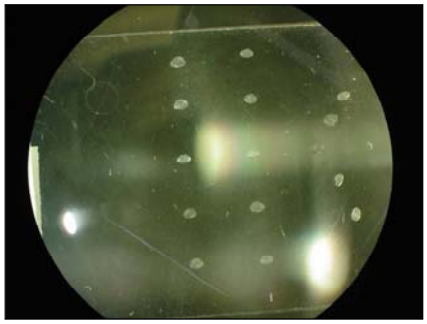

Figure C7. Cleaned scales arranged in rows of 5 on left side of slide. Extra scales arranged in ring on right side of slide.

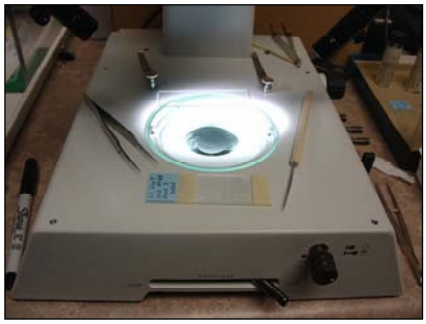

Figure C8. Finished slide, probe and micro forceps on dissecting microscope with clear stage.

VI. Scale preparation for Big River Species (sauger, blue sucker)

1. Press scales using cellulose acetate and roller press
2. A minimum of five scales should be placed ridge side up on a narrow strip of acetate. A second strip of acetate is placed over the top and then pressed providing an impression of the scales on the acetate.
3. Additional scales may be used if needed to determine age.
4. Damaged and regenerated scales should not be used for age and growth as they will be inadequate for determining an accurate age.
5. All pressed scales should be stored within the scale envelope to ensure that all data specific to that collection remain accurate. The information may be written on the side of the pressed specimen as to not interfere with reading the impressions if desired rather than storing in the scale envelope.

VII. Procedures: Spine and Ray Cross Sectioning for Shovelnose Sturgeon, Sauger, and Blue Sucker

A. Most spines and rays are prepared using a Beuhler Low-Speed saw with a 0.0012-inch wafering blade. Speed of the saw is set at about mid-range depending on the size of the specimen to be cut. Care should be taken to sharpen the blade daily and to keep the lubricant relatively free of the saw trimmings that build up after several cuts.
   1. Warning: When using the slow speed saw, always ensure the piece to be cut is secure. If the piece shifts during the cutting process, never attempt to tighten and cut in the same groove. This leads to an increase in the torque on the blade and may cause the blade to break or chip.

B. Soak spine or ray in water for at least 2 hours.

C. With a blunt tool (e.g., tweezers), remove excess flesh from the spine or ray. Do not scrape the structure as this may result in loss of spine/ray tissue.

D. Secure the spine/ray in the saw chuck so that a 90° cross section can be cut. Place a minimal amount of weight on the sawing arm to get a smooth, clean cut.

E. Shovelnose sturgeon do not have a basal groove; therefore, it is necessary to remove the uneven, splintered proximal portion of the ray.
   1. Three 0.40-mm cross sections are then cut and placed on one glass slide for mounting.

F. Clean excess cutting fluid from the cross section and place the sample on a glass slide for mounting. Place the remainder of the spine/ray back in the scale envelope.

VIII. Procedures: Cross-Section Mounting Procedures for Spines and/or Rays

A. A hot plate should be set at a temperature just warm enough to melt the thermal plastic cement (TPC).

B. Place a small amount of TPC on a glass slide and place the slide on the hot plate.

C. Place the cross-sectioned spine or ray in the TPC once the TPC has melted. Leave the slide on the heat source for a few seconds to allow the air bubbles to dissipate. It may be helpful to move the spine in a circular motion to facilitate bubble removal.

D. Transfer the slide to a dissecting microscope. While the TPC is still pliable, press the cross section flat against the slide.

E. After the TPC has completely hardened and the spine/ray is in the proper position, file the spine/ray (if necessary) with 1000 or 1200 grit sandpaper to allow light transmission through the cross section. Remove any excess dust and moisture from the slide and re-melt the TPC to cover the cross section.

F. Put a strip of adhesive tape on the right hand side of the slide and label it with the appropriate information (i.e. segment number, unique identifier, species code, page number, and identification number).

G. The three cross sections should be mounted from left to right on the slide in the order they were cut.

IX. Procedures: Otolith Preparation for Sauger

A. Clean the whole otolith with a cloth or water.

B. One of the two otoliths is cracked along the dorso-ventral axis through the nucleus. The cracked edge of the posterior half of the otolith is sanded (600 or 1200 grit) for a few strokes to make it smooth.

C. The whole otolith and "cracked" otolith are placed in immersion oil and read independently for comparison of the two mounting methods.

X. Procedures: Estimation of Age and Growth

A. Two readers do the aging.

B. Growth rates of individual fish are estimated by aging and back-calculation of length at age.

1. Growth increments are measured with the assistance of image analysis software.

C. Use of scales for age and growth

1. In the laboratory, a minimum of five scales collected from one individual are mounted between glass or acetate slides.
2. Opaque scales are impressed on cellulose acetate slides
3. When assigning ages, all mounted scales are viewed with the exception of regenerated or damaged scales to determine the age of the specimen.
4. When taking measurements for determining radii and annular distances relative to growth data, a single scale will be used rather than measuring these distances on multiple scales.
5. Radii and annular measurements are taken from the focus to the longest anterior edge for all other species. *Hybognathus sp.* scales are compressed and square in nature; this measurement is taken from the focus to the longest "corner".

D. Shovelnose sturgeon, sauger, and blue sucker growth increments are measured from cross sections previously mounted on glass slides.

1. Radii and annular measurements are taken along the longest possible axis from the origin to the edge of the largest lobe (Marzolf 1955; Jearld 1983).

E. Otolith Measurement for sauger

1. Whole otoliths are used to measure annular and radial distances for sauger. These distances are measured from the nucleus to the otolith edge through the longest possible radius.

F. The Fraser-Lee technique is used to back-calculate length at age information based on body structure growth for each species (Busacker et al. 1990).

1. Intercepts (a) for back-calculation are generated from regressions of fish lengths on body structure radius and corrected for size at structure formation.

G. For spines, otoliths, and other body structures that are present at hatch an intercept is not applicable. Therefore, when analyzing these structures,

other acceptable back-calculation methods may be used (i.e., Dahl-Lea method).

X. Procedures: Aging Method Validation

A. To validate the aging methods, each structure is independently read by two readers.

B. Specimens are read a second time (by both readers) in instances where the assigned age is not in agreement between the two readers.

C. If discrepancies remain between the two ages after the second reading, both readers will simultaneously view the structure to assign its age.

D. Multiple structures may be used to assign age to a specimen when deemed necessary by the reader.

XI. References

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MISSOURI RIVER
STANDARD OPERATING PROCEDURES
FOR
SAMPLING AND DATA
COLLECTION

APPENDIX D

BIOLOGICAL PROCEDURES FOR HANDLING PALLID STURGEON

Biological Procedures and Protocols for Researchers and Managers Handling Pallid Sturgeon

Prepared by the Pallid Sturgeon Recovery Team

for

Region 6
U.S. Fish and Wildlife Service
Denver, CO

Approved: _____ _____
Regional Director Date

This document may be cited as:

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EXECUTIVE SUMMARY

Due to their endangered status and the fact that individual fish are important to recovery of the species, extra care is required in handling pallid sturgeon. The following protocol was developed by the U.S. Fish and Wildlife Service in cooperation with the Pallid Sturgeon Recovery Team for activities involving collecting, tagging, holding, handling, and transporting pallid sturgeon.

Prior to performing any work with pallid sturgeon, researchers and managers are required to obtain a Federal endangered species permit or sub-permit. In Louisiana, Mississippi, Arkansas, Tennessee and Kentucky contact 404-679-4176. In Missouri, Illinois and Iowa contact 612-713-5343. In Nebraska, South Dakota, North Dakota, and Montana contact 303-236-4256. Questions, comments or suggested changes to the protocol should be directed to, Pallid Sturgeon Recovery Coordinator, U.S. Fish and Wildlife Service, 2900 4th Ave North, Suite 301, Billings, MT 59101 or at (406) 247-7365. Proposed activities should also be coordinated with appropriate State agencies where a State permit may also be required.

Deviations from the protocol may be requested during the application or renewal process. Researchers and managers should use their best judgment in cases where guidelines are not directly applicable, or if in question, contact the Pallid Sturgeon Recovery Team Coordinator.

The following protocols will be followed to ensure that the best techniques are used regarding collecting, tagging, sampling, holding, culture, transporting, and data recording of pallid sturgeon in order to minimize loss of pallid sturgeon associated with permitted activities.

The primary intent of these guidelines and procedures is to reduce the risks of loss of pallid sturgeon by reducing the severity, duration, and the number of stressors, while still allowing for the data collection to expand our knowledge of these fish. All personnel that work with pallid sturgeon will be trained to handle the fish.

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This document was modified after signature to provide clarity on a few key points and to accommodate a change in address for the lab processing genetic tissue samples. All changes made after signature are identified via red text color.

Record Keeping
All permittees will maintain a copy of their Endangered Species Act 10(a) 1(A) permit and this protocol during all field operations as well as on file. Specific information must be recorded for each pallid sturgeon collected pursuant to activities authorized by a permittee's Endangered Species Act 10(a) 1(A) permit. To accomplish this, the pallid sturgeon data sheet (Appendix 1) must be completed as a minimum. Copies of all completed data sheets must be mailed to the Missouri River FWMAO attn: Project Leader, U.S. Fish and Wildlife Service, 3425 Miriam Ave., Bismarck, ND 58501 no later than December 31 of the year the fish were collected.

Personnel and Training Requirements
Collection: Minimum qualifications include training in appropriate fisheries management collection techniques. Additional activities may also require specific experience and knowledge such as implanting transmitters, culturing, and sexing.

Tagging and sampling: Minimum qualifications include training in fisheries management tagging and sampling techniques and stress mitigation. Specific training will be required for genetic sampling.

Fish Culture: One FTE will be designated and required to care for pallid sturgeon at Garrison Dam NFH, Gavins Point NFH, Natchitoches NFH, Blind Pony SFH and Miles City SFH, or in any facility that maintains pallid sturgeon in culture conditions. The minimum qualifications include training in warmwater fish culture and stress mitigation.

Handling and transportation: All personnel must be trained in the collecting and handling procedures described in this protocol. Drivers should be knowledgeable of proposed routes and coordinate with receiving station with anticipated routes and timelines. Personnel at the receiving point must be informed to expect the shipment. Before transporting, the shipper should make detailed arrangements with the receiver. Arrangements should include where and when fish will be delivered and the need for any specialized equipment at the receiving point. Arrangements should be verified before the vehicle leaves the site and again while in route, if possible. Water quality information from the collection site should be exchanged and matched as closely as possible at the receiving facility.

Trainees: Those individuals not meeting minimum qualifications for fisheries professionals will be considered to be trainees and will not be allowed to independently work with pallid sturgeon. They will be trained in protocols and procedures under the direct supervision of a qualified biologist, until deemed capable by their crew leader or supervising biologist.

Collection Methods
Two weeks prior to actual field work, all field personnel, the Regional Fish Health Center, and hatchery personnel will be notified. All pallid sturgeon are to be collected non-lethally. A fish holding container on the boat shall be of sufficient size to completely submerge the fish.

Gill Nets/Trammel Nets - Monofilament and multi-filament mesh nets may be used to collect pallid sturgeon. There are no mesh size restrictions for gill and trammel nets. Drifting sets should be monitored continuously. Time, date, duration and position of net sets should be recorded. Global positioning system (GPS) data should be used when recording location data. This will provide positional data and time for each set. Total numbers of each species is then noted and recorded with the GPS way points to apply to a Geographic Information System (GIS). Drift distance starts and stops with the clock. Indicate net length, mesh size, and mesh type in reports.

If water surface temperatures are 55 ^{o}F (12.8 ^{o}C) or less, then 24 hour static net sets may be used, and frequent checking for entangled pallid sturgeon is encouraged. When water surface temperatures are between 55 ^{o}F (12.8 ^{o}C) and 60 ^{o}F (15.6 ^{o}C) then overnight sets may be used cautiously, but for no more than 16 hours (i.e., dusk sets and retrieved at or near dawn). Weather conditions must be watched to insure that nets can be picked up as soon as possible the next day. As surface temperatures exceed 60 ^{o}F (15.6 ^{o}C) the nets must be checked for captured pallid sturgeon at regular and more frequent intervals. The following schedule shall apply at these warmer temperatures. Maximum net soak times should not exceed 10 hours when water surface temperatures range between 60.5 ^{o}F (15.8 ^{o}C) and 65 ^{o}F (18.3 ^{o}C). As water surface temperatures exceed 65 ^{o}F (18.3 ^{o}C), but are less than 70 ^{o}F (21.1 ^{o}C), static net sets should be checked for captured pallid sturgeon at a minimum of every 5 hours. At water temperatures above 70 ^{o}F, the use of static net sets is not encouraged and should be replaced with drifting sets and continuously monitored.

When static nets are deployed specifically for brood-stock collection purposes, the following restrictions apply to help ensure the highest probability of artificial propagation success. If water surface temperatures are 55 ^{o}F (12.8 ^{o}C) or less, then 24 hour static net sets may be used, and frequent checking for entangled pallid sturgeon is encouraged. When water surface temperatures are between 55 ^{o}F (12.8 ^{o}C) and 60 ^{o}F (15.6 ^{o}C) then overnight sets may be used cautiously but for no more than 16 hours (i.e., dusk sets and retrieved at or near dawn). As water temperatures exceed 60 ^{o}F (15.6 ^{o}C) then collection of brood stock should cease as recommended transportation temperatures are exceeded (see Handling and fish transportation section).

Calculate CPUE as fish per-net-hour or fish per-net-length/area for stationary sets. For drifting sets, CPUE shall be reported as fish per-net-hour and number of fish per-meter of the drifted area.

Trot Lines/Angling - Use appropriate sized hooks for the size of sturgeon being targeted. Mustad Tuna Circle Hooks in sizes up to 14/0 have proven successful in capturing larger pallid sturgeon in Montana. However, smaller 3/0 stainless steel Eagle Claw O' Shaughnessy hooks baited with a nightcrawler have proven successful in capturing a variety of pallid sturgeon sizes throughout much of the pallid sturgeon range.

In order to reduce risks from trot lines, this gear should be deployed in areas that will minimize hooked fish being excessively exposed to direct river current or while there is heavy debris loading. Trot lines must be checked at least once every 24 hours for hooked pallid sturgeon.

Calculate CPUE as fish per-hook-hour or fish-per-hook night. Indicate line length, dropper length, hook spacing and hook size/style, bait type, and number of hooks per set in reports.

Electrofishing - Electrofishing must not be used to purposefully stun and capture pallid sturgeon. Low power electrofishing (max. 100 volts DC and 3 amperes) may be used to move pallid sturgeon from heavy cover and direct them into nearby nets for capture.

SCUBA -Pallid sturgeon collected using this method are to be captured by hand. Contact should be made with the snout as quickly as possible after carefully grasping the fish by the caudal peduncle. Once in hand, the fish should be enclosed in a large, preferably small-mesh bag and brought slowly to the surface, while maintaining the fish in a horizontal position. SCUBA is used to capture pallid sturgeon primarily during the winter. Exposure of the fish to freezing air temperatures shall be avoided by keeping the fish submerged in water. Record sightings per hour of dive time in reports.

Trawls - Trawls have been effectively used to collect juvenile sturgeon. However, due to the nature of the trawling, a potential for serious injury to the fish is possible. Therefore, trawling efforts should be kept to a maximum of ten minutes under optimal conditions (low debris collection, sand substrate). When conducted in habitats with rock/cobble or when high densities of fish are present, trawling time should be reduced to limit incidental injuries. Calculate CPUE as fish per trawl and number of fish per-meter of the trawled area.

Data collected - The Pallid Sturgeon Data Sheet (Appendix 1), lists the physical data to be recorded for hatchery-reared and all unmarked specimens, as well as general data about the collection. Collecting morphological and meristic* data on all known hatchery fish is not mandatory; however these data should be collected by each sampling crew from a minimum of 5 known hatchery fish representing each year class stocked each year for a minimum of two years (2008 and 2009). At the end of each year, the data set will be evaluated to determine if additional morphometric and meristic data are necessary for hatchery fish released into the wild. This will insure adequate data are represented in the database. While collecting morphometric data, pallid sturgeon should be kept moist and held out of the water for no longer than 2 minutes, unless the gills are irrigated. It is preferred to hold the fish in the water in a stretcher or in a “stock” tank large enough to accommodate the fish. For procedures on taking measurements refer to: Bailey, R.M., and F.B. Cross. 1954. River sturgeons of the American genus Scaphirhynchus: Characters, distribution, and synonymy. Michigan Academy of Science, Arts and Letters, Vol XXXIX.

* Note: if dorsal and anal fin ray counts can not be collected in the field, a clear digital image can be substituted as long as the digital image can be linked back to the data sheet. A clear photo of both fins with identifiable rays, and a piece of paper indicating the PIT tag of the fish is one suitable option to accomplish this. (see Appendix 6)

Copies of all completed data sheets must be mailed to the Missouri River FWMAO attn: Project Leader, U.S. Fish and Wildlife Service, 3425 Miriam Ave., Bismarck, ND 58501 no later than December 31 of the year the sheets were completed for recording into the National Pallid Sturgeon Database. Copies of the Catch Record Database can be obtained from the above address.

Tagging, sampling methodologies and sampling protocols

Fish tagging and marking - All captured pallid sturgeon will be carefully examined for previously implanted PIT, elastomer, coded wire tags, external tags, scute marks, and evidence of external tag loss. Make several passes with the PIT and coded wire tag reader along both sides of the dorsal fin when checking for PIT tags and around the rostrum tip and scute area with the coded wire tag reader. Some fish may have two PIT tags, one on either side of the dorsal the fin with the left side being the primary location.

1) **Identification Tags**

a) PIT Tags - All adult pallid sturgeon must be implanted with a PIT tag prior to release. PIT tags should be inserted horizontally or front to back along the left anterior, fleshy base of the dorsal fin. A second PIT tag can be inserted on the right side of the dorsal fin if the first tag is unreadable. Tags should be scanned prior to implantation for recording and after to ensure it is working properly.

PIT tags provide reliable, long-term identification of individuals. Several companies are now providing tags and readers that work; Biomark (www.biomark.com), AVID (www.avidid.com) or Destron Fearing (www.destronfearing.com). There are basically two types of tags available; encrypted and un-encrypted.

In order to enhance recognition of recaptures and maintain consistency in readability of tags, only un-encrypted, 125 kHz tags will be used for pallid sturgeon work, unless a specific recovery area is already committed to a specific format.

b) External Tags - External tags have met with little success when applied to sturgeon and are therefore not recommended for mass marking. Various external tag types (dangler, cinch, dart, disc) have been used on shovelnose sturgeon and juvenile pallid sturgeon with limited success. Disc tags have had higher long-term retention on sturgeon than other external tags. However, the majority of recaptured adult pallid sturgeon that had previously been externally tagged exhibit tissue inflammation severe enough to be concerned about infection. In some cases, severe inflammation was still evident 2 years after the fish had been tagged. External tags can be used on shovelnose sturgeon, shovelnose X pallid hybrids, as well as on pallid sturgeon stocked for research purposes as well as wild caught pallid sturgeon. Utilization of external markers on wild-caught fish will be evaluated on a case by case basis.

c) Visual Implant Elastomer Tags – Colored elastomer tags are a mix of elastomer and curing agent available in a variety of colors. The mix is injected in rostrum and is visible from the ventral side through the translucent rostral tissue. Elastomer tags are suitable for batch marking hatchery-reared juvenile pallid sturgeon. Potential drawbacks include the limited life span of tag. As pallid sturgeon age, the tissue of the rostrum becomes more opaque making some elastomer tags difficult to discern. Use of UV LED flashlights and the amber glasses can increase detection of marks. In the field, a shade cover or box can be used, to improve the efficiency of the UV flashlight. Elastomer tags are suitable for use on juvenile hatchery-reared pallid sturgeon. Other applications for pallid sturgeon will be reviewed on a case by case basis.

d) Scute Removal – Surgical removal of lateral scutes, in specific patterns, can provide data on hatchery origin, brood year, family lot, or stocking site. Scute removal is suitable for use on juvenile hatchery-reared pallid sturgeon. Other applications for pallid sturgeon will be reviewed on a case by case basis.

2) **Radio/Sonic Transmitters**

a) Internal Transmitters - Internal transmitters are preferred over external transmitters; however, implanting should be performed only by individuals with experience in surgical procedures. During surgery, the head either should be placed in water or the gills flushed with water containing 60-100% Dissolved Oxygen (DO) or aerated such that DO saturation levels are 60-100%. Transmitters should have a biologically inert coating to help prevent expulsion. Prior to surgery, an anesthetic should be used. Limited experimentation at Garrison Dam NFH and Natchitoches NFH has demonstrated that 50-150 mg/l MS-222, in water buffered with sodium bicarbonate, can be a safe and effective anesthetic for pallid sturgeon. An incision, only slightly larger than the tag to be used, should be made in the ventral body wall, one to one and a half inch off the midline and anterior to the pelvic fins. Care should be taken to prevent severing blood vessels and damaging organs while making the incision. The incision should be closed with individually knotted sutures or surgical staples. Before and after surgery, the incision site should be wiped with an antiseptic to prevent infection. This same small incision should be used for sexing the fish.

For additional information and guidance on surgical procedures refer to: Conte et al. 1988. Hatchery manual for the white sturgeon. University of California, Division of Natural Resources, Cooperative Extension Publication 3322. The duration of surgical procedures should be limited to a maximum of 15 minutes per fish.

b) External Transmitters - Use of external transmitters are not recommended, but will be carefully reviewed and authorized on a case-by-case basis. Concerns are that attachment methods create inflammation and cause infection until the tag is shed.

3) **Coded Wire Tags**

Early hatchery-reared fish were marked with coded wire tags. Biologists and researchers operating in areas were these hatchery fish were released i.e., the Missouri River below Gavins Point Dam and the Mississippi River should scan all collected adult pallid sturgeon for the presence of coded wire tags to prevent erroneous classification of hatchery-reared pallid sturgeon as wild fish.

4) **Genetic Marks and Tissue collections**
Recent work has proved the efficacy of using genotype data to determine if an unmarked pallid sturgeon is wild or hatchery origin. Appendix 2 describes the procedures for collecting genetic tissue samples. At a minimum, a sub-set or portion of each pallid sturgeon genetic samples must be sent to the Conservation Genetics Lab at the USFWS Northeast Fishery Center or the Molecular Ecology Lab at Warm Springs Regional Fisheries Center. (addresses are available in Appendix 2) for inclusion in the pallid sturgeon genetic archive. Along with the genetic sample, a copy of the data sheet must be included for accurate cataloging.

Handling and fish transportation

Truck transport: When the objectives of field work are to capture pallid sturgeon broodstock, a hauling truck and tank should be on site for immediate transport. Use a circular hauling tank for larger specimens (>10 pounds), that is equipped with oxygen and a fresh-flow aerator system. Transportation times should not exceed 12 hours and may need to be less depending upon number of fish and water/air temperature. Maintain temperature of hauling-tank water within + 3 ^{o}F (± 1.6 ^{o}C) of ambient water temperature of origin. Temper the fish when moving them between bodies of water.

Pallid sturgeon should not be transported when ambient water temperatures are greater than 60 ^{o}F (15.6 ^{o}C).

To reduce stress during transport, non-iodized salt should be added to water in the hauling tank to provide a 0.25 percent salt solution for juveniles and 0.5 percent solution for adults.

For transport of pallid sturgeon that will exceed six hours, arrangements will be made to have a back-up vehicle and haul trailer available in the event of a mechanical breakdown. Pallid sturgeon should be visually inspected a minimum of every two hours on trips exceeding two hours.

Box and bag shipping equipment: Shipping of fish or eggs in boxes containing plastic bags is recommended for larval and juvenile sturgeon, exceeding 5 inches total length. Industry standard boxes and square bottomed shipping bags should be used. If possible, withhold food for 24 hours prior to shipment. Use two bags in the box. The box should be cardboard with a Styrofoam box insert with fit lid. Check the bags for leaks prior to use. Fill the inside bag with about 2 gallons of water, water additives, and fish. Deflate the bag of air and inflate the bag with oxygen. Twist the top of the bag to put pressure in the bag. Fold over the twisted top and seal with a docking ring (preferred) or two heavy duty rubber bands. Separately, twist the top of the outer bag and double it over prior to sealing with a docking ring or two rubber bands. Place the styrofoam lid on the styrofoam box

and seal with shipping tape. Then seal the cardboard box with two complete rounds of shipping tape. Load and ship with the 'up' arrows pointing up at the lid. If needed, temperature can be maintained by placing cold packs on the sides of the bags. Smaller plastic bags such as Ziploc® heavy duty freezer bags can be used but care must be taken to inflate and pack these in such a manner that the fish cannot be crushed or sharp edges are exposed to create a puncture. Bags used for shipping must not have corners that could trap and crush the fish. The water temperature should be similar to or slightly lower than that used to rear the fish and the bag temperature should be lowered to less than 60° F (15.6° C) prior to shipping. The hauling density should not exceed 0.5 pounds of fish per gallon of water.

Fish acclimatization and therapeutants

Following transfer from the field to a controlled environment, such as Garrison Dam NFH or other appropriate facilities, measures will be taken to mitigate for stress of transfer. Prior to transport, the following therapeutic agents may be used to combat infections.

oxytetracycline (LA200, Bio-Mycin) - shall be injected into muscle tissue of the pectoral fin or muscle tissue of the back at a rate of 0.045 cc/lb of body weight to provide the fish with some defense against bacterial infection due to stress. The injection should occur at the capture site prior to transport or immediately following significant handling.

fluorophenicol (Nuflor) - shall be injected into muscle tissue of the back at a rate of 0.03 cc/lb of body weight to provide the fish with some defense against bacterial infection due to stress. The injection should occur at the capture site prior to transport or immediately following significant handling.

tetracycline hydrochloride - Fry and fingerling pallid sturgeon can be treated with tetracycline hydrochloride soluble powder at a rate of 10 ppm and up to 60 ppm for up to four hours per day. This can be done daily for up to five consecutive days with no major problems when holding conditions or stress may be induce a systemic infection. Following transport, stress reduction techniques will include adding non-iodized salt at 0.5% (18.9 grams per gallon) levels to holding water for at least two days following transfer. Water temperatures will be similar to that at the location and time of capture. Water turnover rates will be between 2 and 4 times per hour in all culture tanks. If parasites have been found in the water supply, the supply will be filtered (15-20 micron) and disinfected using UV irradiation with a minimum of 100,000 microwatts per square centimeter of ultraviolet light intensity. Photo period will approximate levels similar to environmental conditions. Variations in photoperiod should be submitted in the permit application. Oxygen levels will be maintained at > 6.0 mg/L or saturation as measured with an oxygen meter. pH will range from > 6.5 to <7.5. Ammonia levels will be maintained at less than 0.0125 parts per million (ppm) and nitrite levels will be kept below 0.1 ppm for soft water and 0.2 ppm for hard water. Nitrogen supersaturation levels will be maintained below 100 - 102%.

Wound relief protocols and drugs and therapeutants will be administered as

recommended by the Fish Health Center. Prophylactic drug and therapeutant treatments, other than salt, will be recommended by the Fish Health Center. Therapeutic protocols will be initiated prior to transport and assessed after arrival at the facility and shall follow strict recommended schedules.

Health plans will be initiated on a case by case basis. These health plans will consider physical check-ups, intervals between check-ups, personnel training, specific treatments, drugs, chemicals, and therapeutants to be used. The plan should also address salts to be used equipment decontamination, facility decontamination, immunization, vaccination.

The Fish Health Center will determine on a case by case basis if quarantine is required.

Fish Culture/Holding procedures

1) Short-term (1 week or less) Holding Facilities

   a) Field Holding Tanks - Holding tanks should be circular, covered, located in an area free from disturbances, and have provisions for fresh-water circulation. Pallid sturgeon should be maintained in water from the capture location, when possible. Holding tank water temperatures should be maintained within + 5°F (2.8°C) of ambient water temperature. A standby power supply must be provided in the event of a power failure, unless the fish are monitored every 3 hours.

   b) Modified Hoop Nets/Underwater Keeps - Modified hoop nets/underwater keeps can be used as a temporary holding facility, but for no more than 16 hours. Holding pallid sturgeon in hoop nets or keeps might be necessary for a short period if one or more pallid sturgeon are incidentally captured and field crews are not set up with a holding tank. Commercial fishermen, who are previously authorized by permit, may keep incidentally captured pallid sturgeon in hoop nets until personnel who are previously authorized by permit to obtain the pallid sturgeon arrive. Commercial fishermen must notify their contact within 2 hours of capturing a pallid sturgeon. Mesh size must be 1½-inch (3.81-cm) bar measure or smaller to prevent gilling and keeps should be circular. Hoop nets or keeps should be located such that adequate temperature and oxygen conditions vary little from ambient conditions at the capture location. Flow-through is very important if conditions permit and the structure will not be jeopardized. Hoop nets or keeps must be checked every eight hours and posted with a sign or float cautioning against disturbance.

