

PALLID STURGEON POPULATION ASSESSMENT PROJECT

Guiding Document

Volume 1.8

February 2017



Disclaimer: This document serves only as a guide for sampling through the PSPAP. Teams and individuals that have been contracted by the USACE to conduct sampling should consult and follow the Scope of Work (SOW; or Performance Work Statement; PWS) in the current Fiscal Year contract or Military Interdepartmental Purchase Request (MIPR).

Note: Agencies and individuals signatory to a SOW/PWS for the PSPAP are only authorized to expend funds on those activities included in the most current SOW/PWS and, therefore, are directly related to the Missouri River Recovery Program (MRRP). This is not a change, only a further explanation of fiscal regulation to ensure that all partners understand fiscal requirements and know when to seek further clarification. Appropriate use of funds applies to USACE employees as well as all partners. A few examples of expenditures which fall outside of contractual boundaries and could represent inappropriate use of government funds include:

- 1) Non-Project Expenses. It is a fiscal violation to use MRRP funds for expenses from other projects including travel, equipment, and labor. For example, it would be inappropriate to use MRRP funds to participate in Missouri River Relief events, education and outreach activities unrelated to the MRRP, and other partner agency activities unrelated to the MRRP. In a few cases the distinction may not be clear and the USACE project lead should be consulted for clarification.
 - Use of non-required equipment. Equipment needs should be thoroughly described in the current SOP and further detailed in annual cost proposals. For example, if you would like to test the efficacy of newly developed nets to target sturgeon, then this purchase would first require approval prior to purchase by the USACE Project Lead.
 - Non-project related travel, equipment usage, or labor billed to MRRP. Equipment purchased with MRRP funds shall not be used for non-approved activities. Likewise, MRRP shall not be billed for travel and labor for these activities.
 - Non-approved MRRP meetings. Attendance at meetings must be approved by the USACE Project Lead if not already explicitly allowed. Examples of non-approved meetings and events include, but are not limited to, American Fisheries Society, Pallid Sturgeon Governing Board, etc., unless the individual is providing a presentation related to MRRP funded activities and has been approved by the USACE Project Lead.
 - Development of new fisheries sampling technology. Development of new fish-collecting gear must be approved by the USACE Project Lead before developing and purchasing this gear with USACE MRRP funds.
 - Already Funded Activities. MRRP funds cannot be used for activities already funded by the contracted agency.
- 2) Unrelated Training. This is training without a direct link to pallid sturgeon monitoring. For example, agency leadership training would not be an appropriate use of MRRP funds while water safety training, boat training, or other training related to execution of MRRP monitoring is appropriate.

- 3) Work Outside of Scope. Even if work is related to the MRRP and potentially beneficial, if it is outside of the funded scope then funds can't be used without scope modification. For example, conducting nuisance species monitoring or conducting actions beyond the geographic boundary of the MRRP are outside of project scope.

Not all circumstances and needs can be foreseen and the appropriateness of some expenditures may be unclear. Please contact the USACE Project Lead if you have any questions – a brief call can prevent the potential for contractual improprieties.

This document may be cited as:

Welker, T.L., M.R. Drobish, and G.A. Williams (editors). 2017. Pallid Sturgeon Population Assessment Project, Guiding Document, Volume 1.8. U.S. Army Corps of Engineers, Omaha District, Yankton, SD.

This project and subsequent document have 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 this assessment project for the pallid sturgeon (Pallid Sturgeon Population Assessment Project; PSPAP). The objective of the PSPAP is to provide the information needed to meet the Reasonable and Prudent Alternative Elements for pallid sturgeon in the 2003 Biological Opinion for the Missouri River (USFWS 2003). The guidelines developed by the Team and provided in this document are used to standardize and guide sampling of pallid sturgeon and habitats through the PSPAP. All deviations from the guidelines in this document must be approved by the United States Army Corps of Engineers (USACE) PSPAP lead (currently Tim Welker).

The following agencies and offices have contributed to the development of this document and other guiding documents for the PSPAP. 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 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 Conservation Office (Region 6-Bismarck, ND), the Great Plains Fish and Wildlife Conservation Office (Region 6-Pierre, SD) and the Columbia Fish and Wildlife Conservation Office (Region 3-Columbia, MO) have all played active roles in the development of the PSPAP. Current individual team members and their respective agency affiliations are listed in Appendix D.

The Standard Operating Procedures (SOP; “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection”; Welker and Drobish 2016) document is comprised of

detailed technical documentation related to equipment and processes used for several Missouri River pallid sturgeon projects. In contrast, the PSPAP Guidance Document (Welker, Drobish, and Williams 2016) is a more generalized project-level summary document providing information specific for the PSPAP.

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INTRODUCTION

Dams and water management on the Missouri River since the early 1940s have blocked migration corridors, altered the natural hydrograph, and changed the sediment transport system that created the dynamic habitat elements necessary for native fauna and flora survival. Many native fish and animal populations have declined, to the point where some species are endangered. At present, the pallid sturgeon and the least tern are listed as endangered and the piping plover is listed as threatened under the Endangered Species Act.

The USACE, as the water management entity responsible for the Missouri River mainstem from Fort Peck Dam and Reservoir to the mouth and projects making releases to the lower Kansas River, has consulted with the U.S. Fish & Wildlife Service (Service) regarding the conservation of the pallid sturgeon. In 2000, the Service issued the USACE the 2000 Missouri River Biological Opinion (2000 Opinion) on the operations of the Missouri River Mainstem Reservoir System, the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System. The 2000 Opinion addresses four species that were listed as threatened or endangered, the piping plover *Charadrius melodus*, the least tern *Sterna antillarum*, the pallid sturgeon *Scaphirhynchus albus*, and the bald eagle *Haliaeetus leucocephalus* (USFWS 2000). The bald eagle has since been de-listed. The USACE reinitiated consultation in July 2003 to address some of the elements of the 2000 RPAs. In November 2003, the Service presented the USACE an Amended 2000 Biological Opinion (2003 Amendment; USFWS 2003).

The 2000 Opinion and the 2003 Amendment list several Reasonable and Prudent Alternative (RPA) elements addressing the various species and habitat restoration issues. RPA element VI A (Pallid Sturgeon Propagation and Augmentation, p. 250, 2000 Opinion.) and RPA element VI B (Pallid Sturgeon Population Assessment, p. 252, 2000 Opinion) address the lack of pallid sturgeon recruitment and the need to be able to detect any change in population and habitat trends. These elements were adopted by the USACE and reiterated (Elements IV and V) in the Service's 2003 Amendment to the 2000 Opinion. RPA element VI A describes the USACE's responsibility in propagation activity and then states, "The two agencies shall work cooperatively to monitor juvenile stocked pallid sturgeon to determine habitat use, distribution and movements, and survival, and guide future restoration/management efforts. The scope of the monitoring shall be developed and agreed upon by the Service and the USACE through the ACT during 2001."

RPA element VI B states, "Pallid sturgeon population assessment shall include: (1) Total number of fish captured and tag number, (2) GPS coordinates of capture sights, distribution, recapture incidences and numbers, (3) channel and substrate mapping of the habitats used by the fish, (4) tributary use and concentrations by pallid sturgeon, (5) temperature, surface and bottom velocity, turbidity, and depth at capture locations, (6) length of fish frequency, (7) morphological measurements of fish and meristic counts, (8) species characterization utilizing morphological measurements, (9) genetic analysis of fish, and (10) productivity and recruitment. Additional information needs and priorities for the monitoring project should be developed through a cooperative effort between the Service, Corps, and Recovery Team. In addition to these

specific requirements for pallid sturgeon, RPA element VI(B) also states that the project will be designed in such a way to detect improvements in the warm water benthic fishery.

The PSPAP, as required by these RPA elements, proposes to accomplish these tasks through a comprehensive monitoring plan designed to assess survival, movement, distribution, habitat use, and physical characteristics of these habitat used by wild and hatchery reared (stocked) juvenile pallid sturgeon. A series of native Missouri River species have also been identified and incorporated into the PSPAP. An evaluation of these native species in addition to the pallid sturgeon will provide a more comprehensive assessment of the overall changes in form and function through habitat development and flow modification rather than assessing a single species.