2) Long-term Holding Facility Requirements and Rearing Facilities

   a) Hatchery or Aquarium - Pallid sturgeon have been held for more than 8 years in circular tanks with water circulation. Tanks should be covered and

located in an area free from disturbances. An automatic standby power and water supply must be provided to maintain the fish in the event of a failure. These facilities must have a "contaminant-free" water supply. Fish health must be regularly monitored. If signs of disease are noted or if a 20 percent loss of body weight occurs during holding, fish health personnel at the Service's Fish Disease Control Center in Bozeman, Montana (406-582-8656) should be contacted for treatment recommendations. Long-term holding facilities must be within the historical range of pallid sturgeon or be designed to prevent escapement. Water temperatures should be maintained between 40 and 70 degrees Fahrenheit. Densities for adults should not exceed 1.0 pound per square foot of surface area. Densities for juveniles should be maintained at less than 0.5 pounds per square foot of surface area.

Propagation and Stocking

Artificial propagation of pallid sturgeon is an important component for recovery. All activities associated with artificial propagation will be conducted in accordance with the most recent version of the Pallid Sturgeon Propagation Plan. Release of artificially propagated pallid sturgeon into the wild, will be conducted in accordance with the most recent version of the Pallid Sturgeon Range-Wide Stocking and Augmentation Plan. The latest versions of the propagation and stocking plans are available by contacting the Pallid Sturgeon Recovery Coordinator.

Disposal of incidental take

Pallid sturgeon mortalities should be left fully intact and frozen immediately to prevent decomposition. Legal chain-of-custody documentation (Appendix 3) should be maintained for each specimen to facilitate contaminant analysis reporting. Deaths should be reported to the Pallid Sturgeon Recovery Coordinator by phone and in writing as soon as possible. Describe all available information regarding the circumstances under which the fish died. The Service's Fisheries Assistance Office in Bismarck, North Dakota, will coordinate the transfer of specimens to the University of Alabama repository. If personnel are trained in the collection of tissue samples and if equipment for collection is available, the following samples shall be collected prior to freezing.

Fish Health Samples

Refer to Fish Health Protocols (Appendix 4) for proper procedures and data sheet. These samples are only to be taken if part of another study evaluating fish health. All samples shall be labeled with the PIT tag number. Please notify before shipping and forward all samples labeled with the PIT tag number to:

Bozeman Fish Health Center
U.S. Fish and Wildlife Service
920 Technology Blvd., Suite G
Bozeman, MT 59718
406-582-8656

Contaminants Samples

Refer to Standard Operating Procedures for Collection, Storage, and Shipment of Pallid Sturgeon Tissue Samples for Analysis of Organic and Trace Element Contaminants (Appendix 5). These samples should only be collected if on a mortality and part of a study evaluating contaminant levels. All samples shall be labeled with the PIT tag number and sent to:

U.S. Fish and Wildlife Service
Ecological Services Contaminants
3425 Miriam Ave Bismarck, ND 58501,
701-250-4481

Age Analysis (mortalities)

All morphological and meristic data will be collected along with PIT number. The right pectoral fin and spine will be cut off at or below the hinge point of the 1st spine for age analysis before freezing. Fin samples and data shall be shipped to the Service's Fisheries Assistance Office in Bismarck, North Dakota. All samples shall be labeled with the PIT tag number and include a copy of data sheet.

Appendix 1 Pallid sturgeon data sheet

Pallid sturgeon data sheet (02/07)

Date ☐☐ ☐☐ ☐☐

PIT ☐☐☐☐☐☐☐☐☐☐ (10) R/N ☐

Lat. ☐☐ ☐☐☐☐☐
Decimal degree

Long. - ☐☐☐ ☐☐☐☐☐
Decimal degree

ER		EL	
H/V	color	H/V	color

Elastomer Colors

Flouresces	Non-Flouresces
G - Green	W - White
O - Orange	V - Purple
R - Red	B - Brown
P - Pink	K - Black
Y-Yellow	U - Blue

Scute

Loc.	#

CWT ☐

Recapture Y/N ☐

River _____R.M. _____ State _____

Location _____

Other tag information _____

Method: Gill, Trammel, Hoop net, Beam trawl, Otter trawl, Angling, Other _____

Genetics vial # _____ Sex M / F / U – Stage _____ / U

Duration of set _____ Mesh size _____

Fork Length _____mm Weight_____gm/kg

Released – Taken to hatchery _____

Temp. _____ºC Turbidity _____ntu

Picture Y/N ☐

Captured by:_____

Depth _____ m Velocity _____ m/sec

Comments _____

Substrate _____

Head Length _____mm

Snout to Mouth _____mm

Inter _____mm

Mouth Width _____mm

MIB _____mm

L-OB _____mm L-IB _____mm

R-OB _____mm R-IB _____mm

Anal _____rays Dorsal _____rays

Morphometric Measurements

Head Length– Tip of the rostrum to the posterior margin of the operculum.
Snout to Mouth – Tip of the rostrum to the anterior mouth midline.
Inter – Tip of rostrum to anterior insertion point of the R-OB.
Mouth-Width – Widest measurement on the outer edge of lips.
MIB (Mouth to Inner barbel**)** – Anterior point of insertion of the R-IB to the anterior midline of mouth.
L-OB (Left outer barbel)- Anterior insertion point to barbel tip.
L-IB (Left inner barbel)- Anterior insertion point to barbel tip.
R-OB (Right outer barbel)- Anterior insertion point to barbel tip.
R-IB (Right inner barbel)- Anterior insertion point to barbel tip.
Anal/Dorsal – Number of rays counted at fin base.

Field Descriptors

PIT – Pit tag number
R/N – R if recap with pit tag / N if new pit tag is inserted
ER (Elastomer Right) – Horizontal / Vertical position
ER (Elastomer Right) – Color code from elastomer box
EL (Elastomer Left) – Horizontal / Vertical position
EL (Elastomer Left) – Color code from elastomer box
Scute – Location (R=right, D=dorsal, L=left, or N=none)
Scute # - Scute number removed from the anterior
CWT – Y if tag is present / N if tag is not present
Recapture – Y if any marks present / N if not
Picture –Y if picture is taken for morphometrics / N if not

Appendix 2 Protocol for Taking Sturgeon Genetic Samples

Equipment you will need:

1) Two screwcap tubes filled with 95% NON-denatured ethanol
2) Surgical scissors and forceps
3) Sturgeon genetic card

Procedure:

1) Record genetic vial # and corresponding PIT # on the genetic card (this step is critical for pallids). Record all biological data. Please note if the fish is a recapture. Be sure to indicate why the samples are being sent in (genetic analysis needs), i.e. for broodstock analysis, unknown origin pallid sturgeon to check against parental database, sample for archive, etc.
2) To avoid sample contamination keep your hands, sampling instruments and work area clean. Vigorously wash scissors and forceps in fresh water prior to taking each genetic sample. Wipe the scissors and forceps with the clean section of a rag or a new tissue to ensure residual tissue from the last sampled fish is removed.
3) Use the scissors to cut two small pieces of tissue off of the caudal fin (approximately $1cm^2$ each). When it is not possible to obtain samples as large as 1 cm^2 a smaller piece of $0.5cm^2$ should be adequate.
4) Place one piece of tissue into each of the two screwcap tubes (a & b) filled with alcohol and tightly screw on the caps (If the lids are not tight the alcohol will evaporate).
5) Place both samples back in the plastic bag with the completed genetic card. Samples should be stored at room temperature.
6) Contact William Ardren via e-mail before sending samples to the USFWS genetics repository. He will provide details on sending the samples via FedEx.
7) Please e-mail the biological data for each sample when you send the samples.

USFWS Northeast Fishery Center
Conservation Genetics Lab
Attn: Meredith Bartron or Jeff Kalie,
P.O. Box 75
227 Washington Ave.
Lamar, PA 16848
Phone: (570)-726-4995
e-mail: Jeff_kalie@fws.gov or Meredith_Bartron@fws.gov

Tissue samples (or subset) collected from within the Mississippi River basin (includes Atchafalaya R.) should be sent to:

Greg Moyer,
U.S. Fish and Wildlife Service
Warm Springs Conservation Genetics Lab
5151 Spring Street, Warm Springs, Georgia 31830-9712,
Phone (706) 655-3382 ext 231
e-mail: Greg_Moyer@fws.gov

Appendix 2 continued

Genetic data card example:

Sturgeon Genetic Card

Circle **Pallid** **Shovelnose** **Lake**

Genetics vial # Strug-_____ PIT Tag #_____
(For pallid samples include photos head w/side and ventral views)

Capture Location_____
Latitude _____ Decimal degrees Hatchery Origin
Longitude _____ Decimal degrees Yes No Unknown
River _____ River Mile_____
State _____ Date _____

Interrostral Length _____mm Mouth - Inner Barbel _____mm
Outside Barbel _____ mm Inside Barbel _____mm
Head Length _____ mm Fork Length _____mm
Weight _____ lbs/kg Sex Male Female Unknown

Captured by_____

Genetic Analysis Needs_____

USFWS Northeast Fishery Center
Conservation Genetics Lab
P.O. Box 75
227 Washington Ave.
Lamar, PA 16848
Phone: (570)-726-4995

Sturgeon Genetic Card

Circle **Pallid** **Shovelnose** **Lake**

Genetics vial # Strug-_____ PIT Tag #_____
(For pallid samples include photos head w/side and ventral views)

Capture Location_____
Latitude _____ Decimal degrees Hatchery Origin
Longitude _____ Decimal degrees Yes No Unknown
River _____ River Mile_____
State _____ Date _____

Interrostral Length _____mm Mouth - Inner Barbel _____mm
Outside Barbel _____ mm Inside Barbel _____mm
Head Length _____ mm Fork Length _____mm
Weight _____ lbs/kg Sex Male Female Unknown

Captured by_____

Genetic Analysis Needs_____

USFWS Warm Springs Conservation Genetics Lab
5151 Spring Street
Warm Springs, Georgia 31830-9712
Phone: (706) 655-3382 (x 231) Fax: (706) 655-9034

U.S. Fish & Wildlife Service

Northeast Fishery Center
Conservation Genetics Lab

2010 UPDATE
Sample collection and shipping options for ethanol

Any volume of ethanol is now considered a dangerous good for shipping purposes. Due to the new U.S. Department of Transportation, Code of Federal Regulations, *all individuals involved in shipping hazardous goods* must have mandated training to ship either by ground or air through FedEx. UPS will ship hazardous goods on a contract basis only.

Options to address this issue:

1. Training:
    a. Training for shipping hazardous materials by FedEx Ground can be done online by logging onto www.shipsafeshipsmart.com. Log in and follow the directions. The training costs $150 and certification lasts for three years. Recertification after three years can be done once again online for the same price.
    b. Training for shipping hazardous materials by air can be done by attending a three day seminar for $685 dollars. Certification lasts two years. Log onto www.fedex.com/us/services for seminar dates and locations. After logging on to website, go to the Extra Services link and choose Dangerous Goods (FedEx Express) then Seminars: dates, locations and registration information.
2. Alternate to shipping ethanol:
    a. If you are unable to take either of the above training, original sample kits will be sent to you with 95% ETOH from Lamar. After sampling, fin tissue samples will need to be fixed in the 95% ETOH for at least one week and refrigerated (**5** °C).
    b. Once the samples are fixed for one week or longer, the 95% ETOH can be dumped from the sample tubes, tubes can be resealed and SHIPPED IMMEDIATELY to the Conservation Genetics Lab at Lamar. Please only use this method if shipping Monday, Tuesday, or Wednesdays, and please contact Jeff Kalie (570-726-4995 x 2#) prior to shipping for confirmation that samples can be sent at that time.
3. Additional options:
    a. Other sample preservation options are available and will be explored in the future. However, for ease of use in the field, tubes of ethanol seem to be optimal.

Appendix 3 Chain of Custody Record

FILE NO. INV.

CHAIN OF CUSTODY RECORD		FILE NO. INV.
DATE AND TIME OF SEIZURE:	**REGION:**	**EVIDENCE/ PROPERTY SEIZED BY:**
SOURCE OF EVIDENCE/PROPERTY (person and / or location) **TAKEN FROM:** **RECEIVED FROM:** **FOUND AT:**		**CASE TITLE AND REMARKS:**

ITEM NO.	DESCRIPTION OF EVIDENCE/PROPERTY (include Seizure Tag Numbers and any serial numbers):

ITEM NO.	**FROM:**	**RELEASE SIGNATURE:**	**RELEASE DATE:**	**DELIVERED VIA:** **U.S. MAIL**
	TO:	**RECEIPT SIGNATURE:**	**RECEIPT DATE:**	**IN PERSON** **FEDEX:** ☐ **OTHER** ☐
ITEM NO.	**FROM: (PRINT NAME, AGENCY)**	**RELEASE SIGNATURE:**	**RELEASE DATE:**	**DELIVERED VIA:** **U.S. MAIL** ☐
	TO: (PRINT NAME, AGENCY)	**RECEIPT SIGNATURE:**	**RECEIPT DATE:**	**IN PERSON** ☐ **FEDEX** ☐ **OTHER** ☐

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☐
☐

CHAIN OF CUSTODY RECORD (continued)

ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE:	RELEASE DATE:	DELIVERED VIA: U.S. MAIL IN PERSON FEDEX OTHER
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE:	RECEIPT DATE:	
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE:	RELEASE DATE:	DELIVERED VIA: U.S. MAIL IN PERSON FEDEX OTHER
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE:	RECEIPT DATE:	
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE:	RELEASE DATE:	DELIVERED VIA: U.S. MAIL IN PERSON FEDEX OTHER
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE:	RECEIPT DATE:	
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE:	RELEASE DATE:	DELIVERED VIA: U.S. MAIL IN PERSON FEDEX OTHER
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE:	RECEIPT DATE:	
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE:	RELEASE DATE:	DELIVERED VIA: U.S. MAIL IN PERSON FEDEX OTHER
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE:	RECEIPT DATE:	

Appendix 4 Fish Health Tissue Collection Protocols

The initial detection of an iridoviral agent in cultured shovelnose and pallid sturgeon prompted the development of specific guidelines for health sampling. Due to the tropism of the iridovirus for epithelial cells, it is extremely important to handle fish samples delicately. All samples should be handled to ensure that skin surfaces have as little contact with equipment and sampling surfaces. This outline will provide detailed instruction for health sampling of both juvenile and adult sturgeon. The primary means of sampling pallid sturgeon as an endangered species will be by non-lethal methods. However, lethal sampling instruction will also be provided for situations or facilities requiring inspection sampling.

NON-LETHAL SAMPLING TECHNIQUES: (Please contact USFWS Fish Health Biologist for specifics)

Collection of fin punches, barbel clips:

General:
* Label and track each fish individually with unique numbers (i.e. PIT #) for easy reference.
* Utilize only sterilized dissection equipment for collecting samples.
* Disinfect dissecting tools and DNA sampling tools between fish samples.
* Make sure fish are well oxygenated during fin punch collection.

Collection for histology:
* Individual fin punches will be collected from pectoral and caudal fins using a small paper hole puncher. Fins can also be clipped or notched using scissors or pig ear notcher. Refer to sturgeon anatomy picture for proper location of fin samples.
* Barbel clips may be collected by clipping the distal end of the barbel with sharp scissors.
* Both fin punches and barbel clips will be immediately placed into Davidson's fixative for a minimum of 48 hours, followed by immediate transfer to 70% ethanol.
* Place fish tissues into the Davidson's fixative at a ratio of 1 part tissue to 5 parts fixative.
* All histology samples should be collected in chemically resistant plastic containers or glass collection jars for transportation and storage. Seal jars tightly before transport.

Appendix 4 continued

Collection for Viral DNA analysis:

* Collect fin punches from the caudal and pectoral fins using a paper hole punch. Scissors may be used to clip the edge of the fins.
* Collect a portion of barbels with sharp scissors.
* Place each tissue type from individual fish in small 1 ml plastic tubes.
* These samples should be immediately frozen for transportation and then maintained at -70 F ultra-cold temperature for DNA analysis.
* Change gloves between each fish to be sampled.
* Disinfect sample collection instruments between fish.
* Refer to sturgeon diagram for sample locations.

Collection of Virology Cell Culture Samples:

* Collect both fin punches and barbel clips aseptically with sterilized dissection tools. Sample collectors should wear protective examination gloves.
* Refer to sturgeon diagram for sample location.
* Sample collection for virology may be as individual fish or pooled not to exceed a five fish pool.
* Samples will immediately be placed in small whirlpak sample bags. These bags should be chilled, not frozen. They can be kept in the refrigerator before transportation and should be transported chilled, insulated from ice packs. At no time should samples be allowed to become warm.
* These samples must be forwarded to receiving laboratory within 48 hours from collection.
* It is very important to sterilize dissecting tools between fish samples. An appropriate virucidal agent should be used.

Appendix 4 continued

LETHAL SAMPLING TECHNIQUES
(Only on mortalities): Collection of complete internal and external fish tissue samples.

General:
* Label all containers, showing species, and date collected.
* Maintain fish sample collection report with:

** fish source
** fish condition
** water temperature
** fish handling
** fish culture information
** mortality records

All dissecting tools should be sterilized prior to collection and should be disinfected between individual fish.

Sample collectors should wear protective gloves during collection procedure.

Fish should be euthanized with Tricaine Methane Sulfonate (MS-222) prior to sampling.

Collection of Histology Samples:
* Fish should be dead no longer than 15 minutes for good histological sample collection.
* Fish smaller than 60mm can be preserved as whole fish. Slit fish ventrally along the belly, from the vent to the gills. Pull viscera away from the kidney area and puncture the air bladder to facilitate fixation of the kidney.
*Fish larger than 100mm will require thin sections of each organ for fixation. Tissues for histology: gill, heart, liver, spleen, kidney, muscle, ceca, digestive tract, fins, barbels, nares, rostrum, mouth parts, any lesions that are visible.
* The tissue pieces may be as large as 25 mm (1 inch square), but no thicker than 5 mm (about 1/4 inch).
* Histology tissues should be immediately placed in Davidson's fixative. One fish per collection jar. Do not combine tissues from other fish.
* Sample tissues should be placed in fixative at a ratio of 1 part fish to 10 parts fixative.
* After specimens have been in fixative for 48 hours, transfer to 70% ethyl alcohol.
* Samples can be transported in ethyl alcohol and stored for histology processing.
* Sample containers can be glass or chemical resistant plastic.

Appendix 4 continued

Collecting Virology Cell Culture Samples:

* Collect both external and internal samples: caudal fin, pectoral fin, barbel, nares, rostrum, mouth, spleen, kidney, gill, ceca, heart, kidney, gut.

* Maintain separate virology bags for external and internal samples. Samples can be taken individually or five fish pooled.

* Always use sterilized dissecting tools. Wear appropriate gloved protection while sampling.

* Collect in whirlpak plastic bags and immediately chill samples. Do not freeze. Do not allow samples to become warm.

* Transport samples to receiving laboratory within 48 hours.

Appendix 5 Contaminant Sample Collections

STANDARD OPERATING PROCEDURES FOR COLLECTION, STORAGE, AND SHIPMENT OF PALLID STURGEON TISSUE SAMPLES FOR ANALYSIS OF ORGANIC AND TRACE ELEMENT CONTAMINANTS (mortalities)

1. Wash hands thoroughly and rinse completely. Wear vinyl or latex gloves (powder less). Final rinse with distilled water.

2. Rinse fish clean of any debris.

3. Dissection surface should be a chemically inert substance such as a stainless steel solvent (pesticide grade acetone, hexane, or isopropanol) rinsed pan, or solvent rinsed heavy duty aluminum foil placed shiny side down and dull side towards fish. Take care that sample does not contact potentially contaminated surfaces (plastics, identifying labels, printed papers, uncleaned work surface or tools, etc).

4. Use previously cleaned dissection tools which were decontaminated under the following guidelines: 1) non-phosphate detergent wash. Liquinox or Alconox brand detergents are recommended. 2) tap water rinse. 3) distilled/deionized water rinse. 4) solvent rinse (pesticide grade acetone, isopropanol or hexane). 5) air dry. 6) distilled/deionized water rinse. 7) wrap instruments in aluminum foil (shiny side out) for storage until use. Scales for sample weights should also be clean or covered with solvent rinsed aluminum foil.

5. Separate, clean dissection tools are to be used for each individual fish. And instruments used to collect tissue samples should be separate from instruments used to make initial opening in abdominal cavity.

6. Complete a Fish Health Examination Sheet (attached)

7. Do not let dissected samples remain exposed to the air. Exposure can dry samples and reduce the natural percentage of moisture. Prepare each dissected sample for shipping or freezing as it is dissected.

8. Tissue samples to be collected should include: kidneys, gonads, liver, and muscle with skin.

9. Samples should be placed in a chemically-cleaned glass jar and sealed with a teflon-lined lid. Lids are then to be sealed with tape (electrical or packing). Jars should be pre-labeled with a permanent, waterproof marking pen. As an alternative, solvent (pesticide grade acetone, hexane or isopropanol) rinsed, heavy-duty aluminum foil may be used to wrap the sample (remember, shiny side out). After double-wrapping, place the sample (with sample identification label) inside an air-tight zip-lock or Whirl-pak bag.

10. Complete a Chain of Custody Record (Appendix 3)

Appendix 5 continued.

11. Samples are to be sent to US Fish and Wildlife Service, Ecological Services, 3425 Miriam Ave., Bismarck, ND 58501 (701) 250-4481. All coolers should be shipped via OVERNIGHT service. Always call before shipping to ensure personnel will be available to handle incoming samples. Upon receipt in Bismarck, samples will be stored in an Environmental Contaminants freezer until authorization to ship samples to a pre-approved analytical laboratory.

12. Samples not shipped to Bismarck within 24 hours after collection need to be frozen and then shipped on dry ice. For frozen samples, dry ice to sample weight ratio should be 1 to 1. Samples shipped to the Bismarck Field Office within 24 hours of collection need to be chilled immediately and can then be shipped on wet ice. However, chemical coolants such as blue ice packs are preferable to wet ice because their packaging prevents leakage should they thaw. Regardless, coolants such as wet ice or blue ice should be sealed in plastic bags. Sample containers (jars or whirl-paks) should also be separately contained in plastic bags. Samples should be properly packed in the cooler with bubble wrap.

Appendix 6 Meristic count guidance

Example photo of pallid sturgeon dorsal fin
The 3 anterior rudimentary rays in the photo would be counted for a total of 30 dorsal fin-rays (rays individually marked with black dots to aid identification).

In the dorsal and anal fin-ray counts, all anterior rudiments behind the predorsal and preanal plates are included. The last ray in those fins, as counted, is double at its base.

Recommended equipment list

The following three lists contain items that you may find useful when working with pallid sturgeon in the field. Individual activities may need additional items necessary for particular work dependant on field conditions and activities, therefore these lists should only serve as a guide.

List for Field Collection

- ☐ Crew trained in netting and trawling procedures
- ☐ Crew trained in best handling procedures
- ☐ Nets and sampling gear
- ☐ Holding tank on boat, must be at least six feet in length for larger specimens
- ☐ Bucket or bilge pump available for filling holding tank and for circulating water
- ☐ PIT tag reader, tag injectors, and tags
- ☐ Spare PIT tag reader
- ☐ Coded Wire Tag reader
- ☐ Crews trained in proper tagging procedures
- ☐ Water proof field notebooks and data sheets
- ☐ Cloth measuring tape (a quilting tape works well) and weighing scale
- ☐ Stretcher for moving fish and weighing
- ☐ Cellular phone for emergencies
- ☐ Appropriate therapeutic antibiotics, syringes and dosage chart
- ☐ Global positioning system
- ☐ Black light for examination of elastomer tags in stocked fish

List for Genetic Samples

- ☐ 95% NON-denatured alcohol
- ☐ Tissue Forceps
- ☐ Scissors
- ☐ Screw-cap tubes
- ☐ Permanent marker
- ☐ Data sheets
- ☐ Butane lighter
- ☐ Latex gloves
- ☐ Single use razor blades

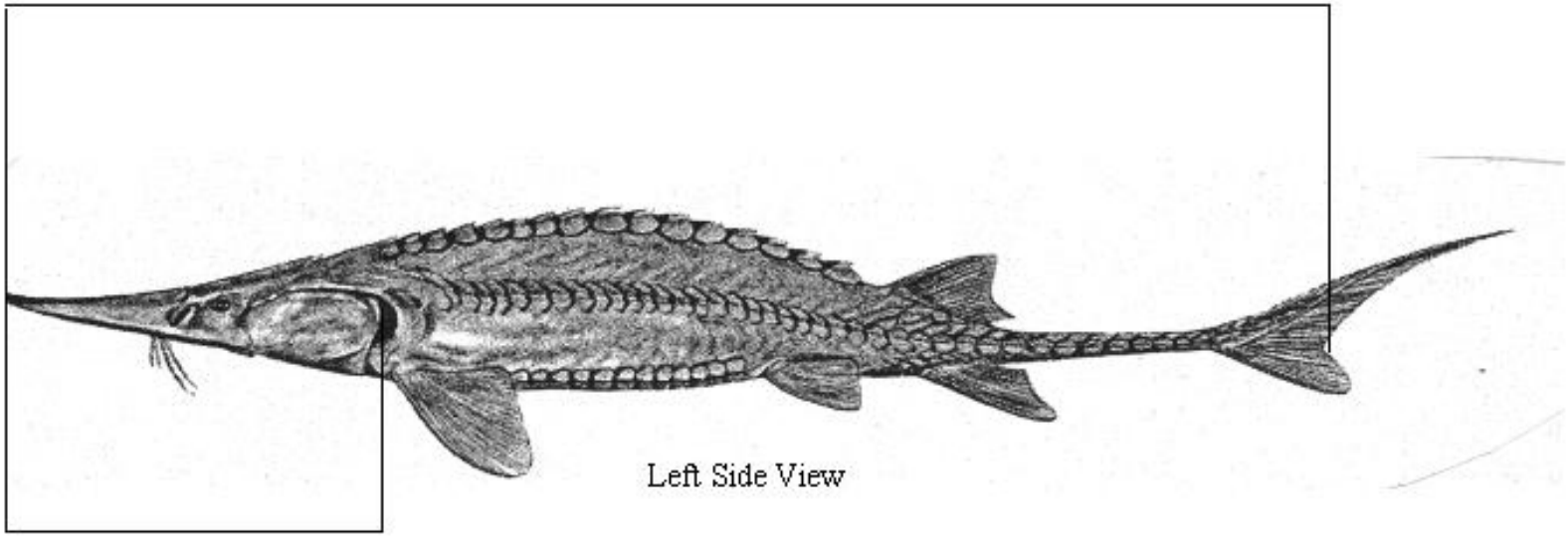
Hauling truck check list

- ☐ Crew trained in hauling procedures.
- ☐ Loading crew trained in best handling procedures.
- ☐ Drivers know the route and maps available.
- ☐ Personnel at receiving point are expecting shipment.
- ☐ Cellular phone and necessary phone numbers.
- ☐ Adequate fuel, spare tires and emergency equipment.
- ☐ Oil and other fluid levels checked.
- ☐ Haul tank filled to proper level with water and water temperature in tank similar to host water (within 3 degrees Fahrenheit) and securely attached.
- ☐ Water additives in tank water (salt).
- ☐ Stretchers and nets in place.
- ☐ Oxygen/temperature meter calibrated, in place, and operating.
- ☐ Primary aeration system functioning oxygen bottles full - adequate supply for trip.
- ☐ Emergency aeration system in place and workable.
- ☐ Filling pump present and functioning.
- ☐ Receiving facility/tanks ready and filled.
- ☐ Two large buckets available.
- ☐ Salt bucket pre-marked for non-iodized NaCl.
- ☐ Pit tag reader, injectors and tags waterproof field notebooks and data sheets

01/03/2003

Required Morphological Measurements for Pallid Sturgeon

A



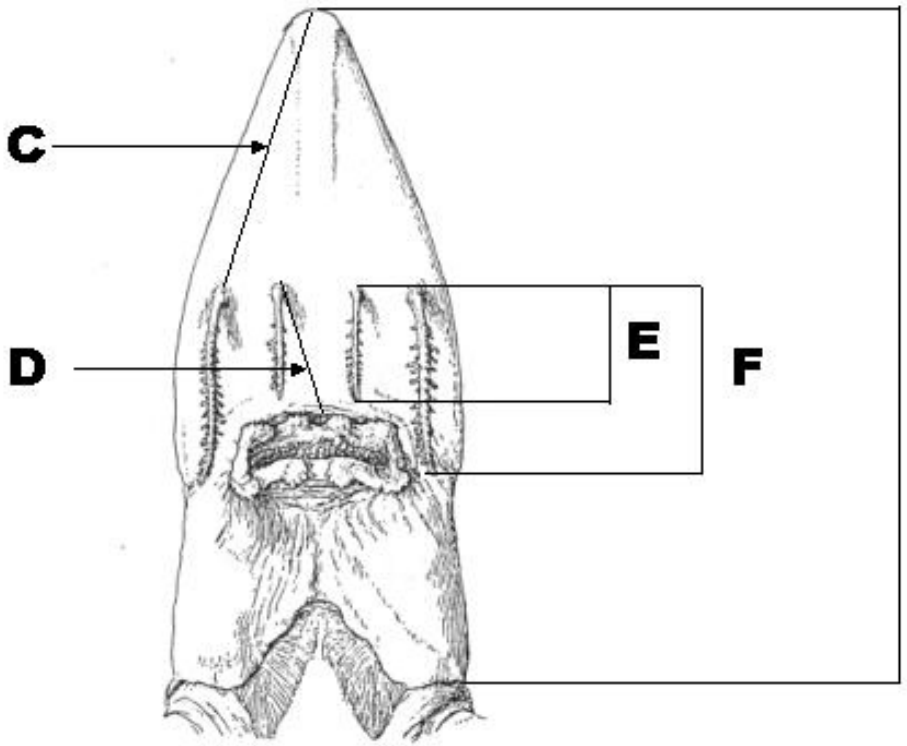
Left Side View

B

A – Fork Length – Tip of snout to the median of the caudal fin rays. (Note: on larger fish, it may be easier to lay tape along bottom of tank to get a straight line measurement)

B – Head Length – Tip of snout to back edge of opercle flap.