The USACE engaged a core group of scientists (Pallid Sturgeon Population Assessment Team; PAT) composed of representatives of state and federal agencies, universities affiliated with Missouri River fisheries projects and/or pallid sturgeon projects to develop the monitoring scheme and protocols that make up this project and the document/plan that describes it. This long-term assessment plan is focused on identifying the best available science, in terms of strategy and techniques, to accomplish the overall purpose of the RPA elements. The plan begins by focusing pertinent actions on Missouri River action areas ranked as “high” (under the Biological Opinion) regarding management action priorities for pallid sturgeon as defined in the PSPAP Area and eventually integrating with other monitoring efforts. Standard Operating Procedures (SOP) for fishery sampling and data collection for the PSPAP have been developed by the PAT. These SOPs are contained in a separate document titled, “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection” (Welker and Drobish 2016). These SOPs will be followed for all sampling and data collection for the PSPAP.

TEAM FUNCTION AND GOVERNANCE COMMITTEE

Since the inception of the PSPAP, the PAT has functioned collaboratively in both the initial development and modification process relative to the design and standard operating procedures guiding the PSPAP. However, the Team recognizes the need for a formal governance process to handle situations that require a vote or fall outside the team's technical expertise.

Therefore, a Governance Committee (GC) has been established to help address contentious issues for the Team. The GC is comprised of a single representative from each participating office, the U.S. Geological Survey, Columbia Environmental Research Center (CERC) and the USACE; each will have one representative and, therefore, one vote on the GC.

PROCESS FOR ADDING OR ELIMINATING GEARS

For adding gears,

1. This process will be initiated by a "Request for Data".
2. The request for data should be in the form of a brief proposal clearly articulating the following: a) purpose of the data/information, b) an explanation of how the data fits within the PSPAP and c) how the information might best be acquired.
3. The Team will review the "request for data" proposal to determine if the request is aligned with the PSPAP's goals and objectives and to identify specifically which crews will participate and who will be responsible for the various aspects of the evaluation including running the statistics and writing up the final report for the effort.
4. If the request is aligned with the PSPAP's goals and objectives, the PAT will select or develop an experimental gear.
5. A request for a new Gear Code will be submitted to the MDC database manager to ensure that a duplicate code is not established for an already existing gear.
6. The office submitting this request will include the Population Assessment Team via email on the request to aid communication and will also provide a detailed description of the gear (i.e., length, mesh size, twine size, lead line weight, etc...).
7. The new gear code, detailed description and date it was developed will be incorporated into the Missouri River Standard Operating Procedures document that will include a comprehensive list of all gears developed to date.
8. The PAT (or Governance Committee if the PAT cannot come to an agreement) will decide if all or just a few crews will run this gear to evaluate its effectiveness in addressing the data request.
9. The gear will be recognized as an "Experimental" gear during the evaluation phase.
10. The resulting data will be utilized to determine whether the gear is incorporated into the PSPAP as a standard (required) gear.

For eliminating gears,

1. The data will be analyzed to identify whether the data generated by a specific gear is providing the information to address the goals and objectives of the PSPAP for which it was intended.
2. The PAT (or Governance Committee if the PAT cannot come to an agreement) will determine whether the gear should be eliminated from the Standard (required) gears or continue to be a Standard (required) gear for the PSPAP. All data from discontinued gear types will be retained in the PSPAP database.

For Data Use in addition to the Standard Reporting Template requirements, refer to Appendix C, “Reporting, Publication and Acknowledgement”.

PSPAP AREA

The PSPAP area encompasses the Missouri River from Fort Peck Dam, Montana at Rivermile (RM) 1771.5 downstream to the confluence of the Missouri and Mississippi Rivers near St. Louis, Missouri (RM 0) and the lower reach of the Kansas River. The 2000 Opinion divides the PSPAP area into river and reservoir segments and assigns high, moderate, or low priority management action to these segments for the pallid sturgeon. The focus of the PSPAP will be the high priority management action segments. The segments identified as moderate or low priority for pallid sturgeon may be categorized as reservoirs or transitional zones between rivers and reservoirs (USFWS, 2000).

The high priority action segments include Segment 2, (Fort Peck Dam, Montana, RM 1171.5 to the headwaters of Lake Sakakawea, North Dakota, RM 1568), Segment 8 (Fort Randall Dam, South Dakota, RM 880 to the Niobrara River, Nebraska, RM 1845), and Segments 10-15 (Gavins Point Dam, South Dakota/Nebraska, RM 811 to the mouth, Missouri, RM 0). Segment 6, (Oahe Dam, South Dakota, RM 1072 to Big Bend Dam, South Dakota, RM 987) and Segment 16 (Confluence of the Republican and Smoky Hills River, Kansas, RM 170 to the mouth of the Kansas River, Kansas, RM 0) are identified as moderate priority action segments. Only the segments identified as high priority for pallid sturgeon will be incorporated into sampling efforts derived from this plan. Two exceptions are the Kansas River from the Johnson County Weir to the mouth and Segment 9 (Niobrara River, Nebraska, RM 845 to the headwater of Lewis and Clark Lake, South Dakota/Nebraska, RM 835). The 2000 Opinion does not recognize Segment 9 as high priority; however, a remnant pallid sturgeon population was trapped after dam construction and has been augmented for several years. Therefore, a portion of Segment 9 will be included in the PSPAP.

BACKGROUND

The USACE, as the federal entity that provides the primary water management for the Missouri and dams on tributaries to the Kansas River, has a responsibility under the Endangered Species Act to minimize jeopardy to species listed as endangered or threatened. Many large-scale restoration actions are underway or have already been finished to provide in-channel habitat diversity as well as backwater, and chute habitat for juvenile sturgeon. The effects of these projects on pallid sturgeon and any potential change to the water management operations need to be clearly understood. It is essential that long-term monitoring take place as part of the USACE's listed species conservation to gather the information necessary to minimize jeopardy to the pallid sturgeon.

Abbreviated Timeline

The following is a chronological history of actions taken with respect to the pallid sturgeon since 1990.

1990 Pallid Sturgeon listed on September 6th.

- Very little monitoring in basin.
No successful spawning.
- 1992** Blind Pony State Fish Hatchery (SFH) successfully spawns sturgeons in captivity. This had never been accomplished before. Pallid sturgeon stocked from hatchery rearing efforts for the 1st time in 1994.
- 1997** Gavins Point National Fish Hatchery (NFH) spawns two females successfully. Blind Pony SFH spawns successfully. All progeny from the Blind Pony spawning efforts are lost due to a viral infection.
- 1998** Gavins Point NFH and Garrison Dam NFH both successfully spawn pallid sturgeon; however, all progeny at the Gavins Point NFH are lost. All progeny from the Garrison Dam NFH are transferred to the Gavins Point NFH for continued rearing. 1997 year class stocked into RPMA's 1, 2 & 3.
- 1999** Gavins Point NFH successful again with spawning.
- 2000** Garrison Dam NFH successfully spawns 2 female pallid sturgeon. Progeny are diagnosed with the Iridovirus. All fish are destroyed based on fish health recommendations.
- 2001** USACE initiates pallid sturgeon population assessment efforts with State and Federal scientists to develop the PSPAP.
Nebraska Game and Parks Commission conducts trawl evaluation.
Monitoring begins.
Onset of development of standardized monitoring.
Columbia Fishery Resources Office begins monitoring under the PSPAP's standard guidelines (Columbia was previously conducting similar assessments).
Teams and workgroups continue to develop and meet.
- 2002** USACE hires fishery biologist to facilitate implementation of the 2000 Opinion. Pallid Sturgeon Population Assessment Team (Team) meets regularly to develop standard operating procedures for the PSPAP.
Nebraska Game and Parks Commission (NGPC) and the Columbia Fishery Resources Office (CFRO) are implementing the PSPAP in portions of the lower Missouri River.
Pallid sturgeon progeny originating from parentage in North Dakota are stocked into Recovery Priority Management Areas (RPMA) 1-4. This is significant as this marks the 1st time fish from this geographic area are stocked into the RPMA 4 (lower Missouri River basin below Gavins Point Dam).
- 2003** Team continues to meet, develop and revise standard protocols and statistical design.
The Team recommended an Independent Science Review (ISR) of the PSPAP.