01/03/2003



Line drawing taken from:

S. A. Forbes and R. E. Richardson. On A New Shovelnose Sturgeon from the Mississippi River. Bulletin Illinois State Laboratory of Natural History 737-44, 1905.

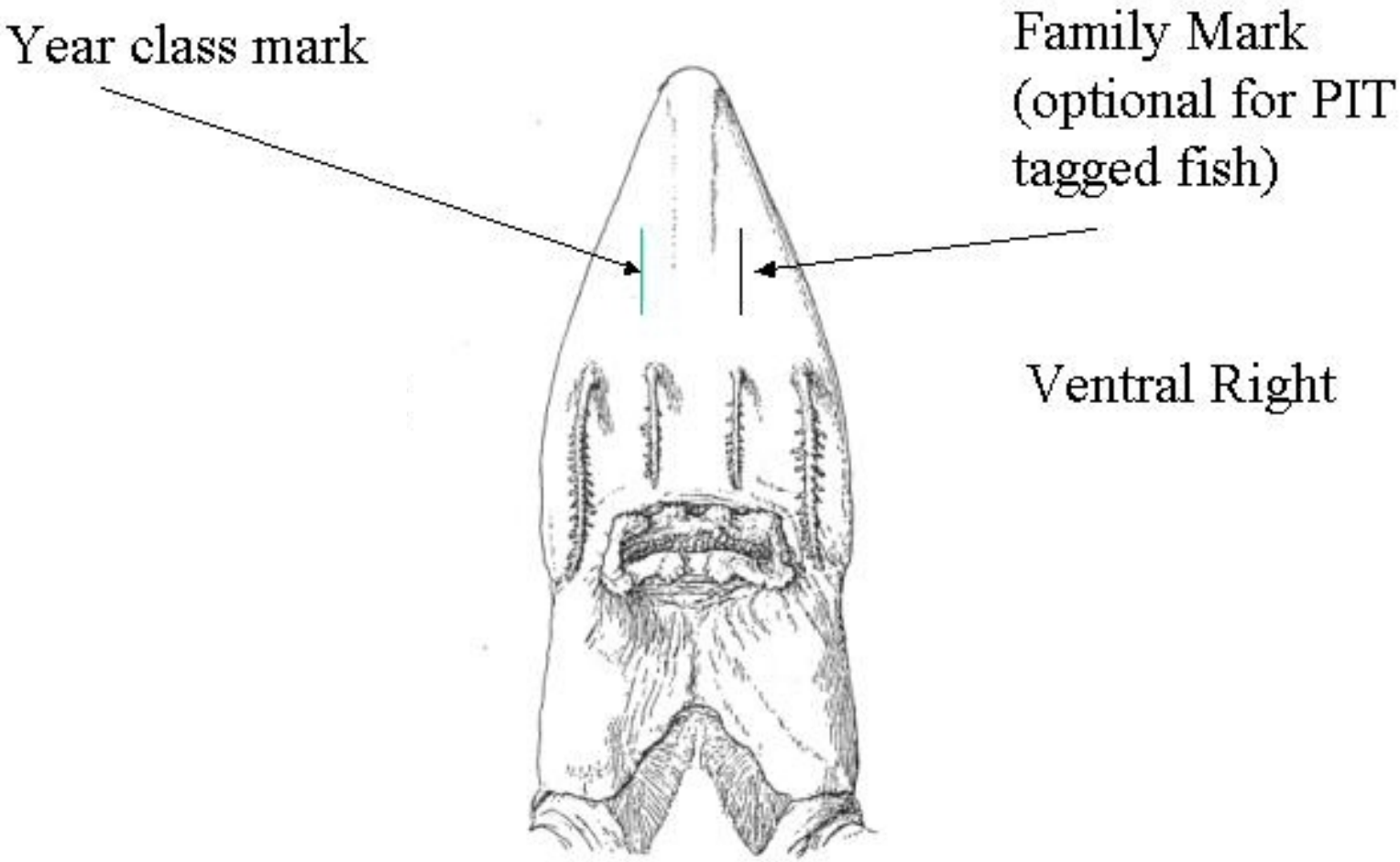
B – Head Length (see previous page)

C – Interrostral Length – Tip of snout to front edge of the outer barbel.

D – Mouth to Inner Barbel Length – Leading edge of mouth to front edge of inner barbel.

E – Inner Barbel Length – Front leading edge of inner barbel to it's tip.

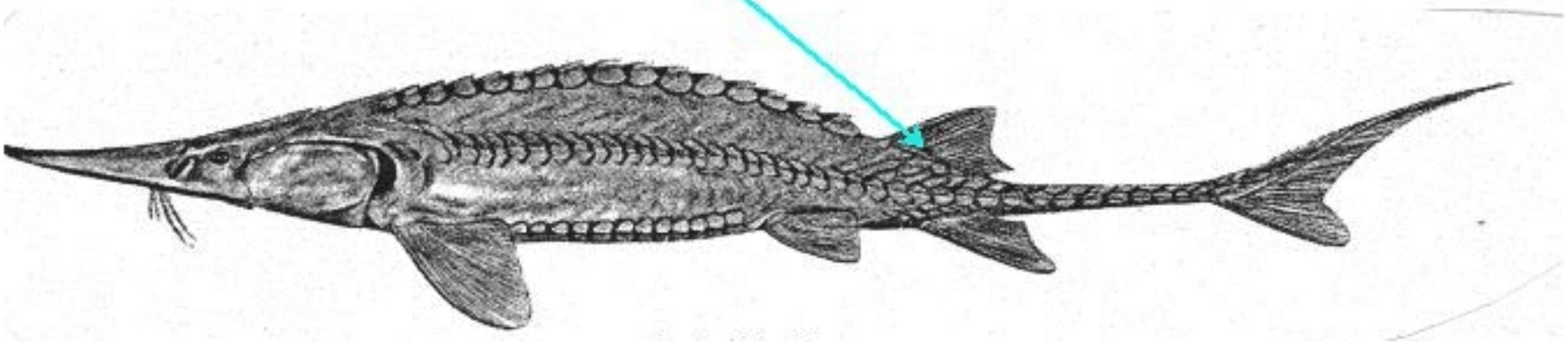
F – Outer Barbel Length – Front leading edge of outer barbel to it's tip.


Year class mark
Family Mark
(optional for PIT
tagged fish)
Ventral Right

01/03/2003

Required Tagging Location for Passive Integrated Transponder (PIT) for Pallid Sturgeon

Insert tag from front to back on fishes left side, into tissue at base of dorsal fin.



Left Side View

Figure D1. Ventral View of Pallid Sturgeon Photo for Genetic Sample

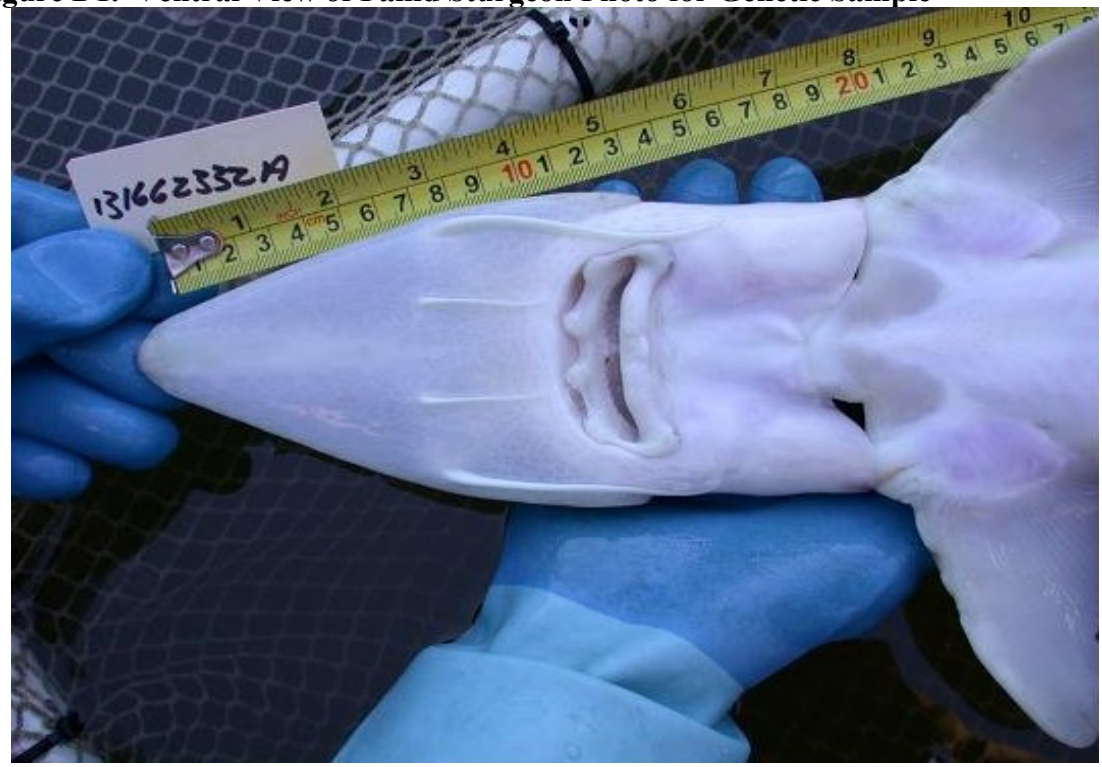
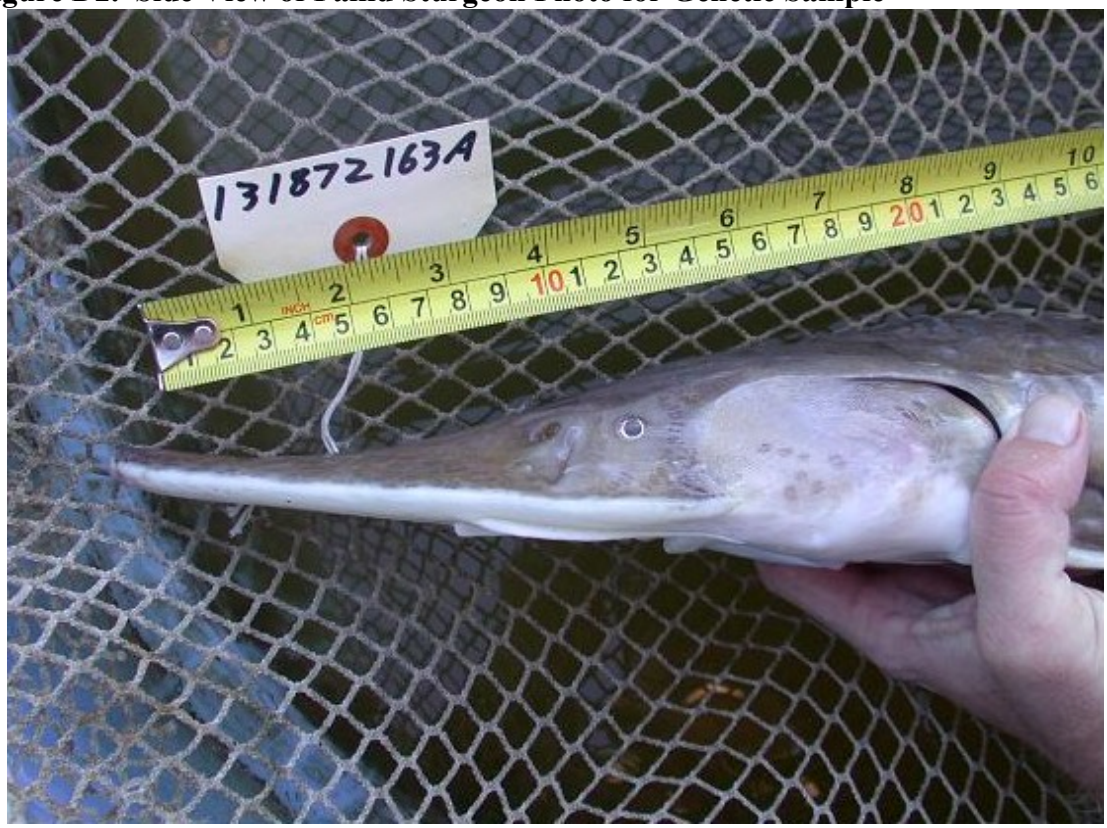


Figure D2. Side View of Pallid Sturgeon Photo for Genetic Sample



PALLID STURGEON
POPULATION ASSESSMENT PROGRAM
FOR THE
MISSOURI RIVER

AND

STANDARD OPERATING PROCEDURES
FOR
SAMPLING AND DATA
COLLECTION

APPENDIX E

PALLID STURGEON
DATA SHEET

Pallid sturgeon data sheet (02/07)

Date | | | | | | |

PIT 10 | | | | | | | | | | | | | | | | R/N |

Lat. Decimal degree | | | | | | | | | |

Long. - Decimal degree | | | | | | | | | | |

ER		EL	
H/V	color	H/V	color

Elastomer Colors

Flouresces	Non-Flouresces
G - Green	W - White
O - Orange	V - Purple
R - Red	B - Brown
P - Pink	K - Black
Y-Yellow	U - Blue

Scute

Loc.	#

CWT

Recapture Y/N

River _____R.M. _____ State _____

Location _____

Method: Gill, Trammel, Hoop net, Beam trawl, Otter trawl, Angling, Other _____

Duration of set _____ Mesh size _____

Temp. _____ºC Turbidity _____ntu

Depth _____ m Velocity _____ m/sec

Substrate _____

Picture Y/N

Other tag information _____

Genetics vial # _____ Sex M / F / U – Stage _____ / U

Fork Length _____mm Weight_____gm/kg

Released – Taken to hatchery _____

Captured by:_____

Comments _____

_____

Head Length _____mm

Snout to Mouth _____mm

Inter _____mm

Mouth Width _____mm

MIB _____mm

L-OB _____mm L-IB _____mm

R-OB _____mm R-IB _____mm

Anal _____rays Dorsal _____rays

Morphometric Measurements

Head Length– Tip of the rostrum to the posterior margin of the operculum.
Snout to Mouth – Tip of the rostrum to the anterior mouth midline.
Inter – Tip of rostrum to anterior insertion point of the R-OB.
Mouth-Width – Widest measurement on the outer edge of lips.
MIB (Mouth to Inner barbel**)** – Anterior point of insertion of the R-IB to the anterior midline of mouth.
L-OB (Left outer barbel)- Anterior insertion point to barbel tip.
L-IB (Left inner barbel)- Anterior insertion point to barbel tip.
R-OB (Right outer barbel)- Anterior insertion point to barbel tip.
R-IB (Right inner barbel)- Anterior insertion point to barbel tip.
Anal/Dorsal – Number of rays counted at fin base.

Field Descriptors

PIT – Pit tag number
R/N – R if recap with pit tag / N if new pit tag is inserted
ER (Elastomer Right) – Horizontal / Vertical position
ER (Elastomer Right) – Color code from elastomer box
EL (Elastomer Left) – Horizontal / Vertical position
EL (Elastomer Left) – Color code from elastomer box
Scute – Location (R=right, D=dorsal, L=left, or N=none)
Scute # - Scute number removed from the anterior
CWT – Y if tag is present / N if tag is not present
Recapture – Y if any marks present / N if not
Picture –Y if picture is taken for morphometrics / N if not

PALLID STURGEON
POPULATION ASSESSMENT PROGRAM
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COLLECTION

APPENDIX F

STANDARD OPERATING
PROCEDURES FOR GPS,
TIME AND PHYSICAL
HABITAT DATA
COLLECTION
AND
PIT TAG READER OPERATION
AND
T-BAR ANCHOR TAGGING PROCEDURES FOR
SHOVELNOSE STURGEON

GLOBAL POSITIONING SYSTEM (GPS)

Newer commercial receivers with Wide Area Augmentation System (WAAS) capability may collect data with 3- to 10-meter horizontal accuracy. WAAS consists of approximately 25 ground reference stations positioned across the United States that monitor GPS satellite data. Two master stations, located on either coast, collect data from the reference stations and create a GPS correction message. This correction accounts for GPS satellite orbit and clock drift plus signal delays caused by the atmosphere and ionosphere. The corrected differential message is then broadcast through one of two satellites with a fixed position over the equator. The information is compatible with the basic GPS signal structure, which means any WAAS-enabled GPS receiver can read the signal. Garmin Ltd. WAAS capable receivers can obtain accuracies within less than 3 meters.

Addition of forest canopy, topography, urban canyons, or other obstructions will affect accuracy of any GPS receiver (i.e., FWS-Columbia FRO staff has occasionally had difficulty with signals received near the St. Louis airport).

The accuracy of GPS receiver can be enhanced using Differential Correction. The U. S. Coast Guard maintains DGPS antennas in St. Louis and Kansas City; however, the goals of this monitoring program do not warrant the expense of auxiliary correction units. GPS units will be used for this Program simply as guiding tools to identify the general location of sub-samples and to quantify distances when sampling.

I. Equipment

A. A WAAS-enabled Mapsounder with accuracy to 3 meters in decimal degrees is the standard GPS equipment.
B. A portable GPS unit may be used for seining and mini-fyke use. This equipment must be a WAAS-enabled Mapsounder with accuracy to 3 meters in decimal degrees.

II. Procedure

A. Format the coordinate system of your GPS receiver by declaring Lat/Long in the setup mode.
B. Format the Map Datum by declaring WGS84 in the setup mode.
C. Reference gear specifications for GPS recording requirements in Lat/Long Decimal Degrees
D. Collect GPS locations in gear deployments in accordance with locations identified in the protocols sections for each gear type.
E. Record GPS readings to five decimal places.

TIME

Recording time accurately for scientific research in a standardized and non-confusing form reduces error and thus adds validity to the experiment. Therefore, the method and procedure used to record time will be standardized for all segments

Time will be recorded as military time (2400 hour) and recorded for the time zone for which the sampling occurred (i.e., Mountain Standard Time for sampling efforts in the Fort Peck Reach to the Lake Sakakawea headwaters, Central Standard Time for all segments downstream of Lake Sakakawea. Clock hours and minutes in military time are recorded as a four digit number in which the tens and units digits represent minutes and the thousands and hundreds digits represent hours (e.g., 1305 = 13 hours and 5 minutes, 1:05 pm) and, consequently, the ambiguities of the am-pm system are avoided. A day in military time begins at midnight and is designated as 0000, the following noon is 1200, and the following midnight (the end of the day) as 2400. For example, 0115 represents 1 hour, 15 minutes past midnight, and 1205 represents 5 minutes past noon.

I. Material & Methods

A. A digital clock will be used to delineate time.

II. Procedure

A. A start and a stop time for each gear used (No stop time required for Active Gears (i.e., trammels, trawls, seines)) to sample a macrohabitat will be recorded in 2400-hour notation (HH/MM).

B. The date for field work conducted will be recorded as month/day/year (MM/DD/YY). For example, July 8, 1996 is recorded as 07/08/96. The day the gear was set is recorded

PHYSICAL HABITAT CHARACTERISTIC DATA COLLECTION

Depth, temperature, velocity, substrate, and turbidity data will be collected in conjunction with fishery sampling efforts. Habitat characteristic data (velocity and turbidity) will be collected at all sites when a pallid sturgeon is captured during sampling regardless of the gear type deployed or the habitat type in which it is deployed. For sampling efforts that do **not** result in capture of pallid sturgeon, habitat characteristic data collection (velocity, substrate, and turbidity) is required in conjunction with one sub-sample per mesohabitat (within a macrohabitat) for each gear type or a minimum of 25% of these sub-samples. Depth and temperature will be collected at **all** sampling locations. For example; eight trammel drifts are conducted in a bend during the Sturgeon Sampling Season. Three drifts were made in the channel border of the outside bend, three in the inside bend, and two in the channel crossover. Habitat characteristic data will be collected for one of the drifts in the outside bend, one of the drifts in the inside bend, and one of the drifts in the channel crossover (These will be selected randomly.). Depth and temperature are collected for all eight of these drifts. Velocity will be visually estimated for all gear deployments in addition to being measured at a minimum 25% of the sub-samples per mesohabitat within a macrohabitat. Additional guidance and specifications are listed under gear specific location within the Velocity Standard Operating Procedure Section of this appendix. Habitat characteristic data will be collected immediately following gear retrieval. Depth may be collected when gear is deployed or retrieved.

Depth

Depth is an essential piece of information in determining habitats based on the habitat classification system that has been designed for this project. Depth information is quickly acquired and may be valuable during future analysis of all data collected in this project.

I. Equipment

A. Sonar Device: For deep-water habitats (>1.2m), the Sonar Device/GPS unit may serve as the standard equipment for collecting depth, provided it has the capabilities.

B. For shallow water habitats (<1.2m), the 1.5 Meter Top Set Wading Rod (cat. # 105-009) will serve as the standard equipment for collecting depth information.

C. A55M or B56M sounding reel: The sounding reels may also be used to collect depth information. All depths should be recorded to the nearest 0.1 m depth from this dial.

* All data will be recorded in meters; however, if depth data is collected in feet, field personnel should convert these depths to the nearest 0.1 m using the following conversion: depth in meters = (depth in feet) * (0.305 m).

II. Procedure

A. Depth information will be collected in meters to a single decimal place (tenths).

B. Depth information will be collected at one to three locations for each gear deployment and recorded on the data sheet.

C. See figures under the velocity section for specific locations of depth and other physical characteristic data.

D. It is the field crew leader's responsibility to determine if conditions are safe enough to use the sounding reel or sonar for depth measurements in high current velocities.

Water Temperature

Water temperature affects physiological processes of fish and other aquatic organisms and also influences the habitat use of fish. Although water quality characteristics are generally similar among main channel habitats of rivers, some habitats (e.g., side channels, backwaters) may have different temperature than main channel areas. Therefore, measurements of water temperature are needed in all habitat types.

I. Specifications/Materials

A. A device with capabilities of reading temperature to $\pm$ 2°C is required for collecting temperature data.
B. Red liquid thermometer.
C. Other temperature measuring devices may be used including GPS/fish finder units with temperature measuring capabilities.

II. Calibration and Quality Assurance

A. Refer to Operator Manuals for calibration instructions for device being used for collecting temperature data.
B. At a minimum of once a month or at any time readings are questionable, the equipment will be recalibrated or verified in accordance with the manufacturer's recommendations.
C. Temperature reading should be within $\pm$ 2°C.
D. Calibration and verification activities must be documented and available for quality assurance purposes.

III. Procedure

A. Water temperature will be measured at all sampling sites on the day that the gear is deployed.
B. Water temperature will be measured near the surface.
C. Water temperature is measured in degrees Celsius to the nearest degree and recorded on the data sheet.
D. See figures under the velocity section for specific locations of water temperatures and other physical characteristic data.

Velocity

Velocity data will be collected whenever a pallid sturgeon is captured during sampling regardless of the gear type used to capture the specimen or the habitat type in which it was captured. For sampling efforts that do **not** result in capture of pallid sturgeon, velocity data are required in conjunction with one sub-sample per mesohabitat (within a macrohabitat) for each gear type or a minimum of 25% of these sub-samples. Additional guidance and specifications are listed under the gear specification sections (Appendix C).

I. Specifications/Required Equipment

A. A55M (cat. # 101-014) Sounding Reel with 75 feet of 0.10-inch cable: This unit is limited to a maximum of a 100-pound sounding weight.

OR

B56M (cat. # 104-026) Sounding reel with 115 feet of 0.125-inch cable. This cable will handle sounding weights greater than 100 pounds. This model is equipped for either powered or manual operation. Accessory options for powered operation: B56 Reel Power Option (cat. # 104-062) or USGS Power Drive Unit (cat. # 104-040).

Selection of the proper sounding weight is dependent upon water velocity. In faster velocities, a heavier weight will be needed. Determination of the appropriate weight size is left to the discretion of each crew leader; however; the selected weight size needs to be adequate to allow the sounding reel cable to remain in a vertical (90-degree angle to the bottom) position. The following equation may be useful in determining the appropriate sounding weight for the various segments of the Missouri River. Velocity (feet/s) x Depth (feet) can be used to determine the size of the sounding weight needed for the various segments of the Missouri River. This information will also be useful in selecting the appropriate sounding reel.

B. Various hanging bars and hanger pins are available for use with the sounding reels and weights. Table F1 identifies the appropriate combination to use for each weight.

Table F1. Sounding weight, Hanger Bars, and Hanger Pins Appropriate for Various Sounding Weights.

Sounding Weight Cat #	Hanger Bar # Cat #	Hanger Pin # Cat #
108-001 15 lbs (7 Kg)	108-020	108-030
108-003 30 lbs (14 Kg)	108-020	108-031
108-005 50 lbs (23 Kg)	108-020	108-031
108-007 75 lbs (34 Kg)	108-020	108-033
108-009 100 lbs (45 Kg)	108-020	108-033
108-011 150 lbs (68 Kg)	108-022	108-035
108-013 200 lbs (91 Kg)	108-022	108-036
108-015 300 lbs (136 Kg)	108-025	108-037

C. The 1.5 Meter Top Set Wading Rod (cat. # 105-009) should be used to determine the depth at which the velocity is measured.

D. Aquacount Digitizer Model 5100 (cat. # 102-003) should be used.

E. Rod Mount (cat. # 102-005) and Rod Adaptor (cat. # 102-006)

F. Either 0.10-inch or 0.125-inch cable will be used as each sounding reel comes with a cable (refer to item “A” for appropriate cable selection.

G. Sounding Reel Pigtail

H. One of the following two velocity meters will be used.

1. Marsh-McBirney Flo-Mate Model 2000 **with sensor disconnect**. Sensor disconnect provides versatility to use with sounding reels for deep water applications. This meter comes with 20 feet of sensor cable, carrying case, and universal sensor mount, and it has an instruction manual.
   Additional cable may be purchased at a rate of $2.25/foot.
   This set up is compatible with the above equipment and may be used interchangeably with the Price Meter.

   OR

2. USGS Price Meter Model 6200 (cat. # 101-001, $745.00) or Model 6215 (Cat # 101-003) AA Current Meter or equivalent. These meters include a carrying case and essential connection accessories. Either of these Price meters can have either a magnetic or standard head.

II. Habitats

A. Deep water macrohabitats (>1.2 m) (i.e., outside bend, inside bend, main channel, tributary mouth-large, deep secondary channels: connected, or secondary channels: non-connected)

1. Velocity should be measured to nearest 0.1 m/s at:
   a. the bottom (representing bottom velocity). Note: This measurement should only be attempted if field personnel determine conditions are safe enough.
   b. 0.8 of the bottom depth.
   c. 0.2 of the bottom depth.

B. Shallow water macrohabitats (<1.2 m) (i.e., tributary mouth-shallow, shallow secondary channels: connected, secondary channels: non-connected, inside bend-sand bar)

1. Depth should be measured to nearest 0.1 m with wading rod
2. Velocity should be measured to nearest 0.1 m/s at 0.6 of the bottom depth to represent mean column velocity (Orth 1983).

III. Gear-Specific Locations to Collect Velocity Data

A. Trammel nets and Trawls

1. The trammel net is set perpendicular to the river's flow and drifted for 75 m to 300m. All physical habitat characteristic data will be collected at the mid-point of the drift (Figure F1).
2. Trawls are fished in a parallel direction with the current for 75m to 300m. Velocity will be measured at the midpoint of each trawl sample (Figure F1).