- NGPC and CFRO continue to sample in the lower Missouri River
Great Plains Fish & Wildlife Management Assistance Office (GPFWMAO)
begins standardized sampling in the Fort Randall reach.
Propagation PSPAP continues with stocking of “North Dakota” pallid sturgeon
progeny throughout the Missouri River.**
- 2004** **The NGPC, CFRO and GPFWMAO continue sampling.
Due to funding limitations, there was no additional expansion (no additional
crews) of the PSPAP this fiscal year.
Sustainable Ecosystems Institute was hired to conduct the ISR of the PSPAP.
Recommendations from this review were provided in a final report. The review
process included a Power Analysis.**
- 2005** **The PSPAP is fully implemented (fiscal year 2005) from Fort Randall Dam to
the mouth. First year of PSPAP implementation in Segment 4 (Yellowstone
River confluence downstream to the Lake Sakakawea headwaters) leaving
segments 1-3 the only voids in the PSPAP.
All data entry, database management and basic analysis are conducted through
a single entity.
The Team met to incorporate the recommendations of the ISR and develop
standardized reporting.
Concerns over genetic differences between Upper and Lower Missouri River
Basin and Mississippi River Basin pallids is topic of discussion resulting in
recommendations to acquire local broodstock into population augmentation
efforts if attainable. Upper basin pallids still stocked into the lower basin as
iridovirus positive fish are not allowed to be stocked into RPMA 1, 2 & 3 because
of respective State Fish Health Pathogen Restrictions.**
- 2006** **Full implementation of the PSPAP (Segments 1-14).**
- 2007** **Full implementation of PSPAP**
- 2008** **Full implementation of PSPAP**
- 2009** **Full Implementation of PSPAP**
- 2010** **Full Implementation of PSPAP**
- 2011** **Full Implementation of PSPAP; contingency monitoring enacted due to high
Missouri River flows. First genetically confirmed wild-borne pallid free-embryo
found in the upper basin near Culbertson, MT.**
- 2012** **Full Implementation of PSPAP. A second genetically confirmed wild-borne,
one-day old free embryo found in the upper basin near the Yellowstone
Confluence.**

- 2013** **Full implementation of PSPAP. Another genetically confirmed wild-borne pallid sturgeon free embryo found near the Yellowstone River confluence.**
- 2014** **Full implementation of PSPAP. First genetically confirmed wild-borne pallid free-embryo found in the lower basin near the Missouri River confluence.**
- 2015** **Full implementation of PSPAP.**
- 2016** A decreased budget led to reductions in scope for most segments relative to full implementation of the PSPAP (full implementation, as described in this document).

The PSPAP helped influence some of the actions listed above and seeks to build off of them. This long-term assessment does **not** focus solely on pallid sturgeon, but will also include data collection of the associated fish community. Monitoring a long-lived species, like the pallid sturgeon, alone would likely provide inadequate information to evaluate management actions in a timely and efficient manner. Of course, this depends upon what factors significantly limit pallid sturgeon populations. The importance of monitoring other species may decline in importance as limiting factors are identified or pallid sturgeon populations increase in size. A long-term population assessment approach that includes understanding the warm water benthic fishery (surrogate species) is addressed in the 2003 BiOp, suggesting that using surrogates will provide improvements in monitoring feedback and efficiency. Evaluation of the responses of other native Missouri River fish species to changes in habitat or flow modifications is likely to provide more immediate feedback as to the biological benefits (successes or failures) of those changes. The information derived from the PSPAP could be important for informing future management decisions.

A number of target fish (i.e., surrogate) species were identified as a monitoring focus because they provided potentially valuable information regarding pallid sturgeon biology (e.g., prey), ecology, or response to management actions. Among the species selected are: Sand Shiner *Notropis stramineus*, Sicklefin Chub *Macrhybopsis meeki*, Sauger *Sander canadensis*, Shovelnose Sturgeon *Scaphirhynchus platyrhynchus*, Plains Minnow *Hybognathus placitus*, Western Silvery Minnow *Hybognathus argyritis*, Shoal Chub (*Macrhybopsis hyostoma*; formerly Speckled Chub *Macrhybopsis aestivalis*), Sturgeon Chub *Macrhybopsis gelida* and Blue Sucker *Cycleptus elongatus*. These species will have additional data related to age, growth, and body condition (relative weight information) gathered on them to feed into the understanding of the affects of management actions on the ecological community. Some of this information will be collected through aging of hard structures and some of this information may be collected through length frequency histograms utilizing aging results to validate this methodology. All fish collected during population assessment activities will be recorded; however, detailed data will only be collected on pallid sturgeon and the representative group of native Missouri River species.

The high priority management segments (identified above) account for nearly 1,100 miles (1775 kilometers) of the Missouri River mainstem. The “Pallid Sturgeon Population Assessment

Team” has designated 13 sampling segments on the Missouri River mainstem and the lower Kansas River encompassing the high priority management areas for pallid sturgeon. Each sampling segment has been selected based on a variety of characteristics such as water temperature, turbidity, tributary influences, degrading or aggrading stream bed, stream gradient, natural hydrograph, spillway releases, and flow fluctuations. Sampling within these segments of the Missouri River will enable biologists to monitor trends of pallid sturgeon and the associated fish community within each of these segments and provide insight regarding the effects of ongoing management actions. Biological benefits of shallow water habitat development efforts and mitigation projects will be captured through other sampling efforts; however, these components will be integrated to serve as complimentary data sets to the PSPAP to enhance the knowledge and understanding of the ecosystem as a whole. Additionally, hatchery-reared juvenile pallid sturgeon have been released in all management areas. The PSPAP will serve to assess the success of these stockings as well as future stockings.

Two sampling seasons have been established to guide assessment efforts. These seasons include a Sturgeon Season that predominately focuses on sturgeon monitoring and a Fish Community Season that continues to assess sturgeon but places an additional emphasis on the native Missouri River target species. Due to the diverse habitats in the river and the longitudinal changes in climate, wide sampling time frames are necessary to facilitate comparable sampling efforts. Focused studies to fulfill unique biological information gaps may be initiated in conjunction with these assessment activities (i.e., early life history bottlenecks, priority spawning habitat, etc. per the current, signed contract or governmental agreement). These specialized studies will fall into a focused research category and must be approved by the USACE PSPAP lead (currently Tim Welker) and included in the current Fiscal Year contract/Project Work Statement.

The most recent version of this document describes the up-to-date guidance for implementation of the PSPAP; however, contracted agencies should refer to their current (signed) Fiscal Year’s Scope of Work (i.e., Project Work Statement) for sampling requirements in the current sample year.

Goals

Although the PSPAP itself will not aid in the recovery of the pallid sturgeon, the information derived from the PSPAP will help provide the information and localized expertise to aid in future management decisions. Therefore, the over-arching goal for the PSPAP is Pallid Sturgeon jeopardy avoidance, which could ultimately affect recovery.

Goal: Provide the information to detect changes in pallid sturgeon and native target species populations in the Missouri River basin.

The team recognizes two geographically distinct recovery units within the Missouri River basin. The Fort Peck Reach (segments 1-4), Fort Randall Reach (Fort Randall Dam to Lewis and Clark Lake; segments 5-6), and the Lower Reach (Gavins Point Dam to the mouth; segments 7-14). These distinct recovery units will be recognized as the “Upper Sampling Universe”, “Middle Sampling Universe”, and “Lower Sampling Universe”, respectfully.

Objectives

The following objectives have been identified for the PSPAP:

- 1. Evaluate annual and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.**
 - 1.1** Ho: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.
Ha: Annual trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.
 - 1.2** Ho: Annual trends in wild and stocked pallid sturgeon geographic distribution for all life stages remains constant over time.
Ha: Annual trends in wild pallid and stocked sturgeon geographic distribution for all life stages increase or decreases over time.
 - 1.3** Ho: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages remains constant over time.
Ha: Long-term trends in wild and stocked pallid sturgeon population abundance for all life stages increase or decrease over time.
 - 1.4** Ho: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages remains constant over time.
Ha: Long-term trends in wild and stocked pallid sturgeon geographic distribution for all life stages increases or decreases over time.
- 2. Evaluate annual results and long-term trends of habitat usage of pallid sturgeon and hatchery stocked pallid sturgeon by season and life stage.**
 - 2.1** Ho: Stocked and wild pallid sturgeon use the same habitat during all life stages annually.
Ha: Stocked and wild pallid sturgeon do not use the same habitat during all life stages annually.
 - 2.2** Ho: Stocked and wild pallid sturgeon use the same habitat during all life stages over the long-term.
Ha: Stocked and wild pallid sturgeon do not use the same habitat during all life stages over the long-term.

3. Evaluate population structure and dynamics of pallid sturgeon in the Missouri River system.

- 3.1 Ho: The population structure of stocked and wild pallid sturgeon remains constant over time.
Ha: The population structure of stocked and wild pallid sturgeon changes over time.
- 3.2 Ho: The population dynamics of stocked and wild pallid sturgeon remain constant over time.
Ha: The population dynamics of stocked and wild pallid sturgeon changes over time.

4. Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River system.

- 4.1 Ho: Annual trends in native target species abundance are stable throughout the year.
Ha: Annual trends in native target species abundance increase or decrease throughout the year.
- 4.2 Ho: Annual trends in native target species geographic distribution remains stable throughout the year.
Ha: Annual trends in native target species geographic distribution increases or decreases throughout the year.
- 4.3 Ho: Long-term trends in native target species population abundance are stable over time.
Ha: Long-term trends in native target species population abundance increases or decreases over time.
- 4.4 Ho: Long-term trends in the native target species geographic distribution remain constant over time.
Ha: Long-term trends in the native target species geographic distribution increases or decreases over time.

5. Evaluate annual results and long-term trends of habitat usage of the target native species by season and life stage.

- 5.1 Ho: Native target species use the same habitat during all life stages annually.
Ha: Native target species do not use the same habitat during all life stages annually.

- 5.2 Ho: Native target species use the same habitat during all life stages over the long-term.
Ha: Native target species do not use the same habitat during all life stages over the long-term.

6. Evaluate annual results and long-term trends in all remaining species (minimum of 50 fish collected/species) population abundance and geographic distribution throughout the Missouri River system.

- 6.1 Ho: Annual trends in non-target species abundance are stable throughout the year.
Ha: Annual trends in non-target species abundance are increase or decrease throughout the year.
- 6.2 Ho: Annual trends in non-target species geographic distribution remains stable throughout the year.
Ha: Annual trends in non-target species geographic distribution increases or decreases throughout the year.
- 6.3 Ho: Long-term trends in non-target species population abundance are stable over time.
Ha: Long-term trends in non-target species population abundance increases or decreases over time.
- 6.4 Ho: Long-term trends in the non-target species geographic distribution remain constant over time.
Ha: Long-term trends in the non-target species geographic distribution increases or decreases over time.

Success Criteria

Evaluation of success will be tied directly to the results of the PSPAP and the resulting information that these assessments provide. The following four statements may be used to determine if success of the PSPAP:

1. The PSPAP has the ability to detect population changes.
2. The PSPAP identifies survival of hatchery-reared and stocked pallid sturgeon in the river.
3. The PSPAP identifies reproduction of pallid sturgeon in the Missouri River.
4. The PSPAP identifies recruitment of wild pallid sturgeon in the Missouri River.

PSPAP Change (2007-Current)

Changes to the PSPAP: 2007

1. The collection of substrate samples will no longer be required for the PSPAP-Effective January 1, 2007.
2. The Montana Fish, Wildlife and Parks will take over age-growth processing of the *Macrhybopsis sp.* (i.e., Sicklefin, Sturgeon and Speckled Chubs) for collections made after July 1, 2007.
3. Additional segment designations have been developed for use in 2007 representing tributaries of the mainstem Missouri River. These are in addition to the large tributary segment designations that were developed in 2006. Prior to segment designation for tributaries, "TRIB" macrohabitat was used when crews sampled in the tributaries.
4. Segment 11: Extended boundary from the Johnson County Weir upstream to the Hwy 7 bridge.
5. Effective February 1, 2007, the crews in segments 5-14 will incorporate a caudal fin clip in addition to Floy Tagging Shovelnose sturgeon. The crews will adhere to the guidelines provided in the Missouri River Standard Operating Procedures document.
6. Effective April 1, 2007, the OT01 will retain the same specifications and will continue to be fished with the 30 inch boards. The same net when fished with 36 inch boards is a different gear and will be recorded as OT04. This change is reflected in Appendix N of Missouri River Standard Operating Procedures for Fish Sampling and Data Collection, Volume 1.2, April 2007.

Changes to the PSPAP: 2008

1. Delete Goal #2 of the PSPAP: Provide the information to determine habitat preferences over time for pallid sturgeon and native target species in the Missouri River basin.
2. Utility Box 6: A code for a net that did not fish properly, but caught fish was developed. This code is recorded in utility box number 6 as MNCF (Malfunction Net Caught Fish).
3. Additional detail was incorporated into the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection Volume 1.3 April 2008 to improve the standardization of gear deployments for the otter trawl and trammel net. The standard is a net or trawl fishing on the bottom regardless of river conditions relative to discharge.

4. Subsample requirements within the sampling unit (bend) will no longer be determined by the length of the bend in segments 8-14. This reduction in sub-samples is based on the power analysis conducted in 2007. Sub-samples will continue to be driven by the macrohabitat types available within a bend with two sub-samples collected within each macrohabitat by mesohabitat for a given gear. A minimum of 8 sub-samples per bend must be collected.
5. Utility box use will be in accordance to the data sheet instructions outlined in the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection Volume 1.3 February 2008. Additional utility box needs will be coordinated and cleared by the database manager.
6. For mortalities of blue sucker, sauger, paddlefish, shovelnose sturgeon, lake sturgeon and pallid sturgeon, record an “M” in the otolith box.
7. Floy Tagging of shovelnose sturgeon: Fish less than 330mm may not be tagged due to their small size. No explanation is necessary when fish are not tagged.
8. BAR microcode was amended by dropping the 1.2 meter maximum depth range. The BARS mesohabitat code will remain the same as the original description following the 1.2 meter depth maximum. Any analysis that will be conducted using the BAR microcode should include depth data since the use of this BAR microcode has not been consistent between crews.
9. The addition of an SOP for Fishing/Angling has been incorporated into the “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection” (Feb 20, 2008).
10. The addition of an SOP for “Crazy Nets” have been incorporated into the “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection” (Feb 20, 2008).
11. Aging structures will no longer be collected from blue sucker, sand shiners, western silvery minnow, plains minnow, speckled chubs throughout the PSPAP area. Sturgeon and sicklefin chub aging structures will be collected in segments 1-3 (only) in 2008 to round out a full three set of this data set. At least 3 years of data for these species exists in the remaining segments of the PSPAP area where these species are present; therefore, length frequency histograms can now be used in conjunction with the existing age-growth data for aging purposes. Sauger scales and dorsal fin rays will be collected year round throughout the PSPAP area and the upper size limit has been removed. The upper size limit has also been removed from shovelnose sturgeon which will allow us to estimate mortality. Structures will continue to be collected in the lower universe from the onset of the sturgeon season (approximately November 1st) through April 30th. In the upper universe, structures will be collected after August 1st-October 31st.
12. Lake sturgeon will be treated like pallid sturgeon with a PIT Tag inserted as well as a genetic sample collected and sent to Dave Herzog, Missouri Department of Conservation. Most crews have already been doing this, but it has not been explicit in any instructions!
13. Addition of segment codes for Missouri Mainstem Reservoirs and a segment for the Mississippi River have been included in the PSPAP.
14. The Push Trawl (POT02) was discontinued as an evaluation gear and is classified as a Wild (optional) gear for the PSPAP.

Changes to the PSPAP: 2009

1. The trotline was implemented as an evaluation gear in 2009. The trotline was a Wild (optional) gear for the PSPAP in 2008.
2. All *Hybognathus* spp. were designated as target species in 2009.
3. Recording Net River Mile is no longer required on the field data sheet.
4. The Missouri River Standard Operating Procedures for Fish Sampling and Data Collection Volume 1.4 July 2009 was updated to allow subsampling of shovelnose sturgeon weights. 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.
5. Collection of age and growth structures was discontinued in 2009.
6. The required annual training was changed in 2009 from single-location training where all PAT members met to review PSPAP protocols and methods to an exchange of crew members. The Team decided that the single-location training did not currently provide the benefits experienced early in the PSPAP as most of the crews, techniques, and equipment had not changed for several years. Swapping crew members between offices for a period of 3 days would provide a better opportunity for examining gear and equipment use in other portions of the river and improve the collective group knowledge with regard to other segments. Each visiting crew submitted a short report detailing their experience to the PSPAP Manager.
7. A new species code, UHI (Unidentified Hiodontidae), was added to the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection Volume 1.4 July 2009.
8. A genetics sample was taken from all Unidentified Shovelnose Sturgeon (USG) that were less than 150 mm in length.
9. Crews collected weights (not a required activity) on Asian carp for a study conducted by D. Chapman (USGS-CERC) and K. Irons (INHS) to assess carp body condition.
10. An appendix will be added to annual reports that documents and explains the rationale for changes made to the annual report template.
11. A procedure for PIT tagging lake sturgeon and a procedure for scanning pallid sturgeon and lake sturgeon for PIT tags and coded wire tags was added to The Missouri River Standard Operating Procedures for Fish Sampling and Data Collection Volume 1.4 July

2009. The field data sheet was also updated to allow a letter “Z” to be placed into the R/N box. The letter “Z” will be used to identify a malfunctioning PIT tag.