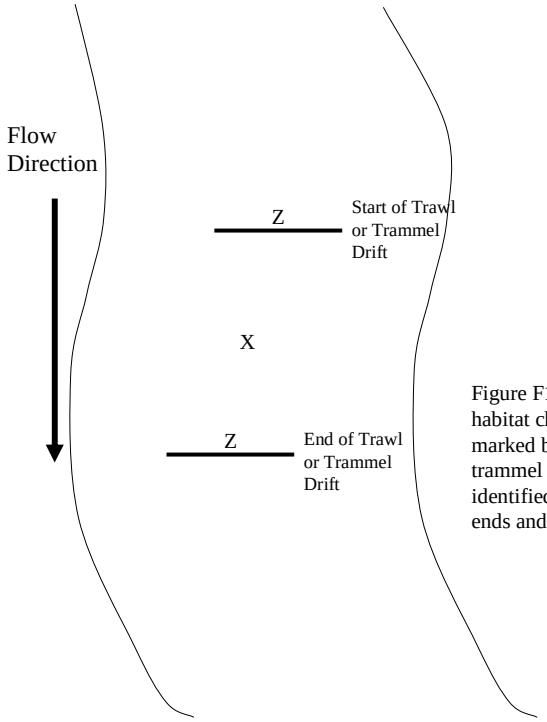

Figure F1. Location to collect physical habitat characteristic data (required) marked by "X" when trawling or drifting trammel nets. Additional (Optional) locations identified by "Z." Depth measured at both ends and the midpoint.

B. Stationary gill nets and Trotlines

1. Trotlines and stationary gill nets are set in all available macrohabitats within a bend. Gill nets, for example, are set parallel to current and shorelines on the inside of the bend and perpendicular to the current and shorelines in small tributary mouths and in secondary channels: non-connected. Trotlines are set parallel to current and shorelines in all macrohabitat types. Velocity will be measured at the mid-point of the sample regardless of the habitat being sampled (with the exception that velocity measurements will not be collected in "Eddies" where flow is circular thus resulting in unreliable velocity measurements). Additional intervals may be collected at each end in addition to the midpoint. Velocity data will be recorded in m/s (Figure F2).

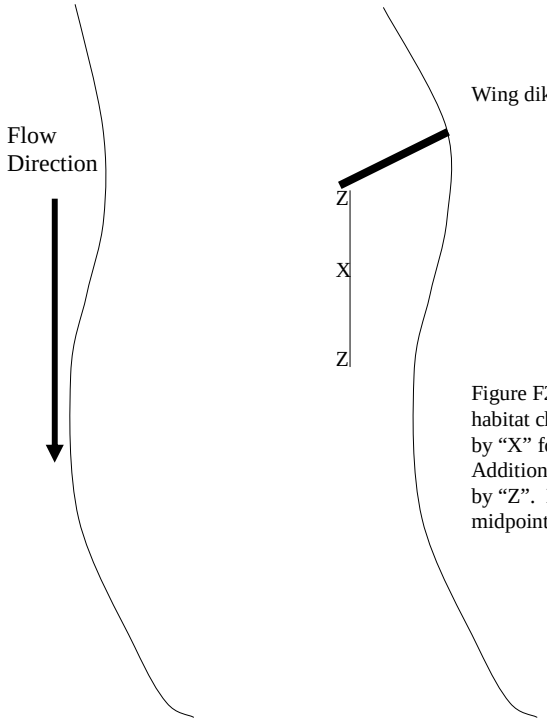

Figure F2. Location to collect physical habitat characteristic data (required) marked by "X" following retrieval of gill nets. Additional (Optional) locations identified by "Z". Depth measured at both ends and the midpoint.

C. Bag seine

1. Velocity will be measured at the midpoint and the maximum extent that the seine was deployed. Velocity will be measured at both .6 depth and bottom (Figure F3).

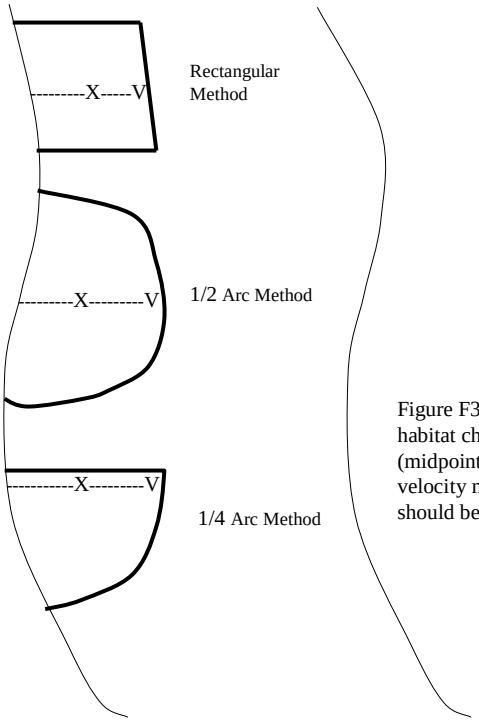

Figure F3. Locations to collect physical habitat characteristic data marked by an "X" (midpoint). At location "V", a second depth and velocity measurement must be taken. Data should be collected following seining.

D. Mini-fyke

1. Velocity will be measured at the mouth of the cab. Velocity reading will be collected at both .6 depth and bottom (Figure F4).

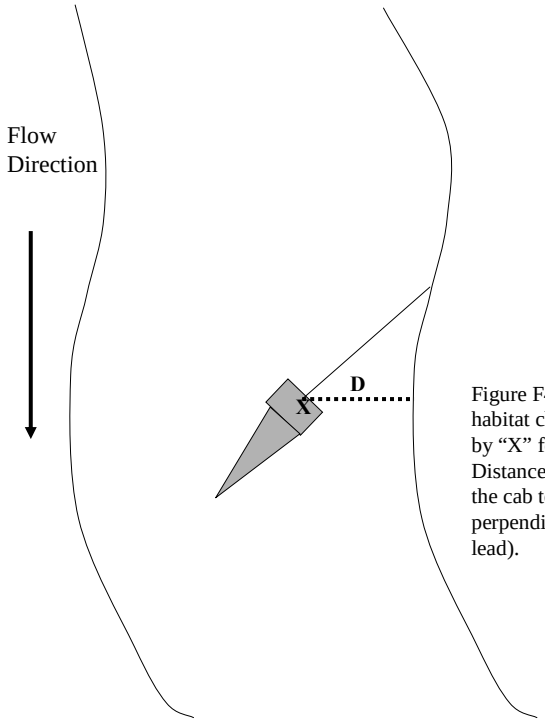

Figure F4. Location to collect physical habitat characteristic data (required) marked by "X" following retrieval of mini-fyke nets. Distance (D) is measured from the mouth of the cab to the shoreline (measurement is perpendicular to the shoreline-not along the lead).

IV. Procedure/Methods

A. All velocity measurements will be made after the fish have been collected.

B. In deep water macrohabitats, the boat will be anchored at the location of each depth/velocity measurement. The sounding reel will be used to position the velocity meter at the bottom of the river bed and a velocity value recorded. The weight is then raised to 80% of the depth to the bottom and a second velocity value recorded. The weight is then raised again to 20% of the depth to the bottom and the third (final) velocity reading taken. Move to the next location and repeat the process if additional location readings are required.

C. In shallow water macrohabitats, one person with the wading rod and velocity meter locates the positions of depth and velocity measurements.
Important: Make sure all personnel are standing downstream from these locations to minimize influence to velocity readings. The person then measures depth with the wading rod and positions the velocity meter to 60% of the depth to the bottom and records velocity. This is repeated for each depth/velocity point along the transect.

V. Procedure: Marsh-McBirney Meter Operation (refer to Instruction Manual)

A. Operate velocity meter in "real time mode" (RTM) – This mode is automatically initiated at start up.

B. Measure velocity in m/s. Pressing the ON/C and OFF keys simultaneously will switch between feet/s and m/s.

C. Beeper can be either on or off.

D. Use "Fixed Point Averaging" (FPA) setting – Press up and down arrow keys simultaneously to switch between FPA and Time Constant Filtering.
   1. The display should register the letters FPA when in this mode.

E. Set Filtering Mode to 10 seconds to average velocities.
   1. Press either the up or down arrow in FPA mode until 10 seconds are reached. Wait a few seconds for display to revert to velocity measuring screen.

VI. Procedure: Price Type AA Meter Operation

A. Assemble unit and adjust pivot (see Rickly Hydrological Co., 1996)

B. Replace sensor mount (used with Marsh-McBirney only) with entire Price meter unit. Price meter should slide over existing hanger bar, to a resting point, and can be fastened into place with an appropriate set screw.

C. Fasten electrical connector from 0.10-inch cable to the top binding post of the unit. The meter is now ready for submersion.

D. Connect sounding reel lead to Aquacount lead and turn Aquacount unit on.

E. Lower sounding weight to desired depth and press “start/stop” button.

F. Elapsed time, bucket revolutions, and velocity in m/s can be read from the display. Record velocity in m/s for each of the depth intervals that velocity measurements were taken (i.e., 0.2 depth, 0.6 depth, 0.8 depth, and bottom). If recorded in feet/s, the reading will be converted to m/s by the following conversion: velocity in m/s = (velocity in feet/s) * (0.305 m/s).

G. The Price meter should be clean and dry while storing and oiled once a week or every 8 hours of use (refer to instruction manual for specifications regarding cleaning, lubricating, and other maintenance requirements).

VII. Acceptable Deviance

A. The permissible error rate for this meter is +/- 0.015 m/s.

VIII. Velocity Meter Calibration

A. Zero Adjust

1. Zero adjust the velocity meter weekly. Prior to use or zero adjust, the unit should be cleaned and batteries checked for power (see Marsh-McBirney, Inc. FLO-MATE Model 2000 Portable Flowmeter Instruction Manual (1990)) (see Marsh-McBirney, Inc. FLO-MATE Model 2000 Portable Flowmeter Instruction Manual (1990)).

B. The velocity meter should be returned to the factory for official calibration about once a year and any time a problem is suspected. Calibration includes complete check of electronics and sensor, replacement of maintenance parts, cleaning of instrument, receipt of calibration certificate, report on existing calibration values, and re-calibrate sensor and electronics.

C. Requires two "D cell" batteries (spare batteries should be available during field work).

IX. Visual Estimation

A. For every gear deployment, the surface velocity will be estimated visually and recorded on the data sheet. The exception to this requirement is when environmental conditions do not allow for reliable visual estimation (e.g., wind, whitecaps).

B. There are 5 numeric velocity ranges to choose from.
0 = If environmental conditions do not allow for making a reliable visual estimation (e.g., wind, whitecaps).
1 = Eddy: Where flow is circular.
2 = 0.0-0.3 meters/second
3 = 0.3-0.6 meters/second
4 = 0.6-0.9 meters/second
5 = >0.9

C. The crews will calibrate their visual estimation by taking surface velocity measurements. Visual estimation will always be completed and recorded prior to the actual measurement using a velocity meter.

D. The crews will continue to take velocity measurements using the Marsh-McBirney or Price Meter in accordance with the protocol at a minimum of 25 % of all net deployments.

X. References

Orth, D. J. 1983. Aquatic habitat measurements. Pages 61-84 in L. A. Nielsen and D. L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland.

Marsh-McBirney. 1990. Model 2000 Installation and Operations Manual. Marsh-McBirney Inc., Frederick, Maryland 21701.

Rickly Hydrological Company, Columbus, Ohio 43219.

Substrate

The collection of substrate sample for visual estimation is **optional** for the Pallid Sturgeon Population Assessment Program, but may be required for other sampling efforts. If point substrate collections are made, the following equipment and procedures should be followed. Additional guidance and specifications are listed under gear specification sections relative to the location of substrate collections for each gear.

Substrate composition will be determined by visual estimation of dredge contents and will be periodically calibrated to insure accuracy. The substrate will be categorized in varying proportions as belonging to four established size classes.

I. Materials

A. Sampling: Hesse Sampler

1. 24-inch x 4-inch metal pipe
2. 4-inch sheet metal disk
3. 2, ¼- inch eyebolts and nuts
4. 3 feet of sturdy chain
5. 2 screwable chain links
6. White spray paint
7. ¼-inch minimum diameter rope (length determined by user)

B. Analysis-Calibration

1. Wash bottle
2. Jug for storing tap water
3. Funnel
4. Metric ruler
5. Sorting tub/tray
6. Sieve #10 (2mm-Item Number 53700, Available through Forestry Suppliers Inc.)
7. Sieve #230 (.0630mm-Item Number 53710); Available through Forestry Suppliers, Inc.)
8. Three plastic graduated cylinders: 1000 ml, 100 ml, and 10 ml
9. One plastic graduated beaker: 1000 ml

II. Procedure

A. Size Classes and Data Recording

1. The frequency of each of the gravel, sand, and silt/clay size classes represented will be rated from 0 to 100%.
2. The sum of the gravel, sand, and silt/clay samples must always equal 100% unless cobble or boulder is ubiquitous, where it would sum to 0%.
3. Cobble and boulders will be rated on an ordinal scale as either present or absent.
4. If cobble or boulders are present, their representation will be classified in one of three categories: ubiquitous, dominant, or incidental.

5.

Classification	Size Range (mm)
Cobble and Boulder	> 64
Gravel	64-2
Sand	2-.0625
Silt and Clay	<.0625

6. Cobble and Boulder Examples
   a. Ubiquitous: bedrock, bank of rip-rap, cobble-bed in a swift, shallow riffle
   b. Dominant: cobble bed with interstitial sand, boulders covering more than half of the stream bed
   c. Incidental: cobble or boulder which forms less than half of the stream bed or occurs anomalously

B. Sampling - HESSE SUBSTRATE SAMPLER
1. Design
   a. The cylinder is a 4-inch inside diameter, metal pipe.
   b. One end is capped with a welded-on plate of sheet metal or threaded pipe end-cap.
   c. 2 holes (1/4 inch) are drilled one quarter the length of the pipe from the open end. Place an eyebolt in each hole for chain attachment.
   d. Using the screw links, attach an end of the chain to each eyebolt.
   e. The dredging rope must be attached to the exact center link of the chain to ensure proper orientation of the mouth of the dredge when it is pulled.
   f. Once given the pipe, any welder or metal fabricator should be able to easily produce this.
   g. Spray paint the inside of the pipe white so that it can be seen to be fully clean after each usage.
2. Procedure
   a. Choose the appropriate location (e.g., midpoint, cab, hoop) depending on the gear deployed to collect the substrate sample.
   b. Make sure that the rope is securely fastened to the boat and the opposite end is securely fastened to the sampler. Throw the sampler over the side of the boat into the river; allowing it to sink to the bottom (When collecting substrate samples in Bar Mesohabitats, the substrate sample may be collected by hand in place of using the Hesse Sampler).
   c. Manually retrieve (drag) the cylinder. While retrieving the cylinder, the cylinder should remain in contact with the substrate until it is pulled upward and into the boat.
      (1) While retrieving the cylinder, note presence and frequency of any cobble or boulder felt while sampling.
      (2) While it is impossible to verify the presence of bedrock, boulders, or cobble at 30 feet, the behavior of the sampler and feel on the line should convey detailed enough information to allow tactile differentiation from gravel, sand, and silt/clay.
   d. A sub-sample is considered complete when it is obvious that the dredge is at least half full or when the distance between the midpoint and endpoint of a sub-sample has been dredged.
   e. Raise the dredge and bring aboard the boat (If the sampler is empty following retrieval, repeat the processes described in “b” and “c”).

f. Empty the contents into a tray, tub or other surface that allows you to conduct the visual estimation.

g. Estimate and record the percentage of each size class represented (having a standardized vial or jar for each size class, filled with particles spanning the range within each size class is recommended)

h. Some cobble-sized substrate may be collected in the Hesse sampler. If its presence in the sampler is considered representative of the entire streambed, then count it as such. Be careful not to overestimate the cobble frequency by assuming that an incidental piece of cobble in the streambed that constitutes half the sample volume is a dominant substrate type.

i. Sample and record an estimate of substrate composition at each site where a gear is used.

III. Calibration/Analysis

A. Calibration requires comparing the subjective data with quantitative data obtained after sieving.

B. Each team member who might be responsible for substrate sampling should calibrate before the study, and monthly thereafter.

C. Procedure

1. Choose several river sites that differ in substrate and follow the routine method for the Hesse Sampler.
2. Sieve the sample collected with the Hesse sampler through two sieves (2mm and 0.0630mm), which will fractionate the sample into 3 size classes.
3. Air dry each substrate fraction thoroughly because mass or volume of substrate finer than 8 mm is significantly affected by the presence of moisture (Gordon et al. 1992).
4. Prepare a graduated container by filling it one quarter to half full of tap water (never use river water). Record the volume
5. Add each size class to an appropriately sized, graduated container.
6. Leave at least the last tenth of the graduated container empty.
7. Fill the wash bottle with a known volume of water and use it to wash all of the particles of a particular separated size class into the graduated container.
8. Calculate the volume ($ml=cm^3$) of each of the three size classes.
9. If an odd-shaped or large piece of gravel is visually indistinguishable from cobble, determine its size (mm) by measuring the axis that bisects its longest and shortest axes (Gordon et al. 1992).
10. Compare the percentage by volume of each size class with the percentage determined by visual inspection of the Hesse sampler contents.
11. Table F2 is an example of a substrate calibration data sheet that should be used during calibration.

Table F2. Example of a Substrate Calibration Data Sheet.

Size Class	% Hesse Sampler Visual Estimate	Actual Volumetric Percent	Difference
Gravel			
Sand			
Silt/Clay			

12. If the cumulative difference for all three size classes between the percent by volume and the percent by visual inspection is >20%, more training is needed to improve the subjective estimates.

V. References

Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. Stream hydrology: an introduction for ecologists. John Wiley and Sons Ltd., New York.

Turbidity

Turbidity data will be collected whenever a pallid sturgeon is captured during sampling regardless of the gear type used to capture the specimen or the habitat type in which it was captured. For sampling efforts that do **not** result in capture of pallid sturgeon, turbidity data is required in conjunction with one sub-sample per mesohabitat (within a macrohabitat) for each gear type or a minimum of 25% of these sub-samples. Additional guidance and specifications are listed under gear specification sections.

Turbidity is a measure of the concentration of suspended particles in solution. The greater the concentration of suspended particles, the greater the turbidity. Turbidity is measured as the amount of light reflected from particles in solution and quantified as NTU (Nephelometric Turbidity Units).

I. Materials: The Hach Turbidimeter (model 2100P) is the standard (required) equipment for measuring turbidity. Only superior equipment may be used in place of the model 2100P. All calibration and quality assurance guidelines established for the model 2100P must be adhered to regardless of the equipment being used to measure turbidity.

A. Turbidimeter, Hach Model 2100P (Catalog # 46500-00)
B. Sample cells
C. StablCal® Calibration Standards and Gelex Standards (Catalog # 26594-00)
D. Operation Manual
E. Carrying case
F. Four AA batteries

II. Instrument Calibration and Quality Assurance

A. The Hach Model 2100P turbidimeter must be calibrated to the StablCal® Stabilized Formazin Standards bi-annually (April, October).
B. At bi-weekly intervals during the field season, the accuracy of the turbidimeter must be verified using the Gelex Secondary Standards.
C. If the turbidimeter readings exceed the calibration criteria (greater than 5 percent error) during the verification process, the turbidimeter must be re-calibrated using the StablCal® following the manufacturer's instructions.
D. There is no need for factory calibration provided that the calibration using the StablCal® Standards and Gelex Secondary Standards complies with manufacturer specifications and yield an error of 5% or less.
E. Refer to the Instrument and Operations Manual for calibration procedures. Maintain a file that includes dates, results, and comments on calibration and checking procedures.

III. Procedure: Turbidity data will be collected at the same sites as velocity and substrate.

A. Turbidity will be measured at the midpoint of the fish collection area following the fish collection at each macrohabitat.
B. A sample cell is filled with water (collected 25 cm below the water surface) and placed in the turbidimeter
C. Set the turbidity meter to autorange, and press READ
D. Turbidity value (NTU) is read directly from the turbidimeter display.
E. If turbidity measurements exceed 1000 NTU's (flashing 1000 on the turbidimeter screen), the sample will be diluted using tap water. A graduated cylinder will be used in the diluting process so that the diluted sample is 50% tap water and 50% original sample. The diluted sample will

then be read and the NTU reading will be doubled (i.e., Diluted sample measures 750 NTU; recorded value would be 1500 NTU).

IV. Supplier

A. Hach Company

Contact: Sue Corsberg (Sales Consultant)
P.O. Box 608
Loveland, CO 80539-0608
1-800-227-4224 (ext: 2569)
Website: www.hach.com

V. References:

Hach Model 2100P operation manual.

Hach 1995 Products for Analysis catalog.

Passive Integrated Transponder (PIT) Tag Reader

The PIT Tag Reader is a compact unit that reads radio frequency identification tags. The reader generates an electromagnetic field which is used to energize the PIT Tag enabling the tag to transmit its identification code back to the reader for display. The unit may be powered by 9 volt batteries, direct AC power (adaptor) or DC power via 12 volt system (adaptor). Although the readers have a variety of capabilities (i.e., scan modes menu, file management, utilities menu); the following guidelines will focus on the basic use of the unit to obtain PIT tag information in the field. For additional information regarding the units capabilities, refer to the owners manual. The following guidelines were written based on the set up and function of the BioMark Mini Portable Reader. Other brands of PIT Tag readers may vary in use and function. For guidelines for other brands of PIT Tag Readers, refer to the appropriate owner's manual.

I. Materials: 125kHz Mini Portable Reader

A. Two replacement Standard Duty 9 Volt Batteries and/or appropriate backup power adaptor(s). Do not use heavy duty 9 volt batteries in these units!
B. Test PIT Tags which are provided with the reader when purchased.
C. Operation Manual
D. Protective Carrying Case
E. Reader Cover

II. Instrument Calibration and Quality Assurance

A. There is no calibration necessary for the Mini Portable Reader.
B. The Test PIT Tags should be used as needed to ensure that the reader is functioning properly.
C. The Reader is typically set up and ready for use when you receive it; however, it should be checked prior to field use to ensure that the Reader is working properly and the operator understands how to use the Reader to obtain PIT tag information.

III. Procedure: The PIT Tag Reader should be used to determine whether a pallid or lake sturgeon possesses a PIT Tag whenever these species are captured during biological collections.

A. Before using the Reader, Read the Mini Portable Reader MPR Manual
B. Use the key pad to turn the reader ON/OFF.
C. "READY" will appear in the display.
D. Verify the function of the Reader by scanning a Test Tag or other functional PIT Tag (Note: The circular portion of the Reader is the antennae).
E. Hold down on the "READ" button while scanning the area in which the tag would be implanted (slowly move antennae along the base of the dorsal fin on the left side of the fish).
F. If no tag is found, repeat the scanning procedure on the right side of the fish along the base of the dorsal fin.
G. The Reader will "Beep" when the tag code is read.
H. If no code is found, continue to scan the area while changing the orientation of the Reader as the Reader is most effective when the PIT Tags long axis is facing the antennae (See illustrations in MPR Manual for clarification).
I. If no tag is found, a PIT Tag should be injected into the fish in accordance with tagging protocols found in the U.S. Fish & Wildlife Service's Handling Protocols.

IV. Additional Guidance

A. When scanning a tag, be sure you are not scanning near metal objects as this will interfere with the electromagnetic field and may inhibit tag reading.
B. Two PIT Tags side by side may also cause the Reader not to read either tag.

C. Low battery power will reduce the effectiveness of the Reader, so always use fresh batteries or direct power from either the AC or DC power sources using the appropriate manufacturer's adaptors.

D. If the Reader will not read a tag, check to make sure that you have the Reader back to the "READY" display screen.

E. If the "Continuous" feature is turned ON (Scan Modes Menu), the Reader will not read the same tag consecutively. If this feature is turned OFF, the Reader will read the same tag over and over. For field use the "Continuous" feature should be turned OFF.

F. Refer to Mini Portable Reader MPR Manual.

V. Supplier

A. BioMark Inc.
7615 W. Riverside Drive
Boise, ID 83714
Phone: (208) 275-0011
Website: www.biomark.com
Contact: Mark Owens

VI. References:

Destron Technologies. Mini Portable Reader MPR Manual.

T-Bar Anchor Tagging For Shovelnose Sturgeon and Caudal Fin Clip

T-bar anchor tags are one of the most popular external tags used to uniquely mark individual fish. A semiautomated, continuously-feeding tagging gun allows the user to quickly and easily implant tags into a large number of fish (Guy et al. 1996). Tags are available in a wide variety of sizes and colors to facilitate a variety of fish species and applications. Further, bright colored tags allow for easy recognition of marked fish upon recapture and detailed information on each tag assists in the determination of the agency that marked the fish.

I. Materials: T-bar tagging system

A. T-bar tagging gun (carry extra)
B. Long, regular needle (carry extras)
C. T-bar tags

II. Procedure: All captured shovelnose sturgeon should be implanted with a T-bar anchor tag.

A. Load ream of T-bar tags into loading slot of tag gun until first tag enters base of needle.
B. Insert tag gun needle to its base into the fleshy area between the lateral scutes and dorsal fin on the left side of the fish (Figure F5). The needle should be inserted at an acute angle to the body angling the needle towards the anterior portion of the fish to allow the tag to lie along the side of the fish (Figure F7). The needle should pass the midline of the body but not penetrate the opposite side of the fish.
C. Squeeze the tag gun to deploy the tag.
D. Rotate the tag gun 90º counterclockwise and remove the needle from the fish (Figure F6).
E. Lightly pull on the tag make certain it is securely anchored. Ensure that the T-bar is lodged between the pterygiophores of the dorsal fin. If T-bar is only held in by the fish's skin, remove and re-tag the fish.
F. Record tag number and proper alpha-prefix (i.e., C) in "Floy tag" box on back page of the Standard Data Sheet.

III. Additional Guidance

A. Insert and remove the needle as straight as possible to avoid bending. Bent needles will not function properly and result in tags not loading properly or tags not staying in the fish when the needle is removed.

Figure F5. Insertion point for T-bar tag needle when tagging shovelnose sturgeon.

Figure F6. Rotate the tag gun 90º and remove needle from fish.

Figure F7. Proper location and orientation of T-bar tag.

IV. Caudal Fin Clip for shovelnose sturgeon

A. All shovelnose sturgeon captured will be checked for a T-bar tag and caudal fin clip.

B. All shovelnose sturgeon that are T-bar tagged will also receive a caudal fin clip.

C. See data sheet instructions for recording mark/recapture information for the T-bar tagging and caudal fin clips for shovelnose sturgeon.