12. Floy tagging shovelnose sturgeon continued in 2009 until the remaining tags were used. Floy tagging will not continue in 2010.

Changes to the PSPAP: 2010

1. Effective April 1, 2010, the use of the Trammel Net (TN) as a standard gear during the Sturgeon Season is discontinued in segments 7-14.
2. The Trotline was implemented as standard gear during the Sturgeon Season in 2010. The trotline was an Evaluation gear for the PSPAP in 2009.
3. 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.
4. In addition to the PSPAP’s standard sampling, a focused non-random sampling effort occurred in segments 1-4. Focused sampling was conducted in 1-2 week periods in the fall (August-September) and the spring (dependent on ice-out) in collaboration with the State of Montana (Montana Fish, Wildlife, and Parks). Data from this effort will be used to improve ongoing survival estimates for RPMA 2.
5. Speckled chub (*Macrhybopsis aestivalis*) captured through the PSPAP are now identified as shoal chub (*Macrhybopsis hyostoma*). A taxonomic analysis and review of *Macrhybopsis aestivalis* (e.g., Eisenhour, 2004, Alabama Museum of Natural History Bulletin #23) identified the Mississippi River basin form as a separate species (i.e., shoal chub; *Macrhybopsis hyostoma*). This change is reflected in the Sixth Edition of the American Fisheries Society’s “Common and Scientific Names of Fishes”. Coding on the datasheet will remain SKCB, but the name will be changed in annual reports and other PSPAP documents.
6. Condition (Kn) and growth for pallid sturgeon will be calculated using a more recent length-weight regression equation developed by Dane Shuman (USFWS-Great Plains Fish and Wildlife Management Assistance Office; in review) that better fits the data collected through the PSPAP. This information was incorporated into annual reports beginning in 2009.
7. BARS, CHNB, and POOL were added as mesohabitats for SCN macrohabitat.

Changes to the PSPAP: 2011

1. Dam tailwaters (DTWT) was changed from a mesohabitat to a macrohabitat for Segments 5, 7, and 11.
2. Collection of weights on non-target fishes will be conducted at the discretion of the individual offices.
3. Whenever 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. If another pallid sturgeon is captured during the additional pass, additional passes are required to be collected. Change: “A limit of four additional passes (first pass plus four) may be collected in this exact location. In situations where many subsamples within a bend contain pallid sturgeon and the extra time associated with processing the

additional captures interferes with completing the remaining standard sampling, the number of duplicate passes will be left to the crew leader's discretion". Changed from: "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".

4. Contingency monitoring protocols were added to the guiding document to guide sampling during extended periods of high water/flows. As soon as there is any indication or doubt that sampling may not be completed, notification should be made to the USACE PSPAP Manager. This knowledge will be used to support ongoing efforts. Priority will be placed on standard sampling, and surrogate units of effort or other contingency sampling will be determined (and approved by the USACE PSPAP Manager) on a case-by-case basis, as events occur.

Due to high flows in 2011, most of the standard monitoring was not completed by the field crews. Contingency monitoring was conducted in lieu of standard monitoring and focused on sampling fish populations on the floodplain and tributary rivers.

5. Monthly standard reports are required from each office. The reports describe the past month's activities conducted by each office and are due to the USACE PSPAP Manager by the 7th of each month.
6. The Teams are no longer required to take morphological and meristic data from known hatchery-reared pallid sturgeon; however, they are still required on any fish collected without a tag.
7. Voucher photos are required for any fish that a genetic sample is collected. A single side photo and a single ventral photo with the PIT tag number visible in each are needed.
8. Push trawls were added as a standard gear in Segment 11 to replace trammel nets. Other trammel net configurations will be evaluated for this segment.
9. Information regarding the use of weights on trammel nets, as well as notation of bow trawling, has previously been entered in the comments section of the datasheet. It was decided that a three digit number indicating the amount of weight used [W + the two digit weight in lbs (e.g., W05, W10, etc.)] would be entered in the utility box when applicable. Similarly, the letters BOW will be entered in the utility box when bow trawling is conducted. These entries will be optional/not required.

Changes to the PSPAP: 2012

1. For template figures in the annual report where there was no standard data collected – no graph will be included.
2. The disclaimer "Genetic records for hatchery-reared fish are incomplete. Thus, fish classified as wild could be considered "potentially wild"; that is, these fish do not match a hatchery cross on file." will be added to the appropriate figures in the annual reports.
3. The number or proportion of hybrid sturgeon will be included in the shovelnose x pallid hybrids section of the annual reports (just included in the text).
4. The push trawl will be used as a standard gear in Segment 11. Trammel nets will be a wild gear for this segment.
5. The DMFT-W and MFT-W High Water Season gear codes were added to the PSPAP.

6. Sampling POOL and BARS mesohabitats will be required with the OT16 gear when the mesohabitats are available in the lower MR Segments 8-14. This has been adjusted in Table A4 of the Guiding Document.
7. Thalweg “TLWG” will be a standard mesohabitat in “SCCS, SCCL, TRMS, TRML” macrohabitats for any gear over 1.2 m in lower MR Segments 8-14 (see Table A7; page A17; fish community season).
8. The segment of the river from Garrison Dam to the Lake Oahe headwaters will be identified as Segment 53 (Lake Oahe).
9. A new online DB management system and hand-held field computers were implemented in 2012.

Changes to the PSPAP: 2013

1. New hand-held computers fielded and validated by all crews.
2. Segment 53 sampling is complete; no pallid sturgeon observed from 2011 flood year.
3. Online DB management system continues to be refined and reports self-generated.

Changes to the PSPAP: 2014

1. Bismarck USFWS will test 3”x8” trammel net in Segment 4 to determine if they sample a larger size of pallid sturgeon when compared to the standard trammel net used by the PSPAP.
2. If a pallid sturgeon is captured with a coded wire tag in Segments 7, 8, 9, 10, 11, 13, or 14, a genetic sample is required. This will hopefully provide information for the genetic reconstruction of fish stocked into the lower Missouri River.

Changes to the PSPAP: 2015

1. No major changes to the PSPAP occurred in 2015. Improvements to the Field Application and the Web Application for data recording and uploading data to the database continued to be a focus.

Changes to the PSPAP: 2016

1. Budget reductions for Fiscal Year 2016 led to changes in sampling (as compared to the years when the PSPAP was considered fully implemented) for most segments of the PSPAP. The changes varied by segment, but resulted in reduced effort or removing gears from the sampling schedule.
2. Termination of services (through non-renewal of an annual governmental agreement) supplied by a government agency led to an absence of sampling in Segments 13 and 14. The timing of the decision prevented arrangement of contract services with another agency to conduct the sampling in 2016.

IMPLEMENTATION STRATEGY

The Implementation Strategy for the PSPAP is built on partnerships, common goals and objectives, and sound science. The USACE, as the Action Agency, is responsible for ensuring that these long-term assessment activities occur. The USACE has developed partnerships with state and federal agencies already active on the Missouri and Kansas Rivers and has provided them funding necessary to implement the field component of this long-term assessment. The USACE will continue to use partnerships to fully implement the PSPAP so long as the approach continues to provide sound and objective scientific information. The strategy to provide guidance and direction to the PSPAP is also based on partnerships and adaptive management. The PAT has developed common goals and objectives thought necessary to accomplish this task. As a guidance team, the PAT refines and adapts priorities and effort by consensus as information needs evolve. The 2000 Opinion also provides direction through description and explanation of the RPA elements. For example, RPA element VI B discusses philosophy and strategy, lists specific segments in which information must be gathered and specific data needs, identifies segments of research and restoration, and also identifies the need for a coordination and communication plan. This PSPAP will refer back to this type of guidance to ensure PSPAP direction is in line with the 2000 Opinion.