D. The lower lobe of the caudal fin will be clipped as shown in figure F8.

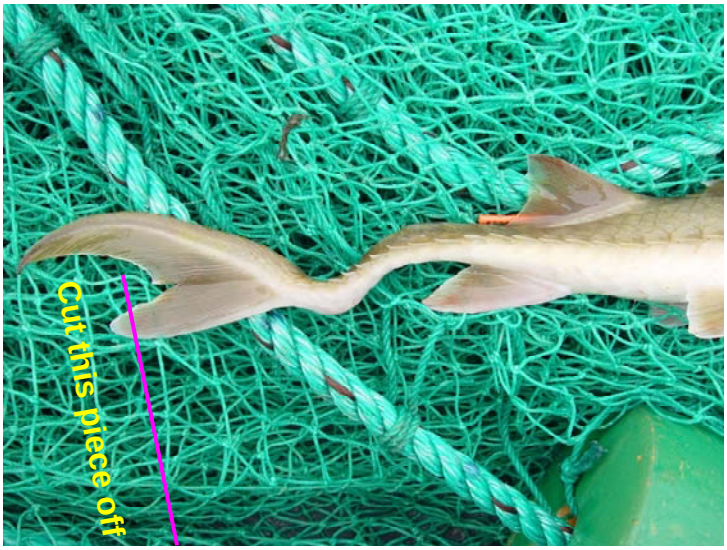

Figure F8. Proper location and orientation of caudal fin clip

V. Supplier

A. Floy Tag Inc.
4616 Union Bay Place NE
Seattle, Washington USA 98105
Phone: 206-524-2700
Fax: 800-843-1172
Email: floytag@halcyon.com

VI. References:

Guy, C. S., H. L. Blankenship, and L. A. Nielsen. 1996. Tagging and Marking. Pages 353-383 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Prepared by:
Tony Kennedy
Missouri Department of Conservation

PALLID STURGEON
POPULATION ASSESSMENT PROGRAM
FOR THE
MISSOURI RIVER

AND

STANDARD OPERATING PROCEDURES
FOR
SAMPLING AND DATA
COLLECTION

APPENDIX G

FOUR-DIGIT
ALPHABETIC SPECIES CODES

Common Name	Scientific Name	LetterCode	NumericCode
Age0 fish	(youngoftheyear)Unidentified	YOYF	992
Alabama shad	Alosa alabamae	ALSD	085
Alewife	A. pseudoharengus	ALWF	084
Alligator snapper	Macroclemys temminckii	AGST	961
American eel	Anguilla rostrata	AMEL	072
American grayling	Thymallus arcticus	AMGL	570
Banded darter	Etheostoma zonale	BDDR	805
Banded killifish	Fundulus diaphanus	BDKF	588
Banded sculpin	Cottus carolinae	BDSP	593
Bigeye shiner	Notropis boops	BESN	147
Bighead carp	Hypophthalmichthys nobilis	BHCP	182
Bigmouth buffalo	Ictiobus cyprinellus	BMBF	254
Bigmouth shiner	Notropis dorsalis	BMSN	134
Black buffalo	Ictiobus niger	BKBF	256
Black bullhead	Ameiurus melas	BKBH	310
Black Carp	Mylopharyngodon piceus	BLCP	177
Black crappie	Pomoxis nigromaculatus	BKCP	790
Black redhorse	Moxostoma duquesnei	BKRH	266
Blacknose dace	Rhinichthys atratulus	BNDC	170
Blacknose shiner	Notropis heterolepis	BNSN	136
Blackside darter	Percina maculata	BSDR	818
Blackspotted topminnow	Fundulus olivaceus	BPTM	586
Blackstripe topminnow	F. notatus	BTTM	581
Blanding's	Emydoidea blandingii	BLDT	953
Bleeding shiner	Luxilus zonatus	BDSN	127
Blue catfish	Ictalurus furcatus	BLCF	350
Blue catfish x Channel catfish	Ictalurus furcatus x punctatus	BCCC	355
Blue Gill x Orange Spotted Sunfish hybrid		BGOS	727
Blue sucker	**Cycleptus elongatus**	**BUSK**	**230**
Bluegill	Lepomis macrochirus	BLGL	730
Bluegill-Redear Sunfish Hybrid	L. macrochirus X L. microlophus	BGRE	745
Bluestripe darter	Percina cymatotaenia	BTDR	820
Bluntnose minnow	Pimephales notatus	BNMW	160
Bonneville cisco	Prosopium cylindraceum	BVSC	480
Bowfin	Amia calva	BWFN	052
Brassy minnow	**Hybognathus hankinsoni**	**BSMW**	**152**
Brook silverside	Labidesthes sicculus	BKSS	592
Brook stickleback	Culaea inconstans	BKSB	597
Brook trout	Salvelinus fontinalis	BKTT	565
Brown Bullhead	Ameiurus nebulosus	BNBH	330
Brown trout	Salmo trutta	BNTT	560
Buffalo or Carpsucker	(Fish too small to differentiate between species in field)	UBC	202
Bullhead minnow	Pimephales vigilax	BHMW	161
Burbot	Lota lota	BRBT	577
Central Mudminnow	Umbra limi	MDMN	452
Central stoneroller	Campostoma anomalum	CLSR	102
Channel catfish	Ictalurus punctatus	CNCF	360
Channel Shiner	Notropis subspecies	CNSN	149
Chestnut lamprey	Ichthyomyzon castaneus	CNLP	012
Chinook salmon	Oncorhynchus tshawytscha	CNSM	555
Cisco	Coregonus artedi	CSCO	482
Coho salmon	Oncorhynchus kisutch	CHSM	510

Common Name	ScientificName	LetterCode	NumericCode
Common carp	Cyprinus carpio	CARP	178
Common shiner	Luxilus cornutus	CMSN	126
Conditions did not Allow for Gear Deployment	(e.g. you accessed the chute, but no flow to drift trammel net)	CNFH	997
Could not access area	(e.g., water in chute too low to access)	CNA	996
Creek chub	Semotilus atromaculatus	CKCB	118
Crystal darter	Ammocrypta asprella	CLDR	802
Cutthroat trout	Salmo clarkii	CTTT	505
Emerald shiner	Notropis atherinoides	ERSN	130
False Map	Graptemys pseudogeographica	FSMT	954
Fantail darter	Etheostoma flabellare	FTDR	815
Fathead minnow	Pimephales promelas	FHMW	162
Finescale dace	Phoxinus neogaeus	FSDC	168
Flathead catfish	Pylodictis olivaris	FHCF	370
Flathead chub	Platygobio gracilis	FHCB	116
Flathead chub x sicklefin chub	Platygobio gracilis x Macrhybopsis meeki	FCSC	113
Freckled madtom	Noturus nocturnus	FKMT	392
Freshwater drum	Aplodinotus grunniens	FWDM	862
Ghost shiner	Notropis buchanani	GTSN	143
Gilt darter	Percina evides	GLDR	822
Gizzard shad	Dorosoma cepedianum	GZSD	086
Gizzard shad x Threadfin shad	Dorosoma cepedianum x petenense	GSTS	087
Golden redhorse	Moxostoma erythrurum	GDRH	264
Golden shiner	Notemigonus crysoleucas	GDSN	128
Golden trout	Salmo aguabonita	GDTT	533
Goldeye	Hiodon alosoides	GDEY	062
Goldfish	Carassius auratus	GDFH	174
Goldfish x Common carp	Carassius auratus x Cyprinus carpio	GFCC	175
Grass carp	Ctenopharyngodon idella	GSCP	176
Grass pickerel	Esox americanus vermiculatus	GSPK	410
Gravel chub	Erimystax punctatus	GVCB	103
Green sunfish	Lepomis cyanellus	GNSF	722
Green sunfish x Bluegill	Lepomis cyanellus x macrochirus	GSBG	735
Green sunfish x Orangespotted	Lepomis cyanellus x L. humilis	GSOS	728
Green sunfish x unknown	Lepomis cyanellus x sp.	GN*?	736
Greenside darter	Etheostoma blennioides	GSDR	811
Highfin carpsucker	Carpiodes velifer	HFCS	216
Hornyhead chub	Nocomis biguttatus	HHCB	114
Hybognathus spp.	**Hybognathus sp.**	**HBNS**	**155**
Iowa darter	Etheostoma exile	IODR	810
Johnny darter	Etheostoma nigrum	JYDR	814
Lab fish to be ID in lab		LAB	990
Lake chub	Couesius plumbeus	LKCB	104
Lake sturgeon	Acipenser fulvescens	LKSG	024
Lake trout	Salvelinus namaycush	LKTT	566
Lake whitefish	Coregonus clupeaformis	LKWF	484
Largemouth bass	Micropterus salmoides	LMBS	770
Largescale stoneroller	Campostoma oligolepis	LSSR	101
Larval fish Unidentified		LVFS	993
Larval lamprey Unidentified		LVLP	011
Least darter	Etheostoma microperca	LTDR	813
Logperch	Percina caprodes	LGPH	828
Longear sunfish	Lepomis megalotis	LESF	738

Common Name	ScientificName	LetterCode	NumericCode
Longnose dace	Rhinichthys cataractae	LNDC	172
Longnose gar	Lepisosteus osseus	LNGR	042
Longnose sucker	Catostomus catostomus	LNSK	222
Map	Graptemys geographica	MAPT	963
Mimic shiner	Notropis volucellus	MMSN	145
Mississippi Map	Graptemys kohnii	MRMT	964
Mississippi silvery minnow	**Hybognathus nuchalis**	**SVMW**	**154**
Missouri River Cooter	Pseudemys concinna metteri	MRCT	966
Missouri saddled darter	Etheostoma tetrazonum	MSDR	809
Mooneye	Hiodon tergisus	MNEY	064
Mottled sculpin	Cottus bairdi	MDSP	594
Mountain sucker	Catostomus platyrhincus	MTSK	226
Mountain whitefish	Prosopium williamsoni	MTWF	558
Muskellunge	Esox masquinongy	MSKG	430
Net Did Not Fish	"Net was lost or compromised and did not catch any fish of interest". Crew leader's discretion to record fish or not. Include MNCF in U6 and put species code on back page if fish data is recorded	NDNF	998
No fish caught	The gear functioned properly, but no fish caught	NFSH	999
Northern brook lamprey	Ichthyomyzon fossor	NBLP	018
Northern hog sucker	Hypentelium nigricans	NHSK	235
Northern pike	Esox lucius	NTPK	420
Northern redbelly dace	Phoxinus eos	NRBD	166
Northern studfish	Fundulus catenatus	NTSF	583
Orangespotted sunfish	Lepomis humilis	OSSF	726
Orangethroat darter	Etheostoma spectabile	OTDR	816
Ouachita Map	Graptemys ouachitensis	OUMT	965
Ozark minnow	Notropis nubilus	OZMW	142
Paddlefish	Polyodon spathula	PDFH	032
Painted	Chrysemys picta bellii	PATT	952
Pallid sturgeon	**Scaphirhynchus albus**	**PDSG**	**026**
Peamouth	Mylocheilus caurinus	PEMT	173
Pearl dace	Margariscus margarita	PLDC	164
Plains killifish	Fundulus zebrinus	PKLF	584
Plains minnow	**Hybognathus placitus**	**PNMW**	**156**
Plains topminnow	Fundulus sciadicus	PTMW	582
Pugnose minnow	Opsopoeodus emiliae	PGMW	163
Pumpkinseed	Lepomis gibbosus	PNSD	724
Quillback	Carpiodes cyprinus	QLBK	214
Rainbow darter	Etheostoma caeruleum	RBDR	806
Rainbow smelt	Osmerus mordax	RBST	461
Rainbow trout	Oncorhynchus mykiss	RBTT	520
Red shiner	Cyprinella lutrensis	RDSN	120
Redear Sunfish	Lepomis microlophus	RESF	740
Red-Eared Slider	Trachemys scripta	REST	955
Redfin Shiner	Lythrurus umbratilis	RFSN	123
Redside shiner	Richardsonius balteatus	RDSS	119
River carpsucker	Carpiodes carpio	RVCS	212
River darter	Percina shumardi	RRDR	826
River redhorse	Moxostoma carinatum	RVRH	268
River shiner	Notropis blennius	RVSN	132
Rock bass	Ambloplites rupestris	RKBS	714

Common Name	ScientificName	LetterCode	NumericCode
Rosyface shiner	Notropis rubellus	RYSN	141
Rudd	Scardinius erythrophthalmus	RUDD	184
Sacramento Perch	Archoplites interruptus	SOPH	716
Sand shiner	**Notropis stramineus**	**SNSN**	**144**
Sauger	**Sander canadensis**	**SGER**	**840**
Sauger x Walleye	Sander canadensis x vitreus	SGWE	845
Shorthead redhorse	Moxostoma macrolepidotum	SHRH	262
Shortnose gar	Lepisosteus platostomus	SNGR	044
Shovelnose sturgeon	**Scaphirhynchus platorynchus**	**SNSG**	**028**
Shovelnose x Pallid Hybrid	Scaphirhynchus platorynchus x Scaphirhynchus albus	SNPD	027
Sicklefin chub	**Macrhybopsis meeki**	**SFCB**	**110**
Silver carp	Hypophthalmichthys molitrix	SVCP	180
Silver chub	Macrhybopsis storeriana	SVCB	112
Silver lamprey	Ichthyomyzon unicuspis	SVLP	014
Silver redhorse	Moxostoma anisurum	SVRH	270
Silverband shiner	Notropis shumardi	SBSN	146
Silverstripe shiner	Notropis stilbius	SSPS	140
Skipjack herring	Alosa chrysochloris	SJHR	082
Slender madtom	Noturus exilis	SDMT	394
Slenderhead darter	Percina phoxocephala	SHDR	824
Slough darter	Etheostoma gracile	SLDR	808
Smallmouth bass	Micropterus dolomieu	SMBS	750
Smallmouth buffalo	Ictiobus bubalus	SMBF	252
Smooth Softshell	Apalone mutica	SMST	956
Snapping	Chelydra serpentine	SNPT	951
Sockeye salmon	Oncorhynchus nerka	SESM	551
Southern brook lamprey	Ichthyomyzon gagei	SBLR	016
Southern redbelly dace	Phoxinus erythrogaster	SRBD	165
Shoal chub (formerly Speckled chub)	**Macrhybopsis hyostoma**	**SKCB**	**106**
Shoal chub x Sturgeon chub	Macrhybopsis hyostoma x gelida	SPST	107
Spiny Softshell	Apalone spinifera	SNST	957
Spotfin shiner	Cyprinella spiloptera	SFSN	122
Spottail shiner	Notropis hudsonius	STSN	138
Spotted bass	Micropterus punctulatus	STBS	760
Spotted gar	Lepisosteus oculatus	STGR	046
Spotted sucker	Minytrema melanops	SPSK	245
Stinkpot	Sternotherus odoratus	SPOT	962
Stippled darter	Etheostoma punctulatum	STPD	807
Stonecat	Noturus flavus	STCT	380
Striped bass	Morone saxatilis	SDBS	640
Striped bass x White bass	Morone saxatilis x chrysops	SBWB	645
Striped shiner	Luxilus chrysocephalus	SPSN	125
Sturgeon chub	**Macrhybopsis gelida**	**SGCB**	**108**
Sturgeon chub x Sicklefin chub	Macrhybopsis gelida x meeki	SCSC	109
Suckermouth minnow	Phenacobius mirabilis	SMMW	158
Tadpole madtom	Noturus gyrinus	TPMT	390
Threadfin shad	Dorosoma petenense	TFSD	088
Three-toed Box	Terrapene carolina triunguis	TTBT	967
Tiger Muskellunge	Esox masquinongy x Esox lucius	TGMG	435
Topeka shiner	Notropis topeka	TPSN	148
Troutperch	Percopsis omiscomaycus	TTPH	568
Unidentified	Unidentified	UNID	991

Common Name	ScientificName	LetterCode	NumericCode
Unidentified Asian Carp	Hypophthalmichthys spp.	UAC	181
Unidentified buffalo	Ictiobus sp.	UBF	250
Unidentified Bullhead	Ameiurus spp.	UBH	305
Unidentified carpsucker	Carpiodes sp.	UCS	210
Unidentified Catostomus	Catostomus spp.	UCA	220
Unidentified Catfish	Other than Ictalurus	UCF	365
Unidentified chub	Macrhybopsis sp.	UHY	105
Unidentified Crappie	Pomoxis spp.	UPM	785
Unidentified darter	Percina or Etheostoma sp.	UDR	804
Unidentified Etheostoma	Etheostoma sp.	UET	812
Unidentified gar	Lepisosteus spp.	UGR	040
Unidentified herring	Clupeidae	UHR	080
Unidentified Hiodontidae	Hiodontidae spp.	UHI	060
Unidentified Ictalurus	Ictalurus spp.	UIC	340
Unidentified lamprey	Petromyzontidae	ULY	010
Unidentified Lepomis	Lepomis sp.	ULP	720
Unidentified Micropterus spp.	Micropterus spp.	UMC	748
Unidentified minnow	Unidentified Cyprinidae	UCY	100
Unidentified Percidae	Unidentified Percidae	UPC	800
Unidentified Percina	Percina sp.	UPN	817
Unidentified Pimephales	Pimephales sp.	UPP	159
Unidentified redhorse	Moxostoma sp.	URH	260
Unidentified shiner	Notropis sp.	UNO	129
Unidentified Sander	Sander sp.	UST	842
Unidentified Sturgeon	Scaphirhynchus sp.	USG	020
Unidentified sucker	Unidentified Catostomidae	UCT	200
Unidentified sunfish	Unidentified Centrarchidae	UCN	700
Unidentified temperate bass	Morone or Percichthyidae spp.	UTB	600
Walleye	Sander vitreus	WLYE	850
Warmouth	Lepomis gulosus	WRMH	721
Wedgespot shiner	Notropis greenei	WSSN	139
Western Box	Terrapene ornata ornata	WEBT	958
Western Mosquitofish	Gambusia affinis	MQTF	587
Western redfin shiner	Lythrurus umbratilis	WRFS	124
Western silvery minnow	**Hybognathus argyritis**	**WSMW**	**150**
White bass	Morone chrysops	WTBS	620
White crappie	Pomoxis annularis	WTCP	780
White perch	Morone americana	WTPH	610
White sucker	Catostomus commersonii	WTSK	224
White-black crappie hybrid	P. annularis X P. nigromaculatus	WCBC	782
Yellow bass	Morone mississippiensis	YWBS	630
Yellow bullhead	Ameiurus natalis	YLBH	320
Yellow perch	Perca flavescens	YWPH	830

MISSOURI RIVER
STANDARD OPERATING PROCEDURES
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APPENDIX H

THREE-DIGIT
NUMERIC SPECIES CODES

CommonName	ScientificName	LetterCode	NumericCode
Unidentified lamprey	Petromyzontidae	ULY	010
Larval lamprey Unidentified		LVLP	011
Chestnut lamprey	Ichthyomyzon castaneus	CNLP	012
Silver lamprey	Ichthyomyzon unicuspis	SVLP	014
Southern brook lamprey	Ichthyomyzon gagei	SBLR	016
Northern brook lamprey	Ichthyomyzon fossor	NBLP	018
Unidentified Sturgeon	Scaphirhynchus sp.	USG	020
Lake sturgeon	Acipenser fulvescens	LKSG	024
Pallid sturgeon	**Scaphirhynchus albus**	**PDSG**	**026**
Shovelnose x Pallid Hybrid	Scaphirhynchus platorynchus x Scaphirhynchus albus	SNPD	027
Shovelnose sturgeon	**Scaphirhynchus platorynchus**	**SNSG**	**028**
Paddlefish	Polyodon spathula	PDFH	032
Unidentified gar	Lepisosteus spp.	UGR	040
Longnose gar	Lepisosteus osseus	LNGR	042
Shortnose gar	Lepisosteus platostomus	SNGR	044
Spotted gar	Lepisosteus oculatus	STGR	046
Bowfin	Amia calva	BWFN	052
Unidentified Hiodontidae	Hiodontidae spp.	UHI	060
Goldeye	Hiodon alosoides	GDEY	062
Mooneye	Hiodon tergisus	MNEY	064
American eel	Anguilla rostrata	AMEL	072
Unidentified herring	Clupeidae	UHR	080
Skipjack herring	Alosa chrysochloris	SJHR	082
Alewife	A. pseudoharengus	ALWF	084
Alabama shad	Alosa alabamae	ALSD	085
Gizzard shad	Dorosoma cepedianum	GZSD	086
Gizzard shad x Threadfin shad	Dorosoma cepedianum x petenense	GSTS	087
Threadfin shad	Dorosoma petenense	TFSD	088
Unidentified minnow	Unidentified Cyprinidae	UCY	100
Largescale stoneroller	Campostoma oligolepis	LSSR	101
Central stoneroller	Campostoma anomalum	CLSR	102
Gravel chub	Erimystax punctatus	GVCB	103
Lake chub	Couesius plumbeus	LKCB	104
Unidentified chub	Macrhybopsis sp.	UHY	105
Shoal chub (formerly Speckled chub)	**Macrhybopsis hyostoma**	**SKCB**	**106**
Shoal chub x Sturgeon chub	Macrhybopsis hyostoma x gelida	SPST	107
Sturgeon chub	**Macrhybopsis gelida**	**SGCB**	**108**
Sturgeon chub x Sicklefin chub	Macrhybopsis gelida x meeki	SCSC	109
Sicklefin chub	**Macrhybopsis meeki**	**SFCB**	**110**
Silver chub	Macrhybopsis storeriana	SVCB	112
Flathead chub x sicklefin chub	Platygobio gracilis x Macrhybopsis meeki	FCSC	113
Hornyhead chub	Nocomis biguttatus	HHCB	114
Flathead chub	Platygobio gracilis	FHCB	116
Creek chub	Semotilus atromaculatus	CKCB	118
Redside shiner	Richardsonius balteatus	RDSS	119
Red shiner	Cyprinella lutrensis	RDSN	120
Spotfin shiner	Cyprinella spiloptera	SFSN	122
Redfin Shiner	Lythrurus umbratilis	RFSN	123
Western redfin shiner	Lythrurus umbratilis	WRFS	124
Striped shiner	Luxilus chrysocephalus	SPSN	125
Common shiner	Luxilus cornutus	CMSN	126
Bleeding shiner	Luxilus zonatus	BDSN	127

CommonName	ScientificName	LetterCode	NumericCode
Golden shiner	Notemigonus crysoleucas	GDSN	128
Unidentified shiner	Notropis sp.	UNO	129
Emerald shiner	Notropis atherinoides	ERSN	130
River shiner	Notropis blennius	RVSN	132
Bigmouth shiner	Notropis dorsalis	BMSN	134
Blacknose shiner	Notropis heterolepis	BNSN	136
Spottail shiner	Notropis hudsonius	STSN	138
Wedgespot shiner	Notropis greenei	WSSN	139
Silverstripe shiner	Notropis stilbius	SSPS	140
Rosyface shiner	Notropis rubellus	RYSN	141
Ozark minnow	Notropis nubilus	OZMW	142
Ghost shiner	Notropis buchanani	GTSN	143
Sand shiner	**Notropis stramineus**	**SNSN**	**144**
Mimic shiner	Notropis volucellus	MMSN	145
Silverband shiner	Notropis shumardi	SBSN	146
Bigeye shiner	Notropis boops	BESN	147
Topeka shiner	Notropis topeka	TPSN	148
Channel Shiner	Notropis subspecies	CNSN	149
Western silvery minnow	**Hybognathus argyritis**	**WSMW**	**150**
Brassy minnow	**Hybognathus hankinsoni**	**BSMW**	**152**
Mississippi silvery minnow	**Hybognathus nuchalis**	**SVMW**	**154**
Hybognathus spp.	**Hybognathus sp.**	**HBNS**	**155**
Plains minnow	**Hybognathus placitus**	**PNMW**	**156**
Suckermouth minnow	Phenacobius mirabilis	SMMW	158
Unidentified Pimephales	Pimephales sp.	UPP	159
Bluntnose minnow	Pimephales notatus	BNMW	160
Bullhead minnow	Pimephales vigilax	BHMW	161
Fathead minnow	Pimephales promelas	FHMW	162
Pugnose minnow	Opsopoeodus emiliae	PGMW	163
Pearl dace	Margariscus margarita	PLDC	164
Southern redbelly dace	Phoxinus erythrogaster	SRBD	165
Northern redbelly dace	Phoxinus eos	NRBD	166
Finescale dace	Phoxinus neogaeus	FSDC	168
Blacknose dace	Rhinichthys atratulus	BNDC	170
Longnose dace	Rhinichthys cataractae	LNDC	172
Peamouth	Mylocheilus caurinus	PEMT	173
Goldfish	Carassius auratus	GDFH	174
Goldfish x Common carp	Carassius auratus x Cyprinus carpio	GFCC	175
Grass carp	Ctenopharyngodon idella	GSCP	176
Black Carp	Mylopharyngodon piceus	BLCP	177
Common carp	Cyprinus carpio	CARP	178
Silver carp	Hypophthalmichthys molitrix	SVCP	180
Unidentified Asian Carp	Hypophthalmichthys spp.	UAC	181
Bighead carp	Hypophthalmichthys nobilis	BHCP	182
Rudd	Scardinius erythrophthalmus	RUDD	184
Unidentified sucker	Unidentified Catostomidae	UCT	200
Buffalo or Carpsucker	(Fish too small to differentiate between species in field)	UBC	202
Unidentified carpsucker	Carpiodes sp.	UCS	210
River carpsucker	Carpiodes carpio	RVCS	212
Quillback	Carpiodes cyprinus	QLBK	214
Highfin carpsucker	Carpiodes velifer	HFCS	216
Unidentified Catostomus	Catostomus spp.	UCA	220
Longnose sucker	Catostomus catostomus	LNSK	222

CommonName	ScientificName	LetterCode	NumericCode
White sucker	Catostomus commersonii	WTSK	224
Mountain sucker	Catostomus platyrhincus	MTSK	226
Blue sucker	**Cycleptus elongatus**	**BUSK**	**230**
Northern hog sucker	Hypentelium nigricans	NHSK	235
Spotted sucker	Minytrema melanops	SPSK	245
Unidentified buffalo	Ictiobus sp.	UBF	250
Smallmouth buffalo	Ictiobus bubalus	SMBF	252
Bigmouth buffalo	Ictiobus cyprinellus	BMBF	254
Black buffalo	Ictiobus niger	BKBF	256
Unidentified redhorse	Moxostoma sp.	URH	260
Shorthead redhorse	Moxostoma macrolepidotum	SHRH	262
Golden redhorse	Moxostoma erythrurum	GDRH	264
Black redhorse	Moxostoma duquesnei	BKRH	266
River redhorse	Moxostoma carinatum	RVRH	268
Silver redhorse	Moxostoma anisurum	SVRH	270
Unidentified Bullhead	Ameiurus spp.	UBH	305
Black bullhead	Ameiurus melas	BKBH	310
Yellow bullhead	Ameiurus natalis	YLBH	320
Brown Bullhead	Ameiurus nebulosus	BNBH	330
Unidentified Ictalurus	Ictalurus spp.	UIC	340
Blue catfish	Ictalurus furcatus	BLCF	350
Blue catfish x Channel catfish	Ictalurus furcatus x punctatus	BCCC	355
Channel catfish	Ictalurus punctatus	CNCF	360
Unidentified Catfish	Other than Ictalurus	UCF	365
Flathead catfish	Pylodictis olivaris	FHCF	370
Stonecat	Noturus flavus	STCT	380
Tadpole madtom	Noturus gyrinus	TPMT	390
Freckled madtom	Noturus nocturnus	FKMT	392
Slender madtom	Noturus exilis	SDMT	394
Grass pickerel	Esox americanus vermiculatus	GSPK	410
Northern pike	Esox lucius	NTPK	420
Muskellunge	Esox masquinongy	MSKG	430
Tiger Muskellunge	Esox masquinongy x Esox lucius	TGMG	435
Central Mudminnow	Umbra limi	MDMN	452
Rainbow smelt	Osmerus mordax	RBST	461
Bonneville cisco	Prosopium cylindraceum	BVSC	480
Cisco	Coregonus artedi	CSCO	482
Lake whitefish	Coregonus clupeaformis	LKWF	484
Cutthroat trout	Salmo clarkii	CTTT	505
Coho salmon	Oncorhynchus kisutch	CHSM	510
Rainbow trout	Oncorhynchus mykiss	RBTT	520
Golden trout	Salmo aguabonita	GDTT	533
Sockeye salmon	Oncorhynchus nerka	SESM	551
Chinook salmon	Oncorhynchus tshawytscha	CNSM	555
Mountain whitefish	Prosopium williamsoni	MTWF	558
Brown trout	Salmo trutta	BNTT	560
Brook trout	Salvelinus fontinalis	BKTT	565
Lake trout	Salvelinus namaycush	LKTT	566
Troutperch	Percopsis omiscomaycus	TTPH	568
American grayling	Thymallus arcticus	AMGL	570
Burbot	Lota lota	BRBT	577
Blackstripe topminnow	F. notatus	BTTM	581
Plains topminnow	Fundulus sciadicus	PTMW	582

CommonName	ScientificName	LetterCode	NumericCode
Northern studfish	Fundulus catenatus	NTSF	583
Plains killifish	Fundulus zebrinus	PKLF	584
Blackspotted topminnow	Fundulus olivaceus	BPTM	586
Western Mosquitofish	Gambusia affinis	MQTF	587
Banded killifish	Fundulus diaphanus	BDKF	588
Brook silverside	Labidesthes sicculus	BKSS	592
Banded sculpin	Cottus carolinae	BDSP	593
Mottled sculpin	Cottus bairdi	MDSP	594
Brook stickleback	Culaea inconstans	BKSB	597
Unidentified temperate bass	Morone or Percichthyidae spp.	UTB	600
White perch	Morone americana	WTPH	610
White bass	Morone chrysops	WTBS	620
Yellow bass	Morone mississippiensis	YWBS	630
Striped bass	Morone saxatilis	SDBS	640
Striped bass x White bass	Morone saxatilis x chrysops	SBWB	645
Unidentified sunfish	Unidentified Centrarchidae	UCN	700
Rock bass	Ambloplites rupestris	RKBS	714
Sacramento Perch	Archoplites interruptus	SOPH	716
Unidentified Lepomis	Lepomis sp.	ULP	720
Warmouth	Lepomis gulosus	WRMH	721
Green sunfish	Lepomis cyanellus	GNSF	722
Pumpkinseed	Lepomis gibbosus	PNSD	724
Orangespotted sunfish	Lepomis humilis	OSSF	726
Blue Gill x Orange Spotted Sunfish hybrid		BGOS	727
Green sunfish x Orangespotted	Lepomis cyanellus x L. humilis	GSOS	728
Bluegill	Lepomis macrochirus	BLGL	730
Green sunfish x Bluegill	Lepomis cyanellus x macrochirus	GSBG	735
Green sunfish x unknown	Lepomis cyanellus x sp.	GN*?	736
Longear sunfish	Lepomis megalotis	LESF	738
Redear Sunfish	Lepomis microlophus	RESF	740
Bluegill-Redear Sunfish Hybrid	L. macrochirus X L. microlophus	BGRE	745
Unidentified Micropterus spp.	Micropterus spp.	UMC	748
Smallmouth bass	Micropterus dolomieu	SMBS	750
Spotted bass	Micropterus punctulatus	STBS	760
Largemouth bass	Micropterus salmoides	LMBS	770
White crappie	Pomoxis annularis	WTCP	780
White-black crappie hybrid	P. annularis X P. nigromaculatus	WCBC	782
Unidentified Crappie	Pomoxis spp.	UPM	785
Black crappie	Pomoxis nigromaculatus	BKCP	790
Unidentified Percidae	Unidentified Percidae	UPC	800
Crystal darter	Ammocrypta asprella	CLDR	802
Unidentified darter	Percina or Etheostoma sp.	UDR	804
Banded darter	Etheostoma zonale	BDDR	805
Rainbow darter	Etheostoma caeruleum	RBDR	806
Stippled darter	Etheostoma punctulatum	STPD	807
Slough darter	Etheostoma gracile	SLDR	808
Missouri saddled darter	Etheostoma tetrazonum	MSDR	809
Iowa darter	Etheostoma exile	IODR	810
Greenside darter	Etheostoma blennioides	GSDR	811
Unidentified Etheostoma	Etheostoma sp.	UET	812
Least darter	Etheostoma microperca	LTDR	813
Johnny darter	Etheostoma nigrum	JYDR	814
Fantail darter	Etheostoma flabellare	FTDR	815

CommonName	ScientificName	LetterCode	NumericCode
Orangethroat darter	Etheostoma spectabile	OTDR	816
Unidentified Percina	Percina sp.	UPN	817
Blackside darter	Percina maculata	BSDR	818
Bluestripe darter	Percina cymatotaenia	BTDR	820
Gilt darter	Percina evides	GLDR	822
Slenderhead darter	Percina phoxocephala	SHDR	824
River darter	Percina shumardi	RRDR	826
Logperch	Percina caprodes	LGPH	828
Yellow perch	Perca flavescens	YWPH	830
Sauger	**Sander canadensis**	**SGER**	**840**
Unidentified Sander	Sander sp.	UST	842
Sauger x Walleye	Sander canadensis x vitreus	SGWE	845
Walleye	Sander vitreus	WLYE	850
Freshwater drum	Aplodinotus grunniens	FWDM	862
Snapping	Chelydra serpentine	SNPT	951
Painted	Chrysemys picta bellii	PATT	952
Blanding's	Emydoidea blandingii	BLDT	953
False Map	Graptemys pseudogeographica	FSMT	954
Red-Eared Slider	Trachemys scripta	REST	955
Smooth Softshell	Apalone mutica	SMST	956
Spiny Softshell	Apalone spinifera	SNST	957
Western Box	Terrapene ornata ornata	WEBT	958
Alligator Snapper	Macroclemys temminckii	AGST	961
Stinkpot	Sternotherus odoratus	SPOT	962
Map	Graptemys geographica	MAPT	963
Mississippi Map	Graptemys kohnii	MRMT	964
Ouachita Map	Graptemys ouachitensis	OUMT	965
Missouri River Cooter	Pseudemys concinna metteri	MRCT	966
Three-toed Box	Terrapene carolina triunguis	TTBT	967
Lab fish to be ID in lab		LAB	990
Unidentified	Unidentified	UNID	991
Age0 fish	(youngoftheyear)Unidentified	YOYF	992
Larval fish Unidentified		LVFS	993
Could not access area	(e.g., water in chute too low to access)	CNA	996
Conditions did not Allow for Gear Deployment	(e.g. you accessed the chute, but no flow to drift trammel net)	CNFH	997
Net Did Not Fish	"Net was lost or compromised and did not catch any fish of interest". Crew leader's discretion to record fish or not. Include MNCF in U6 and put species code on back page if fish data is recorded	NDNF	998
No fish caught	The gear functioned properly, but no fish caught	NFSH	999

MISSOURI RIVER
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APPENDIX I

STANDARD AND SUPPLEMENTAL
DATA SHEETS

Missouri River Data Sheet

Data sheet - 06-16-2009

FIELD OFFICE | PROJECT | SEGMENT | YEAR | UNIQUE IDENTIFIER

PAGE ____ OF ____

SEASON | MONTH | SET DATE DAY | YEAR | BEND | R / N | SUBSAMPLE | Pass | N | RECORDER | CHECKED BY

GEAR | S / W | TEMP (C) | Turbidity (NTU) | Conductivity | D.O.