As the PAT members collect the data, it will be processed as described in the protocols. Each PAT member office is responsible for producing an annual report that summarizes their activity and the data they have collected. These reports are submitted to the USACE.

SAMPLING SEASONS

Two sampling seasons have been established to accomplish sampling objectives 1-6. These sampling seasons are determined by dates and water temperatures to provide flexibility in sampling across the geographic range of the Missouri River Basin. Each PAT member will follow the protocols of the Service's Endangered Species Handling Permit guidelines to minimize the potential for "take" during these biological data collections.

The Sturgeon Season will begin in the fall when the water temperature is $\leq 12.8^{\circ}\text{C}$ (55°F) and will continue through June 30th. This will address the issue of the water temperature variations between the upper and lower portions of the Missouri River and the amount of time in the field season to accomplish restrictive sampling (i.e., gill netting) prior to ice. On July 1st, sampling efforts will incorporate an additional emphasis on the associated fish community. The Fish Community Season will run from July 1st through October 31st. These two seasons may overlap in portions of the river when temperatures fall below 12.8°C prior to the conclusion of the Fish Community Season. All required sampling efforts must be completed for each season in accordance with protocols.

A portion of the Sturgeon Season (when water temperatures $\leq 12.8^{\circ}\text{C}$) will enable crews to deploy standardized experimental mesh gill nets. Gill netting during the Sturgeon Sampling Season may not be feasible in all segments due to uncontrollable environmental factors (e.g.,

climate, weather) from year to year; however, at present, gill netting is feasible in the lower Missouri River. A variety of complimentary gears will be deployed throughout the habitats primarily from March through June.

The Sturgeon Sampling Season will provide trend information regarding pallid sturgeon abundance and distribution, evaluate the success of the ongoing population augmentation project, and provide information related to dispersal, staging, and spawning sites of pallid sturgeon.

The Fish Community Season continues with an equivalent level of sampling effort (excluding gill netting) during the late summer and fall but places an additional emphasis on the fish community. Additional sampling with passive gears (mini-fyke nets) provides information related to species composition in areas where habitat is less than 1.2 meters deep. Sampling during this time frame with this suite of gears will provide an assessment of the young-of-year fish production. All structures for age and growth analysis will be collected primarily during the Fish Community Season, but will follow the guidelines established in the document, “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection” (Welker and Drobish 2016). Sampling during this time frame will provide the greatest opportunity to document natural reproduction via sampling young-of-year pallid sturgeon. Locating pallid sturgeon spawning sites and identifying the timing of these events will be addressed through focused research efforts.

The deployment of multiple gears in all habitat types will also assess growth, survival, movements, distribution, and habitat preference of pallid sturgeon. The sampling and gear efforts will be distributed proportionately throughout this sampling period to ensure representation of the entire sampling period.

Sampling sites will be selected randomly; however, the PSPAP provides the flexibility to sample additional sites as well as the required sampling (e.g., non-randomly selected bends, tributaries, etc.). In addition to collecting routine fisheries and habitat data at these sites, an Acoustic Doppler Current Profiler may be used to provide physical attribute details at these locations (depth, velocity, substrate).

The PAT has identified 13 river segments for sampling throughout the Missouri River and the lower portion of the Kansas River. These segments encompass all of the high priority segments as identified in the 2000 Opinion (Reservoirs within the Missouri River system have been excluded from sampling since they are not a high priority for pallid sturgeon). The numbers of these river segments do not coincide with those identified in the 2000 Opinion and discussed earlier in this document. These segments have been identified based on change in physical attributes such as degrading or aggrading stream bed, flow fluctuations, natural hydrograph, stream gradient, geology, water temperature, turbidity, substrate, discrete habitat changes (tributary or tributary influence), and modifications (presence of restoration projects).

DESIGNATION OF MISSOURI RIVER SEGMENTS FOR THE PSPAP

The segments identified in the 2000 Opinion that will be sampled as part of the PSPAP have been retained as specified in the 2000 Opinion or divided into shorter segments. After these new segments were identified, they were numbered and parceled out to each PAT. A total of 13 new Missouri River Mainstem segments have been delineated. A series of physical characteristics were used to delineate these segments for the Missouri River.

1. Fort Peck Dam downstream to the Milk River (RM 1771.5-1760)
 - a. water temperature, turbidity, spillway releases, degrading streambed
2. Milk River downstream to Wolf Point (RM 1760-1701)
 - a. degrading streambed/transition segment, temperature, turbidity
3. Wolf Point downstream to the confluence with Yellowstone River (RM 1701-1582)
 - a. aggrading stream bed
4. Confluence with the Yellowstone River through the headwaters of Lake Sakakawea (RM 1582-1568)
 - a. major tributary, natural hydrograph
5. Fort Randall Dam downstream to the Niobrara River* (RM 880-845)
 - a. tributaries, temperature, turbidity, degrading/aggrading stream bed
6. Niobrara River downstream to the headwaters of Lewis and Clark Lake* (RM 845-825)
 - a. major tributary, aggrading stream bed, temperature, turbidity
7. Gavins Point Dam downstream to Lower Ponca Bend (RM 811-750)
 - a. temperature, turbidity, flow fluctuations, degrading
8. Lower Ponca Bend downstream to the Platte River (RM 750-595.5)
 - a. degraded stream bed, channelized, turbidity, flow fluctuations
9. Platte River downstream to Kansas River (RM 595.5-367.5)
 - a. major tributary, degrading/aggrading stream bed, tributary mouth, restoration projects
10. Kansas River downstream to Grand River (RM 367.5-250)
 - a. major tributary, less influence of dam releases (Gavins Point Dam), natural hydrograph, restoration projects
11. Kansas River upstream to the Hwy 7 bridge (Kansas River: RM 0-20)
12. Grand River to Glasgow-Combined into segment 13-Effective 7/01/2005.
13. Grand River to the Osage River (RM 250-130)
 - a. major tributary, floodplain, natural hydrograph, restoration projects
14. Osage River downstream to the mouth (RM 130-0)
 - a. major tributary, restoration projects
 - b. backflow, delta, natural hydrograph, restoration projects

DESIGNATION OF TRIBUTARIES AS SEGMENTS FOR THE PSPAP

Due to the importance of tributaries and the flexibility built into the PSPAP to conduct sampling in addition to the standard (required) sampling, the following numeric designations have been assigned to large tributaries following the same format as the PSPAP's segment designations. When sampling these tributaries, these numeric designations must be recorded in the segment box. This facilitates the utility of the existing habitat classification system at all levels to

maintain the consistency relative to data collection between the Missouri River and the tributaries.

Upper Sampling Universe (Fort Peck Reach)

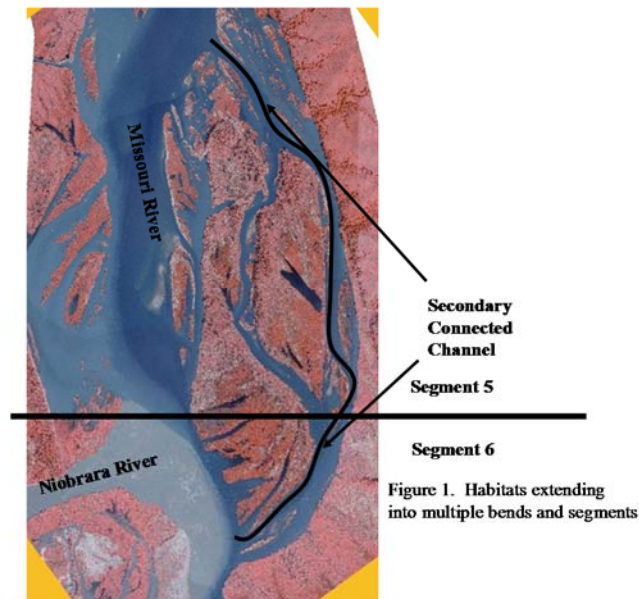
Segment Number	Tributary
21	Milk River (MT)
22	Yellowstone River (ND)
Segment Number	Reservoirs
51	Fort Peck Reservoir
52	Lake Sakakawea
53	Lake Oahe
54	Lake Sharpe
55	Lake Francis Case

Lower Sampling Universe (Fort Randall Dam to mouth)

Segment Number	Tributary
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
56	Lewis and Clark Lake
71	Mississippi River

HABITAT CLASSIFICATION

The basic habitat classification system that was utilized in the Benthic Fishes Study has been adopted by the PSPAP. The Benthic Fishes Study was conducted in the late 1990s by the USGS Cooperative Units located throughout the Missouri River basin states. This basic habitat classification system has been further modified to address both broad and specific habitats by using a hierarchical classification system (i.e., Macrohabitat, Mesohabitat, Microhabitat) to aid in consistent and complimentary data collection for the PSPAP. This approach will provide a more detailed habitat classification system for the river. All habitats will be classified based on the conditions at the time of sampling. A “river bend” (bend) will serve as the basic sampling unit (replicate) within each river segment. A bend comprises three continuous macrohabitats, an outside bend (main channel), an inside bend (main channel) and a channel crossover (main channel). Bends will be determined by the hydrologic nature of the river (Bends will be identified beginning at the origin of each channel crossover and will include the adjacent downstream outside bend/inside bend complex.) rather than the adjacent landforms. In defining a bend, the river bend expands with the landscape to encompass any islands and secondary channels. A single secondary channel will be sampled within the adjacent main channel river bend (Figure 1).



This methodology may be applied to all river segments identified for the PSPAP. Typically, the river parallels the adjacent geographic landforms; however, within the unchannelized reaches, the hydrology of the system does not always mimic the adjacent landforms. In these unique reaches, the number and length of the river bends may change more rapidly than in the channelized portions of the river. The need to remain consistent throughout the river allows for

comparisons despite the magnitude differences and also allows for consistency regarding data collection while incorporating hydrologic factors of the river. The bends themselves and the number of bends within a segment may change over time.

Additional discrete macrohabitats have been identified that may not be present in each bend. Large tributary mouths, small tributary mouths, confluences, large and small secondary connected channels, non-connected secondary channels, deranged, braided, detritic and Wild (all other macrohabitats) plus the 3 continuous macrohabitats make up the 13 macrohabitats (see Figure A1 in Appendix A) representative of the Missouri River from Fort Peck Dam to the mouth and on the lower Kansas River. Mesohabitats have been established and defined to describe macrohabitats, and microhabitats may be used to further describe mesohabitats, including identification of unique structural modifications. The use of microhabitats is required for the PSPAP in segments 8-14.

All habitats will be classified based on the conditions at the time of sampling. For example, a secondary connected channel at the current river stage may be a secondary non-connected channel at a lower river stage. Therefore, habitat is always classified based on the conditions at the time of sampling.

STANDARD OPERATING PROCEDURES

Standard operating procedures (SOPs) have been developed for the PSPAP. These SOPs have been consolidated into a separate document titled, “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection” (Welker and Drobish 2016). These SOPs are the required procedures that will be followed for all activities relevant to the PSPAP to ensure consistency among the data acquired.

**PALLID STURGEON
POPULATION ASSESSMENT PROJECT**

APPENDIX A

**STANDARD OPERATING
PROCEDURES DEFINING
THE SAMPLING STRATEGY**

BASIC SAMPLING STRATEGY DESCRIPTION

Two sampling seasons have been established to sample pallid sturgeon and the associated fish community. These have been identified as the Sturgeon Season and the Fish Community Season for the PSPAP. The Sturgeon Season targets the sampling of pallid sturgeon; however, the diversity of gear/habitat combinations included in this sampling effort will result in the collection of a variety of fish species during sampling efforts. Basic data (i.e. species, length,) will be collected on all fish sampled. The Fish Community Season will continue with the same magnitude of sampling effort of the Sturgeon Season with an additional emphasis on the fish community with special effort on the sampling of shallow water habitats using mini-fyke nets in BAR mesohabitats. The Fish Community Season will provide the greatest opportunity to identify natural reproduction of pallid sturgeon and other native fish species as young-of-the-year (YOY) fish will be susceptible to a variety of gear types. The strategy designed in these sampling seasons will provide data related to the pallid sturgeon and the fish community representative of all habitat types throughout the year.

GEAR AND SITE SELECTION FOR EACH SAMPLING SEASON

Standard gear has been selected targeting specific habitat types for the Sturgeon and Fish Community Sampling Seasons. The standard gear will be deployed in the habitats as identified in Tables A2 through A7. These tables serve as a guide for sampling during each sampling season for all PSPAP segments. In addition to the sampling gear outlined in the tables, a minimum number of gear deployments for each standard gear have been established per bend to ensure adequate representation for comparisons between segments. The standard gears have been selected for various reasons. Some of the gears were designed with the capture of pallid sturgeon in mind, while other gears target the associated fish community. The gear is not species specific and will sample multiple species despite targeting the capture of pallid sturgeon or the fish community. Regardless of the focus of each season, the diversity of gear and habitats that will be sampled will provide a broad spectrum assessment of the Missouri River fishery. The deployment of “Wild” gear is optional but may be used in addition to the standard gear/habitat combinations. This strategy provides flexibility for the field crews to experiment and explore to facilitate improved sampling techniques. The options for use of “Wild” gear are included in Tables A2 through A7.

Current aerial photographs or colored infrared (CIR) maps may be useful in identifying various habitats and river mile information. When multiple “discrete macrohabitats” are identified within a single bend, those included in sampling should be selected randomly. In the channelized river, the channel crossovers are marked for navigational purposes and, therefore, should be easily discernible. Proportionately, channel crossovers comprise an extremely small portion of the river in the channelized sections from Ponca to the mouth.

Procedures for sample site selection and sampling requirements include the following:

1. All bends within a segment will be numbered prior to sampling beginning at the upstream boundary of the segment. This numbering system will remain consistent for each sampling season and from year to year unless significant physical changes occur within the segment (renumbering may be necessary in the unchannelized reaches on a more regular basis as channel morphology changes over time).
2. Bends will be randomly selected using a random number generator, table or random drawing on an annual basis beginning at the onset of the Sturgeon Sampling Season. These randomly selected bends will be sampled throughout the Sturgeon and Fish Community Seasons.
3. All bends within the segment will be randomly selected even though only a portion of the bends selected will actually be sampled based on the requirements of the sampling design. However, to increase statistical power, additional bends may be sampled in the order of their random selection and incorporated into the data set. For bends sampled in addition to the required number of bends within a segment, there is no requirement that all gears be deployed. Therefore, the gears that collect sturgeon may be deployed at the standard level in these additional bends to strengthen the random data set within the strata (i.e., segment) and statistical power of the data set for population and trend analysis.
4. When sampling a bend that contains a tributary mouth, the tributary mouth (lower 300 meters of the tributary) is considered part of the Missouri River as captured in the sampling design of the PSPAP. If the intent of the sampling is to conduct “wild” (not required) or exploratory sampling in a tributary, then the appropriate segment designation should be recorded for the tributary being sampled.
5. The number of bends required within each segment is outlined in Table A1. A minimum proportional rate of 25.2% of all bends within a segment (unless otherwise specified in Table A1) will be sampled each sample year; this sample size was selected to achieve the desired statistical power for detecting changes in population abundance.
6. If evaluation of specific bends is desired but were **not** randomly selected through the bend selection process, these bends may be sampled in addition to the minimum required randomly selected bends. If a bend other than those on the randomly selected list is sampled, the bend should be recorded as a non-randomly selected bend since the sampling effort did not follow the randomly selected bend list priority. Additional non-random sampling efforts should not be conducted in lieu of the required random bend sampling. Complete assessments are not required for non-randomly selected bends (e.g., trammel netting a location within a bend that typically has resulted in pallid sturgeon catch) or in bends that were sampled in addition to the required level of random bend sampling in accordance with Table A1.
7. If discrete habitats (e.g., secondary channels, tributary mouth and confluence, etc.) are minimally represented by the random bend selection (e.g., only 2 secondary connected channels within the 10 bends selected when there are 12 secondary channels located within the segment), additional effort may be directed to a portion of the bends containing these discrete habitats to provide more equal representation of the various habitats. When sampling these additional chosen discrete habitats within a bend, they would be recorded as non-randomly selected on the data sheet. These additional non-