Distance | Width (m) | BEND RIVER MILE | Net River Mile | Structure Number

USGS Gauge Code | River Stage | Discharge | U1 _____ | U2 _____ | U3 _____

U4 _____ | U5 _____ | U6 _____ | U7 _____

MACRO

MESO

MICRO

START TIME | **START LATITUDE** | **START LONGITUDE**

Stop Time | Stop Latitude | Stop Longitude

Habitat R\N

QC

	DEPTH (m)	Velocity (bot)	Velocity (0.8)	Vel (0.2 or 0.6)
1				
2				
3				

WATER VELOCITY

0 = Undetermined
1 = Eddy
2 = 0.0 – 0.3
3 = 0.3 – 0.6
4 = 0.6 – 0.9
5 = > 0.9

Cobble

0 = None
1 = Incidental
2 = Dominant
3 = Ubiquitous

Silt

Sand

Gravel

Must add up to 100% unless cobble = 3

Organic

0 = None
1 = Incidental
2 = Dominant
3 = Ubiquitous

Comments (one character per cell - begin each comment with reference number)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
																														1
																														2
																														3
																														4
																														5
																														6

Field Office	Project	Segment	Year	Unique Identifier
				–

PAGE ____ OF ____

M = Marked w/ Floy Tag
R = Recap w/ Floy Tag
D = Marked w/ Floy Tag & Fin Clip
B = Recap w/ Floy Tag & Fin Clip
L = Recap w/ Fin Clip but shed Floy Tag – Retagged
S = Recap w/ Fin Clip but shed Floy Tag – NOT Retagged

ID	Panel / Hook	Bait	Species	Length (mm)	Weight (g)	Count	Otolith	Ray Spine	Scale	Floy Tag	M/R
1					.						
2					.						
3					.						
4					.						
5					.						
6					.						
7					.						
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35					.						
36					.						
37					.						
38					.						
39					.						
40					.						

Field Office	Project	Segment	Year	Unique Identifier
				–

PAGE ____ OF ____

M = Marked w/ Floy Tag
R = Recap w/ Floy Tag
D = Marked w/ Floy Tag & Fin Clip
B = Recap w/ Floy Tag & Fin Clip
L = Recap w/ Fin Clip but shed Floy Tag – Retagged
S = Recap w/ Fin Clip but shed Floy Tag – NOT Retagged

ID	Panel / Hook	Bait	Species	Length (mm)	Weight (g)	Count	Otolith	Ray Spine	Scale	Floy Tag	M/R
					.						

Missouri River Supplemental Data Sheet

Data sheet – 06-16-2009

Field Office	Project	Segment	Year	Unique Identifier
				–

SEASON	MONTH	SET DATE DAY	YEAR	BEND	R / N	SUBSAMPLE	Pass	N	GEAR	S / W	RECORDER	CHECKED BY	PAGE
				–		–	–			–			OF

ROW	ID	TAG NUMBER	PIT	CWT	Dangler	Scute		EL		ER		Genetic	GENETICS VIAL #
			R/N/Z	Y/N	Y/N	Location /N	#	H/V/X	Color / N / X	H/V/X	Color / N / X	Y/N	
1													--
2													--
3													--
4													--
5													--
6													--
7													--
8													--
9													--
10													--

Column Descriptors

ID -- Row ID number from fish data sheet

Tag Number -- PIT or Dangler tag number

PIT -- R = Recap with PIT tag
N = New Pit tag Injected
Z = Malfunctioning tag Detected

CWT -- Y = Tag Present
N = Tag Not Present

Dangler -- Y = Tag Present
N = Tag Not Present

Scute -- Location (R = right, D = dorsal or L = left scute removed)
N if no scute removed

Scute # -- Scute number removed from the anterior

EL (Elastomer Left) – H = Horizontal position
V = Vertical position
X = Undetermined position

EL (Elastomer Left) – Color Code
N = Tag Not Present
X = Undetermined color

ER (Elastomer Right) – H = Horizontal position
V = Vertical position
X = Undetermined position

ER (Elastomer Right) – Color Code
N = Tag Not Present
X = Undetermined color

Genetic – Y = Genetic sample taken
N = Genetic sample not taken

Genetic Vial # -- Insert vial number

Elastomer Colors

Fluoresces	Non-Fluoresces
G – Green	W – White
O – Orange	V – Purple
R – Red	B – Brown
P – Pink	K – Black
Y – Yellow	U -- Blue

ROW	HEAD	SNOUT to MOUTH	INTER	Mouth Width	M-IB	L-OB	L-IB	R-IB	R-OB	Anal	Dorsal
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Morphometric Measurments

HEAD -- Tip of the rostrum to the posterior margin of the operculum.

SNOUT to MOUTH -- Tip of the rostrum to the anterior midline of the mouth.

INTER -- Tip of the rostrum to the anterior point of insertion of the ROB.

MOUTH WIDTH -- Widest measurement on the outer edge of the lips.

MIB (Mouth to Inner Barbel) -- Anterior point of insertion of the RIB to the anterior midline of the mouth.

L-OB (Left Outer Barbel) -- Anterior point of insertion to the tip.

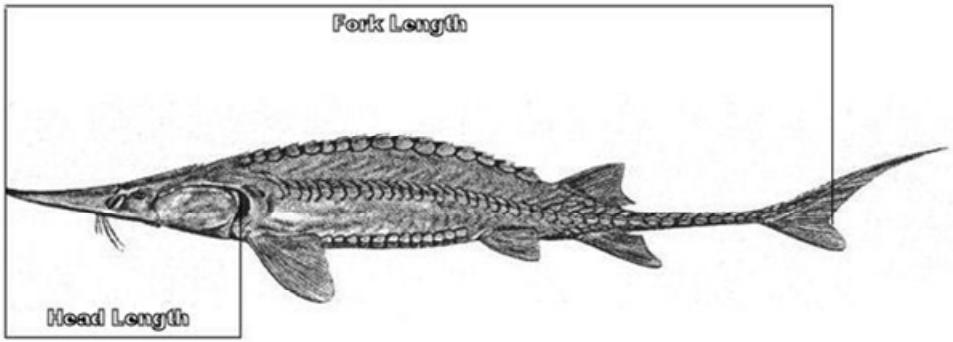
L-IB (Left Inner Barbel) -- Anterior point of insertion to the tip.

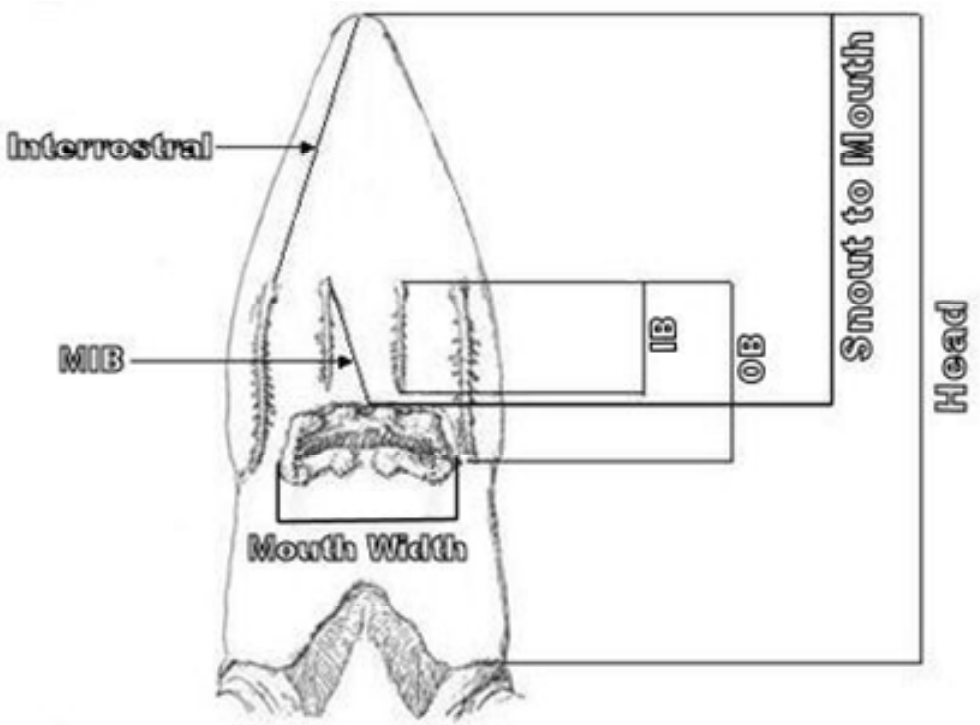
R-IB (Right Inner Barbel) -- Anterior point of insertion to the tip.

R-OB (Right Outer Barbel) -- Anterior point of insertion to the tip.

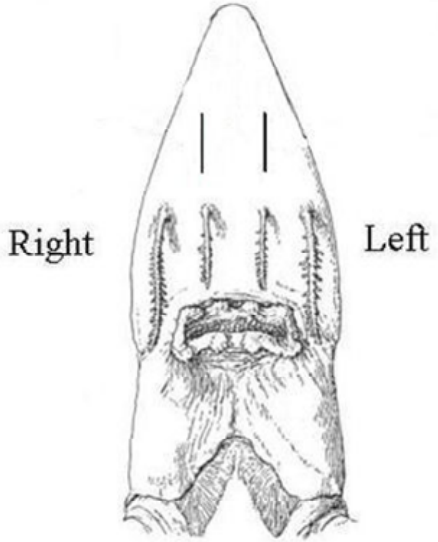
Anal/Dorsal – Number of rays at base of the fin.

Required Morphological Measurements for Pallid Sturgeon

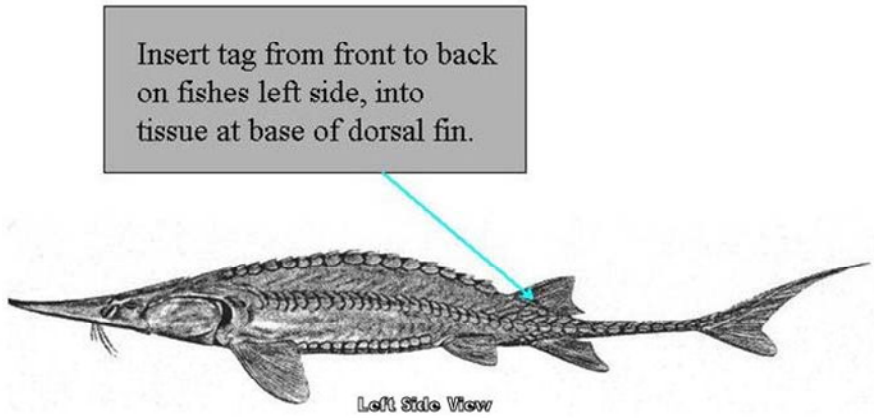




Location of Elastomer Tags



Required Tagging Location for PIT Tags



MISSOURI RIVER
STANDARD OPERATING PROCEDURES
FOR
SAMPLING AND DATA
COLLECTION

APPENDIX J

STANDARD AND SUPPLEMENTAL
DATA SHEET INSTRUCTIONS

DATASHEET INSTRUCTIONS – PROJECTS 1 & 2

SAMPLING DATASHEET INSTRUCTIONS

The first or front page includes specific information for location, gears, habitat, etc. Habitat parameters are required whenever a pallid sturgeon is collected or in conjunction with one sub-sample per mesohabitat (within a macrohabitat) for each gear type or a minimum of 25% of these sub-samples.

When habitat parameters are taken for gill nets, trammel nets and trawls, habitat data are collected at the mid-point of the net, drift or trawl and is recorded in line #2. Additional habitat data may also be recorded at the start and stop locations (ends) of the net, drift or trawl. When this additional data is collected, it is recorded in lines #1 and #3. When habitat parameters are taken for hoop and mini-fyke nets, habitat data are collected at the mouth/cab of the gear and is recorded in line #2.

FIELD OFFICE: Two-digit code (Required)

Columbia National Fish and Wildlife Conservation Office:	CF
Missouri Department of Conservation:	MO
Nebraska Game and Parks Commission:	NE
South Dakota Game, Fish & Parks:	SD
Great Plains FWMAO:	GP
Missouri River FWMAO:	MR
Montana Fish, Wildlife and Parks:	MT

PROJECT: Two-digit code (Required)

Pallid Sturgeon Population Assessment Program:	01
Habitat Assessment Program:	02
Chute Study–Mitigation Project:	03
Spring Rise Evaluation:	04

SEGMENT: Two-digit code (Required)

Segment Number	**Mainstem Missouri River and Kansas River**
01	Fort Peck Dam to Milk River
02	Milk River to Wolf Point
03	Wolf Point to Yellowstone Confluence
04	Yellowstone Confluence to Lake Sakakawea Headwaters
05	Fort Randall Dam to Niobrara Confluence
06	Niobrara Confluence to Lewis and Clark Lake Headwaters
07	Gavins Point Dam to Ponca
08	Ponca to the Platte Confluence
09	Platte Confluence to the Kansas Confluence
10	Kansas Confluence to the Grand Confluence
11	Kansas River from confluence with the Missouri upstream to Hwy 7 bridge
12	Combined into segment 13 effective 7/01/2005
13	Grand Confluence to Osage Confluence
14	Osage Confluence to the mouth
Segment Number	**Tributary**
21	Milk River (MT)
22	Yellowstone River (ND)
23	Niobrara River (NE)

24	James River (SD)
25	Big Sioux River (IA)
26	Platte River (NE)
27	Grand River (MO)
28	Osage River (MO)
29	Gasconade River (MO)
31	Bazile Creek (NE)
32	Vermillion River (SD)
33	Nishnabotna River (MO)
34	Platte River(MO)
35	Fishing River (MO)
36	Lamine River (MO)
37	Chariton River (MO)
38	Perchy Creek (MO)
39	Crooked River (MO)
40	Nodaway River (MO)
41	Nemaha River (MO)
42	Tabo Creek (MO)
Segment Number	**Reservoirs**
51	Fort Peck Reservoir
52	Lake Sakakawea
53	Lake Oahe
54	Lake Sharpe
55	Lake Francis Case
56	Lewis and Clark Lake
71	Mississippi River

Tributary mouth vs. **Tributary Sampling-**When sampling a Tributary mouth (lower 300 meters of a tributary entering the mainstem Missouri River), this will be recorded in conjunction with the Missouri River (Segment, Rivermile, Bend, etc.) which is consistent with the design of the Population Assessment Program. If the intent of the sampling is to conduct "wild" (non-standard sampling) in a tributary, then the appropriate segment designation should be recorded on the data sheet for the tributary being sampled.

YEAR: Two-digit code indicating the current calendar year (Required)

UNIQUE IDENTIFIER: Four-digits (1-9999) (Required)

Restarts to 1 at the beginning of every sampling year. NOTE – it is very critical that the UID's are never the same for each Segment.

PAGE □□ OF □□: Two-digit (Required)

The first set of two boxes indicates which page this is of the total pages for a particular gear deployment and the second set of two boxes indicates the total number of pages used for that particular gear deployment.

SEASON: Two-digit code (Required)

Sturgeon:	ST
Fish Community:	FC

MONTH: Two-digit code (01-12) (Required)

DAY: Two-digit code (01-31) (Required)

For passive gears, day is the set day and not the retrieval day

YEAR: Two-digit code (00-99) (Required)

BEND: Two-digits code (1-99) (Required)

All bends will be identified prior to sampling; all bends within a segment will be numbered in order within each segment. The number of the bend that is being sampled will be recorded when sampling in the main stem Missouri River. When sampling in tributaries, average bend length has been determined at 2.4 river miles. The lowest 2.4 miles of a tributary will be considered bend number 01 followed by bend number 02 (2.4-4.8 miles) and bend 03 (4.8-7.2 miles), etc. Regardless of season or required additional sampling (additional Passes) when a pallid is captured, bends will be distinguished as randomly selected (R) or non-randomly selected (N) on the data sheet.

BEND R/N: Single-digit code (Required)

Randomly selected bend	R
Non-randomly selected bend	N

SUB-SAMPLE: Two-digit code (01-99) (Required)

Each gear deployment is a sub-sample. Sub-sample numbering will be consistent with the design of the Project 1 where gear deployment is guided by the habitats available within the bend. Sub-samples will be numbered 1-X for each gear by Macrohabitat/Mesohabitat combination. For example, if you were sampling in bend and made 5 trammel net drifts in the ISB and 3 in the CHXO, you would number your sub-samples as 1 through 5 for those drifts in the ISB and 1-3 for those drifted in the CHXO to achieve the minimum of 8 sub-samples for that gear.

PASS: Single-digit code (1-9)

The first sub-sample in an area is "pass" 1. When ever a pallid sturgeon is collected with an active gear, it is a requirement to do two additional samples in this exact location even if the minimum distance for the gear is not achieved. The pass box will be left blank for the first sub-sample collected. The additional sub-samples will be recorded in the exact manner (sub-sample will remain the same as the original sub-sample). Each additional pass will be numbered beginning with 2 and then consecutively numbered. If another pallid sturgeon is captured during the additional pass, additional passes are required to be collected. A limit of nine passes may be collected in this exact location. If a crew deliberately makes repetitive gear deployments in the same location for whatever reason (e.g., exploratory, previous hot spot), the same data recording procedures will be followed as when you capture a pallid sturgeon.

"N": Single-digit code

Whenever an additional pass is required or sampling effort is directed specifically in one location place an "N" (non-random) in the box. All other sampling efforts are considered random effort and the box can be left blank.

RECORDER: Three-digit code (Required)

The initials of the individual that recorded the data. The first initial of the individual's first, middle, and last name (If no middle name, use "X" for middle initial.).

CHECKED BY: Three-digit code (Required)

The initials of the individual that checks the data sheet prior to submitting this for data entry. This must be somebody other than the recorder! The first initial of the individual's first, middle, and last name (If no middle name, use "X" for middle initial.). The individual that is checking the data sheets should clarify in the comments section all situations where the protocols were not followed. For example, for a large collection of shovelnose sturgeon that weight data was not collected, this should be explained in the comments section referencing the unique ID and the circumstances (shovelnose sturgeon weight data was not collected…..too many fish, scale malfunction, etc.).

GEAR: Five-digit code (Required)

See the Missouri River Standard Operating Procedures for Sampling and Data Collection Appendix N for a complete list of gear codes. This list also identifies standard gears for projects 1-3. Codes in Green are Standard Gears for the Population Assessment Program

S/W/E: Single digit code (Required)

Standard Gear	S
Wild Gear	W
Evaluation	E

TEMPERATURE: Three-digits to 1 decimal place (Required)

The recorder is required to record to the nearest degree in Celsius, but has the option of record up to a single decimal place. Temperature is recorded on the day the gear is set.

Turbidity: Four-digits (Only required when collecting habitat parameters)

Record to the nearest Nephelometric Turbidity Unit (NTU). Recorded following gear retrieval.

Conductivity: Four-digits (Not required for Project 1)

Record to the nearest microhos/cm^3 . Recorded following gear retrieval.

Dissolved Oxygen: Three-digits (Not required for Project 1)

Record to one decimal place (units are parts per million (ppm) and milligrams/liter (mg/L). Recorded following gear retrieval.

Distance: Three-digits (Required for trawling, drifting trammel nets, seining when using the rectangular method and mini-fyke netting)

Record in meters, indicating length of sample. Mini-fyke netting distance is measured perpendicular to the bank line to the midline of the first cab. This measurement will be recorded in centimeters for mini-fyke nets.
When retrieving the trotline, the number of hooks that fished is recorded in the DISTANCE box on the front of the data sheet.

Width: Three-digits (Only required for Seining)

Record width in tenths of a meter for the width of the seine hauls (not the length of the seine).

Bend River Mile: Five-digits (Required)

Record the upper river mile identifying the bend being sampled in the Missouri River or the river mile of the tributary being sampled. All tributaries being sampled have segment numbers.

Net River Mile: Five-digits (Required)

Record the river mile location identifying where the sample was collected in the mainstem Missouri or the river mile of the tributary if sampling a tributary. Should be recorded to the nearest .1 of a mile based on the quality of the maps available.

Structure Number: Nine-digit code (Optional)

Record the Corps dikes or other structures number (based on 1890 river mileage). An extra box was added after the decimal point for the number structures involving additional letters or numbers.

USGS Gauge Code: Eight digit code (Optional)

USGS Gauge Station Code - The nearest USGS gauge to the sampling location should be used. If sampling near a tributary, use the nearest gauging station that represents the discharge at the location you are sampling. For example, if sampling a bend above a major trib, there's a possibility that the "nearest" gauge will have tributary influence thus a higher discharge and stage. The gauge should be read in conjunction with the time that the net was set for passive gears.

River Stage: Three-digits (Optional)

Record the daily gauge height in feet.

Discharge: Six-digits (Optional)

Record the daily discharge in cubic feet per second (CFS)

Utility Boxes (U1-U7): For additional information (e.g., such as drift netting to record flow meter readings). Use of utility boxes will be in accordance with the following. Additional use of utility boxes must be coordinated with the database manager to ensure

multiple uses of these boxes is compatible do not conflict with data queries and subsequent analysis within each project.

Utility Box	Project	Required	Usage	Comments
U1	1		was being used in conjunction with the PIT Tagging/Scute Marking effort in the Fort Peck Reach.	
	3	X	Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. The main river above the chute will be coded as segment 17	
U2	1	X	initial hook number for trotline	
	2	X	Trip/Rounds for repeat visits to bends or chutes	
U3	1		Push Trawl/Minifyke proximity evaluation	
U4	3	X	Number of seconds of shock time for electro fishing.	
U5	3	X	Gauge height of river 6 AM the day the nets are picked up. If collected for other projects, it should be recorded in U5.	
U6	All	X	If a net does not fish properly, but catches fish, MNCF will be recorded in this utility box and the actual fish species codes will be recorded on the back of the standard data sheet.	
U7	All	X	For targeted pallid sturgeon broodstock collection efforts, "BS" (Broodstock) will be recorded for all gear deployments	

The map box may be used for keeping track of the number of jars taken back to the lab for post processing as this information does not need to be entered into the database.

MACRO: Four-digit code (Required)

See the Missouri River Standard Operating Procedures for Sampling and Data Collection for the description of macrohabitats.

MESO: Four-digit code (Required)

See the Missouri River Standard Operating Procedures for Sampling and Data Collection for the description of mesohabitats.

MICRO: Six-digit code (Required for Segment 8 – 14)

See the Missouri River Standard Operating Procedures for Sampling and Data Collection for the description of microhabitats.

START TIME: Four-digits (Required)

Recorded in military time and is required for all gears.

Stop Time: Four-digits (Required for passive gears only)

Recorded in military time for passive gears only.

START LATITUDE AND LONGITUDE: Seven-digits (Required)

Recorded in decimal degrees and is required for all gears.

Stop Latitude and Longitude: Seven-digits (Required for active gears only)

Recorded in decimal degrees for active gears only.

DEPTH: Three-digits (Required but each gear had different depth requirements)

Gill Nets: Record depth at the upstream end of the net in row 1, the midpoint depth is recorded in row 2 and the downstream end of the net in recorded in row 3.

Trotline: Record depth at the upstream or near shore end (if set perpendicular to shore) of the line in row 1, the midpoint depth is recorded in row 2 and the downstream or far shore end of the line is recorded in row 3, with line 1 being in conjunction with the GPS coordinate.

Active Nets (TN and OT16): Record depth at the beginning of the drift in row 1, the midpoint depth is recorded in row 2 and the end of the drift is recorded in row 3.

Hoop Nets: Record depth at the approximate location of the mouth in row 2

Bag Seine: Depth will be recorded at the midpoint and the fullest extent of the seine and recorded in rows 1 and 2.

Mini-fyke: Depth will be recorded at the mouth of the cab and will be recorded in row 2.

Set lines: Depth will be recorded at the approximately location of the hooks and recorded in row 2.

Fishing/Angling: Depth will be recorded at the location of the boat and recorded on line 2 (If significantly different than directly below the boat, depth is measured via sonar in the area the hooks are deployed).

Velocity Measurement: Three-digits (only required when collecting habitat parameters)
Recorded following gear retrieval.
Record three digits in meter pre second (m/s) to two decimal places. When depths are greater than 1.2 meter, velocity measurements are taken on the bottom, 0.8 and 0.2 of the water column and recorded on their respective boxes. When depths are less then 1.2 meter (BARS habitats), velocity measurements are taken on the bottom and 0.6 of the water column and recorded on their respective boxes. Velocity measurements will not be collected in "Eddies" as circular flow will provide unreliable measurements.

VISUAL ESTIMATIONS: Single-digit (Required)

Record a number in the water velocity box based on your estimation of the surface velocity. Visual estimation is required for every gear deployment (unless environmental conditions inhibit the ability to make a visual estimation) and is always completed prior to measuring water velocity.

0 = If environmental conditions do not allow for making a reliable visual estimation.

1 = Eddy: Where flow is circular.
2 = 0.0-0.3 meters/second
3 = 0.3-0.6 meters/second
4 = 0.6-0.9 meters/second
5 = >0.9

Habitat: Single-digit (only required when collecting habitat parameters)

Random	R
Non-random	N

A non-random selection would be a site that wasn't included in the random selection, but a pallid sturgeon was collected and therefore the habitat data collection was required by the protocols.

Substrate: (Optional but only recorded when collecting habitat parameters):
Recorded following gear retrieval.

Cobble: Single-digit code

Absent from the sample	0
Incidental	1
Dominant	2
Ubiquitous	3

Silt, Sand and Gravel: Visual estimate of percent composition by particulate size. Each recorded from 0 to 100%. The three estimates must total 100

Organic: Single-digit code

Absent from the sample	0
Incidental	1
Dominant	2
Ubiquitous	3

Quality Control: Single-digit code (Optional)

Place and "X" in this box if the substrate sample is quantified by laboratory methods of drying, sieving and measuring to compare against the visual estimation that was conducted in the field. Do not change estimates on the data sheet based on the QC sample.

Comments: Up to 180 characters can be recorded with one character per box.

Mapping Box: This space is available for sketches for better clarification.

FISH DATASHEET INSTRUCTIONS

The second page is for recording information specific to the fish collected (i.e., species, length, weight, etc.) and is designed to handle up to 40 fish. It is critical the Field Office, Project, Segment, Year and UID are identical to the information on the Sampling Datasheet.

Panel/Hook: Record numeric code (Required for gill nets, set lines and trot lines)

Gill Net	Panels 1-8
Set Line	Hook sizes
Fishing/Angling	Not Required
Trot Line	Hook sizes

Hook Size	Code
1/0	10
2/0	20
3/0	30
4/0	40
5/0	50
6/0	60
7/0	70
8/0	80
9/0	90
10/0	99
11/0	11
12/0	12
13/0	13
14/0	14
1	01
2	02
3	03
4	04
5	05
6	06
7	07
8	08
9	09

Bait Box: Record single alpha code (Required for set lines and trot lines)

Worm or Crawler	W
Leech	L
Fish	F
Cut Bait	C

Species Codes: Record up to four digit alphabetic code or three digit numeric code (Required)

Length: Record up to four digits (0-9999) in millimeters (Required for all fish unless greater than 25 fish per species is collected and a count is completed). If a fish does not have a tail or is deformed to the point that a measurement cannot be taken, no length or weight

data should be collected, but a brief explanation should be included in the comments section.

Weight: Record up to six digits (0-99999.9) in grams to the nearest tenth. Required for pallid sturgeon, shovelnose sturgeon, blue suckers and sauger. If these species are not weighed and are greater >500mm in length, the reason for not weighing these must be recorded in the comments section identifying the Unique Identifier for each gear deployment for which this occurs (e.g., "Too many fish to weigh") If a fish is too small to weigh, this field will be left blank (No explanation is required). In segments where gill net catch rates for shovelnose sturgeon are high, crews have the option of subsampling weights to reduce the time spent processing these fish. See Appendix C, page C-1 for a description of the subsampling protocol.

Count: Record up to four digits (0-9999) by species for the total number of fish that were not individually measured. This column can only be used for trawling and mini-fyke netting only. For all other gears, all fish will be measured.

Otolith, Ray/Spine, Scale: Place an "X" in the appropriate column to indicate which structure(s) were collected for age-growth analysis. One or more columns may be marked. When the entire fish is preserved, place an "X" in the scale column. For mortalities of blue sucker, sauger, paddlefish, shovelnose sturgeon, lake sturgeon and pallid sturgeon, record an "M" in the otolith box. The presence of distended mouth in shovelnose and pallid sturgeon will be recorded as the letter "D" in the Otolith box. Project 4: For gravid shovelnose sturgeon, record a G in the scale box.
Record Egg Check marks in the comments section of the data sheet.

Floy Tag: Up to 8 digits may be recorded in the Floy Tag Box. The 1st digit will be an alphabetic character to provide a link with the appropriate tag prefix based on the tags already being used in the Mississippi, Missouri and Wabash Rivers. Include the appropriate alphabetic character corresponding with the pre-fix followed by the number of the tag in the Floy Tag Box (e.g. A tag with COE-NWD 23535 would be recorded as C23535 on the data sheet). All Floy Tags will be recorded on the standard data sheet and not on the supplemental! Fish less than 330mm may not be tagged due to their small size. No explanation is necessary when fish are not tagged. If a shovelnose sturgeon does not have a tail or is deformed to the point that a measurement cannot be taken, no length or weight data should be collected, but a brief explanation should be included in the comments section and the fish should be floy tagged.

Crews sampling in segments 1 - 4 will provide the data to the Fort Peck Office of the Montana Fish, Wildlife and Parks and will not record the data on the standard data sheet. Therefore, this information will not be included in the centralized database.

Tag Prefix	Code	Agency/Group	River Used
COE-NWD	C	Corps-Northwest Div.	Missouri
MDC	M	Missouri Dept. of Conservation	Mississippi/Missouri
ORFS	O	Missouri Dept. of Conservation	Mississippi/Missouri
LTRMOO	L	Missouri Dept. of Conservation	Mississippi
LTRMP	P	Illinois-Dept. of Natural Resources	Mississippi
LTRM	X	Missouri Dept. of Conservation	Mississippi

WES	W	Waterways Experiment Station (ERDC)	Mississippi
WES	W	Illinois-Dept. of Natural Resources	Mississippi
SIUC	S	Southern Illinois University (Carbondale)	Mississippi
SIUC	S	U.S. Fish & Wildlife Service-Carterville	Mississippi
USFWS	U	U.S. Fish & Wildlife Service-Carterville	Mississippi
USFWS	U	Indian-Dept. of Natural Resources	Wabash
*No prefix	B	Purdue University	Wabash
**MDCLS	A	Missouri Dept. of Conservation	Missouri/Mississippi
USGS	G	USGS-Columbia Environmental Research Center	Missouri
UNL	N	University of Nebraska-Lincoln	Platte
Other	All other Floy Tags encountered will be recorded in the comments section		

*There is no prefix to the number on the Purdue University tags.
**This tag prefix was used for Lake Sturgeon only.

M/R: Record a single digit alphabetic code when a floy tag is implanted or recaptured.

M	Marked with Floy Tag
R	Recapture with Floy Tag
D	Marked with Floy Tag and fin clip
B	Recapture with Floy Tag and fin clip
L	Recapture with fin clip but the Floy Tag was shed and retagged
S	Recapture with fin clip but the Floy Tag was shed and not retagged

Information for all other tag types should be recorded on the supplemental data sheet. There are 3 pages to the standard data sheet. The first or front page includes specific information for location, gears, habitat, etc. The second page is for recording information specific to the fish collected (i.e., species, length, weight, etc.) and is designed to handle up to 40 fish. An additional datasheet (that is same as the second page with the exception that there are no ID numbers pre-printed) must be used if more than 40 fish are collected for a single gear deployment. The additional data sheet may be used in place of the second page, but the ID numbers must be filled in. This is essential to link the individual fish information with tagging information which is recorded on the supplemental data sheet.

MISSOURI RIVER SUPPLEMENTAL DATA SHEET

The supplemental data sheet is required whenever a pallid sturgeon is collected. This sheet may also be used for other species such as lake sturgeon or other species that may have additional information such as tag numbers or other unique tagging. **The supplemental data sheet must be used in conjunction with the basic data sheet (It is not designed to stand alone.)!** This form does **not** replace the Pallid Sturgeon Data Sheet required by the USFWS.

The instructions for the Data Sheet also apply to the header portion of the Supplemental Data Sheet. The unique identifier is critical to link the data up between these sheets (i.e., length and weight, GPS, etc.). The Supplemental Data Sheet will enable this Program to incorporate the tagging and recapture information into this database.

Be sure to complete the header information and ensure that the unique identifier and page □□ of □□ is completed and accurate on the Supplemental Data Sheet.

ID (Identification): Transfer the ID Number from the Standard Data Sheet corresponding with this fish to the ID boxes on the Supplemental Data Sheet.

Thoroughly scan/check the fish for a tag (i.e., PIT Tag, Coded Wire Tag, elastomer tag, etc). The PIT Tag is the primary tag (provides the most detailed history information about the fish) and will supersede all other tags when recording recapture information on the supplemental data sheet. If the fish has a PIT Tag, record the PIT Tag number. Currently, all hatchery-reared and stocked pallids are being tagged using two tag types (since tag retention rates are highly variable). If an encrypted tag is encountered, a new unencrypted tag should be injected into the fish and recorded. Lake Sturgeon should be treated like a pallid sturgeon. Check for a PIT Tag. If a tag is not present, a PIT Tag should be injected into the lake sturgeon in the same location as is done on the pallid sturgeon. Additionally, a genetic sample should be collected on all lake sturgeon and sent to Dave Herzog at the Missouri Department of Conservation. Follow the same protocols as used for genetic samples for pallid sturgeon. Dave Herzog, Open Rivers and Wetland Field Station, 3815 East Jackson Blvd.,Jackson, MO 63755.

Tag information: All of the tags types are listed. If more than two tags are present, the PIT Tag will always receive priority for recording its number on the data sheet as it provides the greatest information about that individual fish. No priority order for the remaining tags; however, additional tagging information should be recorded under each of the remaining tag boxes. For each of the remaining tag types, place a "Y" in the box if the tag is present or an "N' in the box if the tag is not present. Only place an "N" in the box if you actually checked for this type of tag and no tag was present. Leave the box blank if you did not check for that particular tag type. Refer to the Column Descriptors box on the supplemental data sheet for additional guidance in completing this section.

Tag Codes:
R/N/Z: Recorded for any pallid that does not already have a PIT Tag to identify this as a new tag. Any pallid sturgeon that does not have a PIT Tag will be PIT Tagged prior to release provided it is >160mm fork length. This will enable the database to identify these new fish (tags) and make the information readily available to include into the Service's database for all pallid sturgeon PIT Tagging information. Record an R if a pallid is recaptured with a PIT Tag and a Z if a malfunctioning tag is detected.

Other Tag Types (CWT, Scute): Record "Y" if these tag types are present, "N" if no tag present or no scutes removed. Leaving this blank indicates that you did not check.

For recording Scute Mark information: (Single digit code)
Location: R=Right, L=Left and D=Dorsal
Number: Record the number of the scute removed (count starts from the anterior). This will never be a 1 as the 1st scute will never be removed as this serves as a reference point. If more than 1 scute is missing, record the number of the most anterior scute. For example, during the marking effort, both the 3rd and 4th right lateral scutes were removed. This would be recorded as R 3

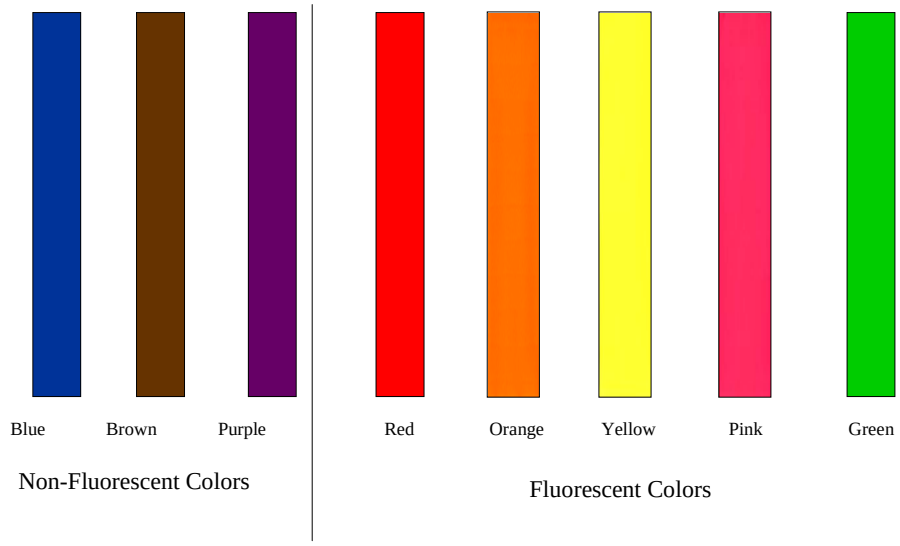
EL (elastomer left side) and ER (elastomer right side)
H/V/X: Elastomer orientation recorded as:
H: Horizontal (mark is perpendicular relative to the fish's body)
V: Vertical (mark is parallel relative to the fish's body)
X: Unknown (indicating that the original mark could have been either a vertical or horizontal mark. Note: fish marking practices only include the horizontal and vertical marks). If the mark is identified as an unknown in the field, the crew leader may be able to correct this on the datasheet prior to submitting this for data entry based on the tag combinations and orientation schemes that have been used.
Color/N:
EL (Elastomer Left): Fill in appropriate color code (letter code) for the elastomer locations-leave blank if NA. Codes are on the Supplemental Data Sheet. If color cannot be determined using the Visible Implant Elastomer Color Standard (card), record an "X".

ER (Elastomer Right): Fill in appropriate color code (letter code) for the elastomer locations-leave blank if NA. Codes are on the Supplemental Data Sheet. If color cannot be determined using the Visible Implant Elastomer Color Standard (card), record an "X".

Elastomer Colors and Codes:

G	Green	**W**	White
O	Orange	**V**	Purple
R	Red	**B**	Brown
P	Pink	**K**	Black
Y	Yellow	**U**	Blue
X	Unable to determine color		

Elastomer Color Combinations



For all pallid sturgeon captures without evidence of a tag, a series of morphological measurements must be taken. In addition to measurements on these unmarked fish, morphometric measurements will be collected on a minimum of 5 fish per year class (known year class) per crew. Dorsal and anal fin ray counts must also be completed when collecting morphometric measurements. For further clarification on these measurements refer to the diagrams on the back of the supplemental data sheet.

Head (Head Length): Tip of the rostrum to the back of the opercle flap.
Snout to Mouth: Anterior edge of mouth (midline of anterior cartilage edge of labial depression {This is anterior to the lips}) to the Tip of the Rostrum.
Mouth Width: Widest measurement on the outer edge of the lips when mouth is retracted.
Inter (Interrostral Length): Tip of rostrum to the front edge of the outer barbell.
M-IB (Mouth to Inner Barbell): Leading edge of mouth to the front edge of inner barbell.
L-IB (Left -Inner Barbell Length): Front leading edge of inner barbell to its tip.
L-OB (Left-Outer Barbell Length): Front leading edge of outer barbell to its tip.
R-IB (Right -Inner Barbell Length): Front leading edge of inner barbell to its tip.
R-OB (Right-Outer Barbell Length): Front leading edge of outer barbell to its tip.
Anal Fin Ray Count: Required
Dorsal Fin Ray Count: Required

A small tissue sample must be collected for genetic analysis of all wild pallid sturgeon. For guidelines regarding tissue sample collection and other handling procedural information, refer to Biological Procedures and Protocol for Collecting, Tagging, Sampling, Holding, Culture, Transporting, and Data Recording for Researchers and Managers Handling Pallid Sturgeon (10/02/2002), which is printed below for easier reference.

Data Sheet Protocol for Mitigation/Chute Study
April 2008

Segment Selection:

Each chute/backwater will be separated into 16 equal segments. These 16 segments will be randomly ordered for each gear in each chute. The first 8 of these randomly ordered segments will be selected per gear per chute. In cases where a randomly selected segment cannot be accessed or the specific gear cannot be fished, the first segment in the second group of eight will be used. In cases where the replacement segment cannot be accessed or fished, the next segment in order will be used. This process will continue until you have reached a fishable segment, run out of segments, or reach a total of 8 fishable samples per gear per chute.

EX: **Upper Hamburg Chute----**

	EF
Randomized chute segments	3
	11 --- CNA Replaced w/ 15
	1
First 8 segments	7
	8
	16 --CNFH Replaced w/5; 5 is dry so go to 9
	4
	2
	15
	5
	9
Second 8 segments	6
	10
	12
	14
	13

Data Sheet instructions: Regardless of gear used these are required.

--Segments will be recorded on the data sheet in **Utility Box 1**. A replacement segment will always be coded with a 9 in front of the segment number.

EX: Segment 15 in the above scenario will be coded in U1 as 915.

--Each segment that has been drawn will have its own data sheet.

EX: Segment 16 above will have data sheet with CNFH code. Segment 5 (coded 905) will have a data sheet with CNA code.

NE -- Nebraska Game and Parks
IA -- Iowa DNR
CF -- USFWS Columbia, MO

Project --- **03 --** Mitigation/Chute Study

Segment-- Segment of main river channel as designated by the Pallid Sturgeon Assessment.

Year --- Year sampling is occurring

Unique Identifier—Individual number for each data sheet. **IT CANNOT BE DUPLICATED IN THE SAME YEAR!!!!!!!!** It can start back at 0 the following year.

Page-- Each side of data sheet equals 1 page.

EX: front side of data sheet = page 1 of total number of pages.
Back side of data sheet = page 2 of total number of pages.

Month Day Year—Date that sampling occurred or day sets were made.

Bend- R/N -- Number assigned to bend by the Pallid Sturgeon Assessment. All bends for project 3 are N for non-random.

Recorder -- Initials of person recording data.

Checked By – Initials of person (**not the recorder**) who checks data for QA/QC.

Bend River Mile—River mile where bend starts as designated by the Pallid Sturgeon Assessment.

Species-- Four digit code based on the Pallid Sturgeon Assessment.

Length (mm)—Total length measurement of all species with these exceptions: paddlefish are measured from the eye to fork and sturgeon are measure to the fork.

Weight (g)-- Weight is measured on species of interest.

Count-- Only 25 individuals of a single species are to be measured per sample. Any additional individuals just need to be counted and the number entered in this box.

Floy Tag—M/R/D/B/L-- If tagging or you recapture a tagged fish, enter tag number here. M designates a new floy tag. R designates a recaptured fish. D designates a new floy tag and fin clipping. B designates a recaptured fish that has been fin clipped. L designates a recaptured fish that has been fin clipped but has lost the floy tag.

Additional Data Sheet Instructions: Gear Specific

Electrofishing –Chute segments will have both banks sampled for the entire length of the segment and both banks will be combined into 1 sample. Shocking requires a minimum of 2000 watts. Dip nets require 1/8" mesh.

Gear- S/W – EF standard (S)
NEF Night electrofishing is wild (W)

Temp (C) -- Taken at the mid point of segment in degrees Celsius.

Turbidity -- Taken at the mid point of segment.

Conductivity—Taken at the mid point of segment.

D.O. -- Taken at the mid point of segment one time inside the chute and one time outside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1.

U4 -- Number of seconds of shock time.

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site. For segements shocked the last three boxes will be coded as **000**.

Start Time-- Recorded in military time. Time electrofishing started.

Stop Time-- (**Optional)** Recorded in military time. Time electrofishing stopped (can be used to determine shock seconds.

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the start of the segment.

Stop Latitude/Stop Longitude—A GPS coordinate (decimal degrees) will be taken at the end of the segment.

Depth (m) -- Taken at the mid point of the segment. **Recorded in Line 2.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mid point of the segment at the **bottom**, **80%** of the depth and **20%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mid point of the segment. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel—Taken at mid point of the segment. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Trammel netting—Start and stop time must be recorded if dead setting trammel nets. Do not exceed 3 hours when dead setting.

Gear-S/W -- **TN11** 25' net Standard (S)
TN12 75' net Standard (S) >size determined by conditions
TN13 100' net Standard (S)
TN50 50' net Standard (S)
TN 125' net Standard (S)

Temp (C) -- Taken at the mid point of every drift in degrees Celsius.

Turbidity -- Taken at the mid point of every drift.

D.O. -- Taken at the mid point of every drift one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

Distance-- Total distance of drift in meters.

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Recorded in military time. Time trammel netting started.

Stop Time-- **(Optional)** Recorded in military time. Time trammel netting stopped.

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the start of the drift.

Stop Latitude/Stop Longitude—A GPS coordinate (decimal degrees) will be taken at the end of the drift.

Depth (m) -- Taken at the beginning, mid point, and end of every drift. **Recorded in Lines 1, 2, and 3 respectively.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mid point of every drift at the **bottom**, **80%** of the depth and **20%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mid point of every drift. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel—Taken at mid point of every drift. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Hoop netting-- Hoops can be fished as long as throats are under water and the hoops will remain standing.

Gear-S/W -- **HN** 4' hoop net Standard (S)
SHN 2' hoop net Standard (S)
XHN Tandem set Wild (W)

Temp (C) -- Taken at the mouth of hoop in degrees Celsius.

Turbidity -- Taken at the mouth of hoop.

D.O. -- Taken at the mouth of hoop one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Time of day net was set (military time).

Stop Time-- Time of day net was picked up (military time).

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the mouth of hoop.

Depth (m) -- Taken at the mouth of the hoop. **Recorded in Line 2.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mouth of the hoop at the **bottom**, **80%** of the depth and **20%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mouth of the hoop. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel— Taken at mouth of the hoop. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Mini-fyke

Gear-S/W -- **MF** 2 x 4 Standard (S)
FN 4 x 4 Wild (W)

Temp (C) -- Taken at the cab in degrees Celsius.

Turbidity -- Taken at the cab.

D.O. -- Taken at the cab one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Distance-- The distance from the cab perpendicular to the bank.

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Time of day net was set (military time).

Stop Time-- Time of day net was picked up (military time).

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the cab.

Depth (m) -- Taken at the cab. **Recorded in Line 2.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the cab at the **bottom** and **60%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at the cab. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel— Taken at the cab. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Fyke Net

Gear-S/W -- FN36 3 x 6 Standard for backwaters (S)

Temp (C) -- Taken at the cab in degrees Celsius.

Turbidity -- Taken at the cab.

D.O. -- Taken at the cab one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Time of day net was set (military time).

Stop Time-- Time of day net was picked up (military time).

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the cab.

Depth (m) -- Taken at the cab. **Recorded in Line 2.**

Cobble/Organic—Taken at the cab. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel— Taken at the cab. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Bag Seine— At least **50 m^2** is required to be seined for each sample.

Gear-W –

BSQU	**Quarter arc upstream**
BSQD	**Quarter arc downstream**
BSQ	**Quarter arc in little/no flow**
BSHU	**Half arc upstream**
BSHD	**Half arc downstream**
BSH	**Half arc in little/no flow**
BSRU	**Rectangular upstream**
BSRD	**Rectangular downstream**
BSR	**Rectangular in little/no flow**

Temp (C) -- Taken at the mid point perpendicular to the bank in degrees Celsius.

Turbidity -- Taken at the mid point perpendicular to the bank.

D.O. -- Taken at the mid point perpendicular to the bank one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Distance-- Only required for rectangular seine hauls. The distance the seine was pulled.

Width (m)-- Width of the seine during the seine haul for rectangular and the width of seine when perpendicular to the bank for quarter and half arcs. **To obtain the required area quarter arcs must have ~8m width, half arcs ~7m width.**

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the mid point perpendicular to the bank.

Depth (m) -- Taken at the mid point perpendicular to the bank and the end of the seine perpendicular to the bank. **Recorded in Lines 1 and 2 respectively.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mid point and end perpendicular to the bank at the **bottom** and **60%** of the depth. This is recorded in **Lines 1 and 2 respectively**.

Cobble/Organic—Taken at the mid point perpendicular to the bank. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel— Taken at the mid point perpendicular to the bank. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Otter Trawling

Gear-S/W -- OT02 8' trawl Standard (S)
OT16 16' trawl Standard (S) >size depends on conditions

Temp (C) -- Taken at the mid point of every sampled area in degrees Celsius.

Turbidity -- Taken at the mid point of every sampled area.

D.O. -- Taken at the mid point of sampled area one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

Distance-- Total distance of trawl in meters.

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Recorded in military time. Time trawling started.

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the start of the trawl.

Stop Latitude/Stop Longitude—A GPS coordinate (decimal degrees) will be taken at the end of the trawl.

Depth (m) -- Taken at the beginning, mid point, and end of every trawl. **Recorded in Lines 1, 2, and 3 respectively.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mid point of every trawl at the **bottom**, **80%** of the depth and **20%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mid point of every trawl. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel—Taken at mid point of every trawl. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Push Trawling

Gear-S/W— POT02 (S)

8’ wide x 24” Height x 6’ Long with 3/16” mesh, zipper cod end, and 30”x 15” doors

Temp (C) -- Taken at midpoint of every sampled area in degrees Celsius.

Turbidity-- Taken at midpoint of every sampled area.

D.O. -- Taken at midpoint of every sampled area one time inside the chute. Taken more often at the discretion of the crew leader.

Distance-- Total distance of trawl in meters.

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1.

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Recorded in military time. Time trawling started.

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the start of the trawl.

Stop Latitude/Stop Longitude—A GPS coordinate (decimal degrees) will be taken at the end of the trawl.

Depth (m) -- Taken at the beginning, mid point, and end of every trawl. **Recorded in Lines 1, 2, and 3 respectively.**

Velocity (bot; 0.2/0.6)—Velocities will be taken at the mid point of every trawl at the **bottom**, and **60%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mid point of every trawl. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel—Taken at mid point of every trawl. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Gill nets

Gear-S/W -- GN!4 100’ gill net set w/panel 1 at the bank Standard (S) for back waters
GN41 100’ gill net set w/panel 4 at the bank Standard (S) for back waters

Temp (C) -- Taken at the mid point of every set in degrees Celsius.

Turbidity -- Taken at the mid point of every set.

D.O. -- Taken at the mid point of every set one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Time of day net was set (military time).

Stop Time-- Time of day net was picked up (military time).

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the start of the set.

Depth (m) -- Taken at the beginning, mid point, and end of every set. **Recorded in Lines 1, 2, and 3 respectively.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mid point of every set at the **bottom**, **80%** of the depth and **20%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mid point of every set. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel—Taken at mid point of every set. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Panel/Hook-- The panel where fish was caught.

Trotline

Gear-S/W -- **TL1C** 105' trotline set with 20 3/0 Eagle Claw Circle Sea hooks (S)
TL2C 205' trotline set with 40 3/0 Eagle Claw Circle Sea hooks (S)

Temp (C) -- Taken at the mid point of every set in degrees Celsius.

Turbidity -- Taken at the mid point of every set.

D.O. -- Taken at the mid point of every set one time inside the chute. Taken more often at the discretion of crew leader (i.e., backwater that is stagnant).

U1 -- Two digit chute/backwater segment number (01-16) that is being sampled. All replacement segments will be preceded by a 9. See example on page 1

Micro -- Six digit code based off of the Pallid Sturgeon Assessment. First three boxes describe chute/backwater itself. Last three boxes describe actual sampling site.

Start Time-- Time of day net was set (military time).

Stop Time-- Time of day net was picked up (military time).

Start Latitude/Start Longitude—A GPS coordinate (decimal degrees) will be taken at the start of the set.

Depth (m) -- Taken at the beginning, mid point, and end of every set. **Recorded in Lines 1, 2, and 3 respectively.**

Velocity (bot; 0.8; 0.2/0.6)—Velocities will be taken at the mid point of every set at the **bottom**, **80%** of the depth and **20%** of the depth. This is recorded in **Line 2**.

Cobble/Organic—Taken at mid point of set. Presence in a sediment sample is noted based on the scale on the data sheet.

Silt/Sand/Gravel—Taken at mid point of set. A visual estimation of each that adds up to 100% unless cobble is a 3. Size classes and QC guidelines are found in the Pallid Sturgeon Assessment SOP.

Optional data:

Subsample-Pass-N –Number of each sample. Additional sub-samples (2) only if pallid is caught in and active gear (trawl, trammel). If pallid caught then duplicate sample is non-random (N).

Distance -- For EF only. Combine distance of both banks shocked.

USGS Gauge Code—The nearest gauge station upstream from the chute.

River Stage-- Gauge height of river at 6 am the day nets are set.

Discharge-- Stream flow of river at 6 am the day nets are set.

U5-- Gauge height of river at 6 am the day the nets are picked up.

Water Velocity—Visual estimation of surface velocity.

QC-- Quality Control box for sediment samples. Mark X in the box if sample of sediment is taken for QC as described in the Pallid Sturgeon Assessment SOP.

Otolith/Ray Spine/Scale—If one of these aging structures is being taken place an X in the appropriate box. Protocols for taking age structures is found in the Pallid Sturgeon Assessment SOP.

***All remaining boxes on data sheet not covered in the preceding document do not currently apply to project 3.**

Species of Interest- sport fish, forage species, and exotics. (pretty much everything except common carp, grass carp, and gar)

Channel Catfish	**Redhorse sp.**	**Smallmouth Buffalo**
Crappie	**Western Silvery Minnow**	**Black Buffalo**
Sauger	**Plains Minnow**	**River Carpsucker**
Largemouth Bass	**Bullhead Minnow**	**Highfin Carpsucker**
Asian Carp	**Fathead Minnow**	**Quillback**
Paddlefish	**Silver Chub**	**Goldeye**
Shovelnose Sturgeon	**Shoal Chub**	**Mooneye**
Lake Sturgeon	**Sturgeon Chub**	**Skipjack Herring**
Pallid Sturgeon	**Sicklefin Chub**	**Blue Sucker**
Bigmouth Buffalo	**Gizzard Shad**	**Blue Catfish**
Flathead catfish		

MISSOURI RIVER
STANDARD OPERATING PROCEDURES
FOR
SAMPLING AND DATA
COLLECTION

APPENDIX K

STANDARD OPERATING
PROCEDURES FOR
FIELD DATA COLLECTION
AND ENTRY

FIELD DATA COLLECTION AND ENTRY

Data collected utilizing standardized methods and terminology enhances the quality and the usability of the data by providing complimentary data sets between various projects. Data must be collected, recorded and entered into a database accurately to facilitate data management and sound analysis.

I. Data Sheets and Recording

A. Standardized data sheets will be used for recording data for all Missouri River Programs. The two-page Standard Data Sheet is designed for recording all information (e.g., sample site, habitat characteristic, and fish data).

1. All required fields must be completed. Data sheet instructions should be followed at all times. (refer to Data Sheet Instruction Section).
2. The Supplemental Data Sheet which was designed for recording specific information for the pallid sturgeon must be completed for all pallid sturgeon collected. The supplemental data sheet was not designed to be used independently and so must be used along with the Standardized Sheet. The Supplemental Data Sheet may also be used for species other than pallid sturgeon to record unique data (e.g., tag information for shovelnose sturgeon)
3. All data entries should be made in pencil
4. Errors made during data recording will be corrected in a legible fashion to ensure that the data entry folks can accurately enter the data.
5. Use the standardized codes to ensure consistency in the database.

II. Data Sheet Quality Assurance

A. The field crew leader is responsible for reviewing the data sheets promptly following field data collection efforts.

1. The field crew leader will ensure that all codes are complete, accurate, and legible.
2. Errors identified on the data sheet will be corrected following the same protocols as identified under the Data Sheets and Recording Section.
3. After all data sheets have been reviewed by the field crew supervisor, the original will be submitted for data entry, and a copy of each data sheet will be maintained at the field station.

III. Data Entry

A. All data will be entered into a database via double-blind entry to identify any mistakes that may occur during the process of data entry.

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APPENDIX L

PALLID STURGEON
POPULATION ASSESSMENT TEAM

Craig Fleming	U.S. Army Corps of Engineers	P.O. Box 710 Yankton, SD 57078	402-667-2880	Craig.A.Fleming@usace.army.mil
Casey Kruse	U.S. Army Corps of Engineers	P.O. Box 710 Yankton, SD 57078	402-667-2580	Casey.D.Kruse@usace.army.mil
Tim Welker	U.S. Army Corps of Engineers	P.O. Box 710 Yankton, SD 57078	402-667-2582	Tim.L.Welker@usace.army.mil
Tyler Haddix	Montana Fish, Wildlife and Parks	MTFWP Administration Bldg. Box 165 Ft. Peck, MT 59223	406-526-3289	THaddix@mt.gov
Landon Holte	Montana Fish, Wildlife and Parks	MTFWP Administration Bldg. Box 165 Ft. Peck, MT 59223	406-526-3289	LHolte@mt.gov
Pat Braaten	U.S. Geological Survey	C/O MTFWP Administration Bldg. Box 165 Ft. Peck, MT 59223	406-526-3253	Patrick_braaten@usgs.gov
Mark Wildhaber	U.S. Geological Survey	Columbia Environmental Research Center 4200 New Haven Road Columbia, MO 65201	573-876-1847	Mwildhaber@usgs.gov
Rob Klumb	U.S. Fish & Wildlife Service	Great Plains FWCO 420 S. Garfield Ave. Suite. 400 Pierre, SD 57501	605-224-8693 ext. 228	Robert_klumb@fws.gov
Greg Wanner	U.S. Fish & Wildlife Service	Great Plains FWCO 420 S. Garfield Ave. Suite. 400 Pierre, SD 57501	605-224-8693 ext. 225	Greg_Wanner@fws.gov
Dane Shuman	U.S. Fish & Wildlife Service	Great Plains FWCO 420 S. Garfield Ave. Suite 400 Pierre, SD 57501	605-224-8693 ext. 233	Dane_shuman@fws.gov
Kristen Grohs	U.S. Fish & Wildlife Service	Great Plains FWCO 420 S. Garfield Ave. Suite 400 Pierre, SD 57501	605-224-8693	Kristen_Grohs@fws.gov
Steve Krentz	U.S. Fish & Wildlife Service	Missouri River FWCO 3425 Miriam Ave Bismarck, ND 58501	701-355-8547 701-355-8550 fax	Steven_krentz@fws.gov
Ryan Wilson	U.S. Fish & Wildlife Service	Missouri River FWCO 3425 Miriam Ave Bismarck, ND 58501	701-355-8548	Ryan_wilson@fws.gov
Sam Stukel	South Dakota Game, Fish & Parks	31247 436th Avenue Yankton, SD 57078	605-668-5464 605-668-5467 (fax)	Sam.stukel@state.sd.us
Steve Labay	South Dakota Game, Fish & Parks	31247 436th Avenue Yankton, SD 57078	605-668-5465	Steve.Labay@state.sd.us
Wayne Nelson-Stastny	U.S. Fish and Wildlife Service	P.O. Box 710 Yankton, SD 57078	402-667-2884	Wayne.NelsonStastny@fws.gov
Vince Travnichek	Missouri Dept. of Conservation	701 James McCarthy Drive St. Joseph, MO 64507	816-271-3111 ext. 226	vince.travnichek@mdc.mo.gov
Ron Dent	Missouri Dept. of Conservation	2901 W. Truman Blvd. Jefferson City, MO 65109	573-751-4115 ext. 3168	Ron.dent@mdc.mo.gov
Dave Herzog	Missouri Department of Conservation	Open Rivers and Wetland Field Station 3815 East Jackson Blvd. Jackson, MO 63755	573-243-2659 ext. 24	David.Herzog@mdc.mo.gov
Darby Niswonger	Missouri Dept. of Conservation	15302 LIV 2386 Chillicothe, MO 64601	660-646-3140 ext. 248	darby.niswonger@mdc.mo.gov

Kyle Winders	Missouri Dept. of Conservation	15302 LIV 2386 Chillicothe, MO 64601	660-646-3140 ext. 247	kyle.winders@mdc.mo.gov
Yan Hong	Missouri Dept. of Conservation	15302 LIV 2386 Chillicothe, MO 64601	660-646-3140 Ext. 245	Yan.hong@mdc.mo.gov
Jenny Mosley	Missouri Dept. of Conservation	15302 LIV 2386 Chillicothe, MO 64601	660-646-3140 Ext. 286	Jenny.mosley@mdc.mo.gov
Tracy Hill	U.S. Fish & Wildlife Service	Columbia Nat'l Fish & Wildlife Conservation Office 101 Park DeVille Drive, Suite A Columbia, MO 65203	573-234-2132 ext.102	Tracy_Hill@fws.gov
Wyatt Doyle	U.S. Fish & Wildlife Service	Columbia Nat'l Fish & Wildlife Conservation Office 101 Park DeVille Drive, Suite A Columbia, MO 65203	573-234-2132 ext. 111	Wyatt_doyle@fws.gov
Patty Herman	U.S. Fish & Wildlife Service	Columbia Nat'l Fish & Wildlife Conservation Office 101 Park DeVille Drive, Suite A Columbia, MO 65203	573-234-2132 Ext. 170	Patricia_herman@fws.gov
Andy Starostka	U.S. Fish & Wildlife Service	Columbia Nat'l Fish & Wildlife Conservation Office 101 Park DeVille Drive, Suite A Columbia, MO 65203	573-234-2132	Andy_starostka@fws.gov
Gerald Mestl	Nebraska Game and Parks Commission	2200 N. 33rd Street (PO Box 30370) Lincoln, NE 68503-0370	402-471-1512 402-471-5447	Gerald.mestl@nebraska.gov
Kirk Steffensen	Nebraska Game and Parks Commission	2200 N. 33rd Street (PO Box 30370) Lincoln, NE 68503-0370	402-471-1514	Kirk.steffensen@nebraska.gov
Schuyler Sampson	Nebraska Game and Parks Commission	2200 N. 33rd Street (PO Box 30370) Lincoln, NE 68503-0370	402-471-1513	Schuyler.sampson@nebraska.gov

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APPENDIX M

EQUIPMENT AND COST
ESTIMATES

Equipment Item	Supplier, Model &/or Catalog #	Cost	Comments
GPS Unit	Garmin 168 Mapsounder (or similar unit—e.g., Garmin 430s or 530s)	$600.00	GPS, depth, temperature; minimum requirements—WAAS enabled, 12 channel GPS; <15 meters accuracy; 50/200 kHz dual transducer
Portable GPS Unit	Garmin GPS 76	$200.00	GPS for Seines & Mini fyke
Red Liquid Thermometer	Fisher Scientific Catalog # 15-059-214	$25.00	Accurate to 1 degree
Turbidimeter	Model 2100P (Catalog # 46500-00)	$837.00	
StablCal® Calibration Standards and Gelex Standards	Hach Co. (Catalog # 26594-00)	$76.00	
Sounding Reel	Rickly Hydrological Inc. A55M (cat. # 101-014)	$1295.00	with 75 feet of .10 inch cable. This unit is limited to a maximum of a 100 pound sounding weight.
Sounding Reel	Rickly Hydrological Inc. B56M (cat. # 104-026)	$2,190.00	with 115 feet of .125 inch cable (This cable will handle sounding weights > 100 pounds). This model is equipped for either powered or manual operation.
B56 Reel Power Option	Rickly Hydrological Inc. (cat. # 104-0620)	$295.00	
USGS Power Drive Unit	Rickly Hydrological Inc. (cat. # 104-0400)	$1,520.00	

Sounding Weights Cat #	Cost	Hanger Bar # Cat #	Cost	Hanger Cat #
108-001 15 lbs (7 Kg)	$195	108-020	$18	108-030
108-003 30 lbs (14 Kg)	$230	108-020	$18	108-031
108-005 50 lbs (23 Kg)	$275	108-020	$18	108-031
108-007 75 lbs (34 Kg)	$355	108-020	$18	108-033
108-009 100 lbs (45 Kg)	$450	108-020	$18	108-033
108-011 150 lbs (68 Kg)	$655	108-022	$28	108-035
108-013 200 lbs (91 Kg)	$895	108-022	$28	108-036
108-015 300 lbs (136 Kg)	$1,145	108-025	$38	108-037

1.5 Meter Top Set Wading Rod	Rickly Hydrological Inc. (cat. # 105-009)	$395.00	
Aquacount Digitizer Model 5100	Rickly Hydrological Inc. (cat. # 102-003)	$945.00	
Rod Mount	Rickly Hydrological Inc. (cat. # 102-005)	$45.00	
Rod Adaptor	Rickly Hydrological Inc. (cat. # 102-006)	$45.00	

Sounding Reel Pigtail	Rickly Hydrological Inc.	$24.00	
Marsh-McBirney Flo-Mate	Marsh-McBirney Model 2000 **with sensor disconnect**	$3,790	
Additional cable	Marsh-McBirney	rate of $2.25/ft	
calibration	Marsh-McBirney	$195.00	
fixed priced repair	Marsh-McBirney	$395.00	
USGS Price Meter	Rickly Hydrological Inc. Model 6200 (cat. # 101-001)	$745.00	
USGS Price Meter	Rickly Hydrological Inc. Model 6215 (Cat # 101-003)	$725.00	
Pocket Reader EX Passive Integrated Transponder (PIT) Tag Reader	Biomark, Inc. 208-275-0011	$575.00	Detects both 125 and 134.2 kHz tags.
Gill Net		$250	
Trammel Net	Bruce Sederberg, President, H. Christiansen Co., 218-722-1142 or 1-800-372-1142.	$218	
Otter Trawl	Innovative Net Systems	$600	
Beam Trawl	Innovative Net Systems	$200	
Hoop Net		$400	
Bag Seine		$200	
Mini fyke Net		$230	
Trotline		$200	

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APPENDIX N

GEAR, GEAR CODES, DESCRIPTIONS, INCLUDED IN SOP, STANDARD OR WILD DESIGNATION, APPLIED OFFICES, COMMENTS INCLUDING EFFECTIVE DATES

Gear	Gear Code	Description	Standard or Wild or Evaluation S/W/E	Office Proposed	Comments
Bag Seine	BSHD	Bag seine, half arc method, pivoting downstream	W		Changed to wild from standard for project 1 on the conference of Feb 17, 2006
Bag Seine	BSHU	Bag seine, half arc method, pivoting upstream	W		Changed to wild from standard for project 1 on the conference of Feb 17, 2006
Bag Seine	BSQD	Bag seine, quarter arc method, pivoting downstream	W		Changed to wild from standard for project 1 on the conference of Feb 17, 2006
Bag Seine	BSQU	Bag seine, quarter arc method, pivoting upstream	W		Changed to wild from standard for project 1 on the conference of Feb 17, 2006
Bag Seine	BSRD	Bag Seine, rectangular method, seining downstream	W		Changed to wild from standard for project 1 on the conference of Feb 17, 2006
Bag Seine	BSRU	Bag Seine, rectangular method, seining upstream	W		Changed to wild from standard for project 1 on the conference of Feb 17, 2006
Bag Seine	BSH	Bag Seine, half arc method, little or no flow	W		project 3 Only. Developed on 6/26/2006. Changed to wild from standard on 11/6/06.
Bag Seine	BSQ	Bag Seine, quarter arc method, little or no flow	W		project 3 Only. Developed on 6/26/2006. Changed to wild from standard on 11/6/06.
Bag Seine	BSR	Bag Seine, rectangular method, little or no flow	W		project 3 Only. Developed on 6/26/2006. Changed to wild from

					standard on 11/6/06.
Beam Trawl	BT	2 meters wide, height of .5 meters, length of 5.5 meters; inner mesh size of 1/8 inch, outer mesh of 1.5 inch, bottom line of 3/8 inch chain	W		
Beam Trawl	BT8	Beam Trawl: 8 foot trawl	W		
Beam Trawl	BTF	Faulkner Beam Trawl: 2 m (6.4 ft.) x 0.5 m (1.6 ft.) x 5.5 m (18 ft.), No. 12 poly 42mm str. Body, No. 24 Olivene braided poly 42 mm st. codend, Forward running sweep chain -- 1/4" galv. (attached), Adjustable headrope for catenary or "low beam", Reinforced corners, Doubled hooped codend with 6mm raschel mesh removable liner insert, Detachable codend hook up with tie straps, Lazy line pick up system, Designed to fit sled rig 2 meters x 0.5 meters	W		Added in the December 6~8, 2006 conference meeting
Larval Drift Netting	DN	Drift Nets	W		
Fishing Pole	FISH	Fishing Pole	W		
Gill Net	DGN14 or DGN41	Drifting Gill Net: 100 feet long, 1.5, 2.0, 3.0, 4.0 inch mesh	W		
Gill Net	DGN18 or DGN81	Drifting Gill Net:200 feet long, repeating panels of 1.5, 2.0, 3.0, 4.0 inch mesh	W		
Gill Net	G4IN	300-feet (91.4 m) multifilament, nylon sinking gill net, 6-feet (1.8m) deep 4-inch (10.2 cm) bar mesh of #139 twine with a braided poly-foam core 0.5” (1.3 cm) diameter floatline and a 50-pound (13.6 kg) lead line.	W	CF	
Gill Net	GN14 or GN41	Stationary Gill Net: 100 feet long, 1.5, 2.0, 3.0, 4.0 inch mesh	S		
Gill Net	GN14G/GN41G	Stationary Gill Nets Dyed Green:100 feet long, 1.5, 2.0, 3.0, 4.0 inch mesh	W		Proposed on April 11, 2006
Gill Net	GN14T or GN41T	Timed Stationary Set Standard Gill Net 100ft (Same specifications as GN14 or GN41)	W		Proposed on May 18, 2006
Gill Net	GN18 or GN81	Stationary Gill Net: 200 feet long, repeating panels of 1.5, 2.0, 3.0, 4.0 inch mesh	S		
Gill Net	GN18G/GN81G	Stationary Gill Nets Dyed Green: 200 feet long, repeating panels of 1.5, 2.0, 3.0, 4.0 inch mesh	W		Proposed on April 11, 2006
Gill Net	GN18T or GN81T	Timed Stationary Set Standard Gill Net 200ft (Same specifications as GN18 or GN81)	W		Proposed on May 18, 2006
Gill Net	GNM18/81	Nearly identical to GN81 or GN81. The only real difference is the mesh is made from monofilament instead of multifilament. The depth of these nets are 8 foot with ½ inch foam core float line and 30 pound lead line.	W	MO	Proposed on April 10, 2008

Gill Net	GN3	100 ft. (30.5 m) sinking gill nets made of #10 monofilament 3” (7.6 cm) netting with the wall 10 ft. (3.1 m) deep with a polypropylene float line with FL130 hard, foam floats every 10 ft. (3.1 m) and 50-pound (13.6 kg) lead line.	W	CF	
Gill Net	GNH3	200 ft. (61 m) sinking gill nets will be made of #139 multifilament nylon 3” (7.6 cm) mesh netting with the wall 8 ft. (2.4 m) deep, hobbled down to 6 ft (1.8 m) every 10 ft (3.1 m) of length with a braided poly-foam core 0.5” (1.3 cm) diameter floatline and a 50-pound (13.6 kg) lead line.	W	CF	
Gill Net	GNH3T	Timed Stationary Set Hobbled 3 inch gill net (Same specifications as the GNH3)	W		Proposed on May 18, 2006
Gill Net	GNMN3	Gill Net set overnight: 200ft, 3 1/4 inch mesh 8ft deep, MONOfilament, 2:1 hanging ratio, 3/8" leadline, 1/2" floatline.	W	CF	Proposed on Mar 9, 2006
Gill Net	GNM3T	Timed Stationary Set Monofilament 3.25 inch gill net (Same specifications as the GNMN3)	W		Proposed on May 18, 2006
Gill Net	GNM25	Overall net dimension is 200' long by 8' deep Float line - 1/2" braided foamcore float line Bottom line - braided nylon lead core (No. 50 - 50 lbs of lead per 600 feet) Mesh - 2.5" square (5" stretch) Netting - monofilament nylon with #208 twine size (0.52-mm).	W	NE	Proposed on 3/30/07.
Gill Net	GNM31	200ft, 3 1/4 inch mesh, 10ft deep, #208 monofilament, 2:1 hanging ratio, 50 lb leadcore, 1/2" foamline	W	MO	Proposed on Mar 14, 2007
Gill Net	GNM3C	Length: 200', Height: 8' with lead line and float line hobbled together rendering the net 4’ high Panels: none, Mesh size: 3.25 inch, Netting: monofilament Float Line: braided poly-foam core, 0.5-inch diameter, Lead Line: 3/8 in Anchors: Three grapple anchors (one at each end and in the center) Floats: Attach floats to retrieval line allowing adequate slack for depth and flow conditions in the macrohabitat Position: Within channel border Orientation: Crazy nets should be set perpendicular to flow	W	CF	Proposed on Feb 14, 2008
Hoop Net	HN	Hoop Nets-4 foot diameter	S		Project 3 Only.
Hoop Net	HN	Hoop Nets	W		
Hoop Net	SHN	Small Hoop Net - 2 foot diameter hoop net with the same mesh as HN	W		Proposed on May 18, 2006
Hoop Net	SHN	Small Hoop Net - 2 foot diameter hoop net with the same mesh as HN	S		Project 3 Only. Developed on 6/26/2006.
Hoop Net	XHN	Code to be used when HN and SHN are set in Tandem (Mitigation-Chute Monitoring)	W		Project 3 Only.
Fyke net	FN	1/8" mesh, with cab dimensions of 4' x 4'.	W		Proposed on May 18,

					2006
Fyke net	FN36	3/4" mesh, with cab dimensions of 3' (height) x 6' (wide).	W		Proposed on May 18, 2006
Fyke net	FN36	3/4" mesh, with cab dimensions of 3' (height) x 6' (wide).	S		Project 3 Only. Developed on 6/26/2006.
Mini-fyke	MF	Mini-fyke: 1/8" Ace mesh	S		
Mini-fyke	MFD	Mini-fyke: 1/8" Delta mesh	W	MR	Proposed on Feb 1, 2006
Otter Trawl	OT01	16' SKT 4mm x 4mm HB2 MOR Sampler. It will consist of: -4-mm stretch mesh made from HD cross-over stitch (Aquamesh). -Designed similar to Skate for maximum spread and little lift (28-30"). -1/4" Forward chain attached to the footrope. - Chafe Apron made of No. 36 untreated nylon covering the first 1.5M of the belly of the trawl. -Cod end will be 4mm mesh HD Aquamesh 16" dia x 48" long. -Require 30x15 trawl doors at a Spread Ratio of 75 -80% at 2.5 knots, +/- 5% due to current changes and bottom configurations. -Oil Based (non-xylene) net coating (NOT water based coatings). -20 oz. of SB 3 floats. -Hung on 3 string. x 10mm dia. Polycruse Class "D" lines. -Tied in with 8 carrier braided , non-shrunk No.36 nylon twine. -5 count Center Lock grips on the head and foot rope. -5" fishing circle of 200/24 Nitto HDPE 2 X24 "Z" lock Guardmesh sewn into the 4mm Aquamesh.	W	CF	Proposed on 3/17/2006.
Otter Trawl	OT04	Same specifications as OT01, except using 36 inch (rather than 30 inch) boards to increase the speed and to get the net down to the bottom in deeper water.	W	CF	Proposed on 3/30/07.
Otter Trawl	OT04	Same specifications as OT01, except using 36 inch (rather than 30 inch) boards to increase the speed and to get the net down to the bottom in deeper water.	S		Project 2 Only
Otter Trawl	OT02	8' envelope style trawl composed of 4mm mesh with zipper, using 30 x 15in doors, fished from bow or stern.	W		Proposed on May 18, 2006
Otter Trawl	OT02	8' envelope style trawl composed of 4mm mesh with zipper, using 30 x 15in doors, fished from bow or stern.	S		Project 3 Only.
Otter Trawl	OT03	27 foot otter trawl 48mm knotless mesh (K-Less)	W		Proposed on May 18, 2006

Otter Trawl	OT05	downstream trawl 25' Skate Model 75-mm 25' Headrope 30' Footrope # 9 HDPE Sapphire netting 3" stretched braided sapphire mesh No codend 1/4" chain @ the wings and 3/16" in center 42" x 21" doors	W	NE	Proposed on July 11, 2007
Otter Trawl	OT05U	upstream trawl same specifications with OT05	W	CF	Proposed on July 11, 2007
Otter Trawl	OT16	Otter Trawl:16 foot trawl	S		
Otter Trawl	OT16C	Otter Trawl: 16 foot trawl w/ liner run in "Sidewinder" configuration	W		
Otter Trawl	OT16L	Otter Trawl:16 foot trawl w/ liner	W		
Otter Trawl	OT16S	Otter Trawl: 16 foot trawl run in "Sidewinder" configuration	W		
Otter Trawl	OT22	Otter Trawl: 22 foot trawl	W		
Otter Trawl	OT22C	Otter Trawl: 22 foot trawl w/ liner in "sidewinder" configuration	W		
Otter Trawl	OT22L	Otter Trawl: 22 foot trawl w/ liner	W		
Otter Trawl	OT22S	Otter Trawl: 22 foot trawl run in “Sidewinder” configuration	W		
Otter Trawl	OT8	8' skate model style composed of 38mm mesh with a 4mm mesh liner, using 30 x 15in doors, fished from bow or stern	W		
Otter Trawl	OT8P	Otter Trawl: 8 foot trawl run on Plumb Staff	W		
Rock Hopper	RH	Rock Hopper	W		
Set Line	SL	Set Line	W		
Trammel Net	HTN	Trammel nets will be made of multifilament nylon netting with the inner wall 8 feet deep (2.4 m) and outer wall 6 feet (1.8 m) deep--net is also hobbled to 4 feet (1.2 m)deep to allow for loose mesh in an attempt to capture larger fish,--125 feet (38.1 m) long with 1inch (2.5 cm) bar mesh for the inner panel of #139 twine, 8inch (20.3 cm) bar mesh for the outer panel of #9 twine, with 3/8-inch (9.5 mm) to ½- inch (12.7 mm) foam floatline, and 50-pound (13.6 kg) lead line.	W	CF	
Trammel Net	TN	Drifting Trammel Net:125 feet long, 1 inch inner mesh	S		
Trammel Net	TNG	Drifting Trammel Net: 125 feet long, 1 inch inner mesh,dyed green (Same specifications as TN)	W		Proposed on May 18, 2006
Trammel Net	STN	Stationary Trammel Net set overnight: 125 feet long, 1 inch inner mesh (Same specifications as TN)	W		
Trammel Net	STNT	Timed Stationary Set Standard 1inch Trammel Net (Same specifications as TN)	W		Proposed on May 18, 2006

Trammel Net	STN2T	Timed Stationary Set 200 feet long 1inch Trammel Net (Same specifications as TN, but 200 feet long)	W		Proposed on May 18, 2006
Trammel Net	TN11	Same as standard 1 inch trammel net, 25 feet long	W		Proposed on May 18, 2006
Trammel Net	TN12	Same as standard 1 inch trammel net, 75 feet long	W		Proposed on May 18, 2006
Trammel Net	TN13	Same as standard 1 inch trammel net, 100 feet long	W		Proposed on May 18, 2006
Trammel Net	TN11	Same as standard 1 inch trammel net, 25 feet long	S		Proposed on May 18, 2006. Project 3 Only
Trammel Net	TN12	Same as standard 1 inch trammel net, 75 feet long	S		Proposed on May 18, 2006. Project 3 Only
Trammel Net	TN13	Same as standard 1 inch trammel net, 100 feet long	S		Proposed on May 18, 2006. Project 3 Only
Trammel Net	TN2	Trammel nets will be made of multifilament nylon netting with the inner wall 8 feet deep (2.4 m) and outer wall 6 feet (1.8 m) deep, 200 feet (60.96 m) long with 1inch (2.5 cm) bar mesh for the inner panel of #139 twine, 8inch (20.3 cm) bar mesh for the outer panel of #9 twine, with 3/8-inch (9.5 mm) to ½- inch (12.7 mm) foam floatline, and 50-pound (13.6 kg) lead line. Trammel net is deadset in water overnight.	W	CF	
Trammel Net	TN25	Drifting Trammel Net:125 feet long with 2.5" inner mesh	W		Changed to wild from standard on 3/7/07.
Trammel Net	TN48	Drifting Trammel Net:125 feet long, two panels (4 inch & 8 inch)	W	MT	Proposed on 11/18/08
Trammel Net	TN483	Drifting Trammel Net:125 feet long with THREE panels, 2 - 8" panels and 1 - 4" panel	W	MR	Proposed on 3/4/09
Trammel Net	STN25	Stationary Trammel Net set overnight: 125 feet long with 2.5" inner mesh	W		
Trammel Net	ST25T	Timed Stationary Set Standard 2.5 inch Trammel Net (Same specifications as TN25)	W		Proposed on May 18, 2006 The code was changed from STN01 on 7/8/08
Trammel Net	TN3	150 ft. (45.7 m) sinking trammel nets made of multifilament nylon netting with the inner wall 8 ft (2.4m) deep and the outer wall 6 ft (1.8 m) deep, with 3” (7.6 cm) bar mesh #9 twine for the inner panel, and 15” (38.1 cm) bar mesh #12 twine for the outer panel, with 3/8-inch (9.5 mm) to ½- inch (12.7 mm) foam floatline, and 50-pound (13.6 kg) lead line.	W	CF	
Trammel Net	TN50	Drifting Trammel Net: 50 feet long, 1 inch inner mesh	S		Standard gear only used in Project 3
Trammel Net	STN50	Stationary Trammel Net set overnight: 50 feet long, 1 inch inner mesh	W		
Trammel Net	TN610	Drifting Trammel Net:125 feet long with just two panels (6 inch & 10 inch)	W	MR	
Trawl	MT8	Missouri Trawl	W		

Trotline	TL--	The first dash will be filled in with a letter corresponding to one of three hook style choices (TLC- = Circle hooks; TLS- = O'Shaughnessy hooks; and TLO- = Octopus hooks). The second dash indicates the main line length abbreviation. (e.g., a 200' trotline set using 40 circle hooks would be recorded as TLC2, the retrieved hook number is recorded in Distance box)	S/W		Wild gears proposed on May 18, 2006. Trotlline with 3/0 Eagle Claw Circle hooks changed to Evaluation on 1/29/2009, and then changed to Standard in February PSA crew leaders' meeting in 2010. The code is TLC1S or TLC2S.
Trotline	TL--T	Timed trot line: set and pulled on the same day. (same specifications as trotline set overnight)	E/W		Wild gears proposed on 7/8/08. TLC1T changed to evaluation in segments 1-4 in February PSA crew leaders' meeting in 2010.
Electrofishing, Tote Barge	EFTB	Smith-Root, Inc. tote barge with 2.5 GPP generator and pulsator	W	GP	Proposed on 9/15/08
Electrofishing	EF		S		Project 3 Only.
Night Electrofishing	NEF		W		Project 3 Only.
Push Trawl	POT8	Push trawl, with the same specifications as OT8	W	CF	Project 3 Only. Proposed on 8/31/2006
Push Trawl	POT02	Push trawl, with the same specifications as OT02	S	CF	Project 2 & 3 Only. Wild gear proposed on 7/21/2006. Changed to standard on 11/6/2006.
Push Trawl	POT02	Push trawl, with the same specifications as OT02	W	CF	Proposed on 3/27/07 Changed from evaluation to wild gear in the meeting on 7/8/08

The codes in green are standard gears.

The codes in yellow are newly developed.

The codes in blue were used by Project 3 (Mitigation Program) only.

The codes in purple are currently used by Project 2 (Habitat Assessment Program) only.