- random sampling efforts should not be conducted in lieu of the required random bend sampling.
8. Additional bends above and beyond the randomly and non-randomly selected bends may be sampled at the crew leader's discretion. For example, a series of angler reports indicate pallid sturgeon located in an area that does not fall within the randomly and non-randomly selected bends. These areas may be sampled. However, additional bends should not be sampled in lieu of the required sampling efforts in accordance with the experimental design.
 9. Randomly and non-randomly selected (chosen) bends shall be identified in the appropriate box (R=random or N=non-random). Refer to the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection (Welker and Drobish 2016).
 10. Once a bend is selected, all macrohabitats and mesohabitats (and microhabitats when appropriate) shall be identified.
 11. Each mesohabitat within a macrohabitat requires sampling using the standard gears that are identified in Tables A2 through A7.
 12. A minimum of two sub-samples are required for each standard gear type for the habitats identified within a bend (must achieve the minimum gear deployments identified for each season per bend identified in Tables A2 through A7).
 13. When collecting sub-samples within a given habitat, the sub-samples should be collected at randomly selected intervals throughout the habitat (i.e., four sub-samples collected in the given habitat; the sub-samples should be spaced at locations ranging from 0-100 percent of the length of the habitat).
 14. Additional optional (non-standard) sampling (e.g., dragging a trammel net in a BAR mesohabitat) may be conducted and identified as "Wild".
 15. As part of the process of evaluating new gears, an "E" will be utilized for gears undergoing an "Experimental or Evaluation Phase". This will only apply to the evaluation of gears that the Team has agreed to evaluate throughout the PSPAP Area or throughout the upper or lower sampling universe. These gears will be identified in tables A2 through A7 as "E" rather than as an "S" (Standard) or "W" (Wild) indicating an optional gear. These gears will also be recorded as "E" and incorporated into the database with this designation.
 16. Habitat characteristic data collection (velocity, turbidity) is required for all gear deployments resulting in the capture of a pallid sturgeon and for one of the sub-samples within a given macrohabitat/mesohabitat for each required gear type (collection of substrate data is no longer required-effective January 1, 2007).
 17. Depth and temperature will be collected at all sampling locations.
 18. If the habitat is available for a standard gear type, and the gear type is not deployed, the reason the gear type was not deployed will be briefly described in the comments section. A crew leader will reserve the right not to deploy a gear if conditions are unsafe, or conditions are such that loss of gear is probable based on current river conditions.

Table A1. Required Sampling Effort (River Bends-Replication) for Each River Segment

Segment Number and Description	Randomly Selected River Bends
1 Fort Peck Dam to Milk River	0
2 Milk River to Wolf Point (Hwy 13 bridge)	12
3 Wolf Point to Yellowstone (Confluence)	21
4 Confluence to Headwaters (Sakakawea)	12
*5 Fort Randall Dam to Niobrara (Confluence)	10
*6 Confluence to Headwaters (Lewis & Clark)	combined w/ segment 5
7 Gavins Point Dam to Lower Ponca Bend	12
8 Lower Ponca Bend to Platte River (Confluence)	15
9 Platte River to the Kansas River (Confluence)	20
10 Kansas River to the Grand River (Confluence)	10
11 Kansas River from the Hwy 7 bridge to the Confluence with the Missouri River	3
13 Grand River to Osage River (Confluence)	11
14 Osage River to the mouth	14

*Bends will be selected with segments 5 and 6 combined as one unit and subsequent analysis of data collected in the Fort Randall reach will also be combined to increase power; however, data will be recorded by segment to differentiate between these segments to facilitate other analysis opportunities.

STURGEON SAMPLING SEASON

The focus of the Sturgeon Sampling Season targets abundance and distribution of sturgeon populations, specifically pallid sturgeon. A diversified sampling approach will also evaluate survival and growth of stocked pallid sturgeon resulting from basin wide propagation/population augmentation efforts. Initiation of this season will be determined by water temperature ($\leq 55^{\circ}$ Fahrenheit; 13° C) rather than by date. The season will begin when water temperatures decline to 55° F or less (in the fall) and will continue through June 30. The reason for this is that gill nets must **not** be set when water temperatures exceed 55° Fahrenheit to reduce the potential for “take” during sampling activities. Because of this requirement, the timeframe for the sampling efforts within the Lower Sampling Universe may vary significantly with regards to gill netting sampling efforts. Gill netting is not included in the Upper Sampling Universe as a required sampling effort targeting sturgeon during the Sturgeon Season. Environmental conditions may conflict with these sampling efforts in the more northern latitudes, depending on weather conditions; however, similar sampling efforts have proven to be effective in documenting sturgeon abundance in the lower Missouri River. Although this season may cover several months, gill netting will be the only required gear for this season from the time the water temperatures decline to 55° F through February. Gill netting shall continue through completion of required sampling efforts after February, provided water temperatures are $\leq 55^{\circ}$ F. The remaining required efforts included in the Sturgeon Season will be deployed from March through

June (Tables A2, A3, and A4). Additional “Wild” sampling efforts may be conducted at any time during this season, but these will NOT be in lieu of any standard sampling.

Tables A2 through A4 serve as a guide for sampling during the Sturgeon Season for the unchannelized reach in Montana, the unchannelized reaches below Fort Randall and Gavins Point Dams, and the channelized river from lower Ponca Bend to the mouth near St. Louis. A secondary guide to the effort outlined in Tables A2 through A4 for the Sturgeon Season will require that a minimum gear effort be deployed per bend. These minimums will include 8 sub-samples of each standard gear per bend. When the effort prescribed in the tables do not meet the minimum requirements, then the netting effort will be distributed proportionately among the habitats that are available. Within each segment, half (half of the bends) of the required effort for trammel drifting (Segments 1-6 only; the trammel net is no longer a standard gear for the Sturgeon Season in Segments 7-14) and trawling will be completed in March and April and half will be completed in May and June. The minimum effort for gill netting is 20 net-nights per bend (2000 feet of gill net/bend). Within each segment, half of the gill netting effort (half the bends in the channelized river will be sampled with the full gill netting effort prior to January 15, and the remaining bends will be sampled after Jan 15. In the unchannelized river all of the bends will be sampled with half of the required effort (1000 feet) of gill net prior to January 15. These bends will receive the remaining effort after January 15. In the channelized river, trotlining will begin in the fall following the Fish Community Season (in general, this aligns with the start of fall gill netting) and continues through the next sampling year with approximately one-half the required trotlining effort (half the bends) sampled in the Sturgeon Season and one-half sampled in the Fish Community Season. In the unchannelized river, standard trotline sampling will begin during the Sturgeon Season in spring (March or April depending on conditions) and continue through the Fish Community Season with approximately one-half the required effort (half the bends) sampled in both seasons.

Once a river bend is selected, all macrohabitats and mesohabitats should be identified.

1. Each mesohabitat within a macrohabitat requires sampling using the standard gear (s) identified in Tables A2 through A4.
2. A minimum of two sub-samples are required for each standard gear type for the habitats identified within a bend. A minimum of 8 sub-samples/bend will be collected for each standard gear.
 - a. In segments 1-14, the minimum sub-samples required within a bend will remain at 8, but will be determined by the available macrohabitats within the bend. Crews will focus on increasing the number of randomly selected bends as time allows. However, only the TN, OT16, and TLC) will be deployed in bends above the number of bends required in Table A1. The emphasis here is to increase the statistical power for the “sturgeon capturing gears”. The three gears will be deployed equally in these bends.
3. Habitat characteristic data collection (velocity, turbidity) is required in conjunction with one sub-sample per mesohabitat (within a macrohabitat) for each gear type. Habitat characteristic data will be collected at a minimum of 25 percent of all sub-samples collected within a mesohabitat for each gear type.

4. Depth and temperature will be collected at all sampling locations.

Table A2. Standard (required) and Wild (optional) Gear Deployment for Each Habitat Type for the Sturgeon Season in the Fort Peck Reach (segments 1-4).

Macrohabitats	CHXO, OSB, ISB, SCCL, SCCS, DRNG, BRAD, DEND, CONF				TRMS			TRML		
Mesohabitats	BARS	POOL	CHNB	ITIP*	B A R S	P O L S	C H N B	B A R S	P O L S	C H N B
Gear Type										
Trammel Net TN			S	S			S			S
Otter Trawl OT16			S	S			S			S
Trotline** TLC1	S	S	S	S	S	S	S	S	S	S

S=Denotes the Standard (required) gear type for a given habitat

E=Denotes a gear that is undergoing an experimental evaluation proposal.

All other Applications are wild (W)

Applicable to all gear types and habitats: Deploy gear within a habitat type where conditions (depth, width, velocity) allow proper deployment

*Island Tips are only associated with Secondary Connected, Deranged, Braided and Dentritic Channels

**Excludes non-flowing pools

Examples of gear deployment locations are shown in Figure A1.

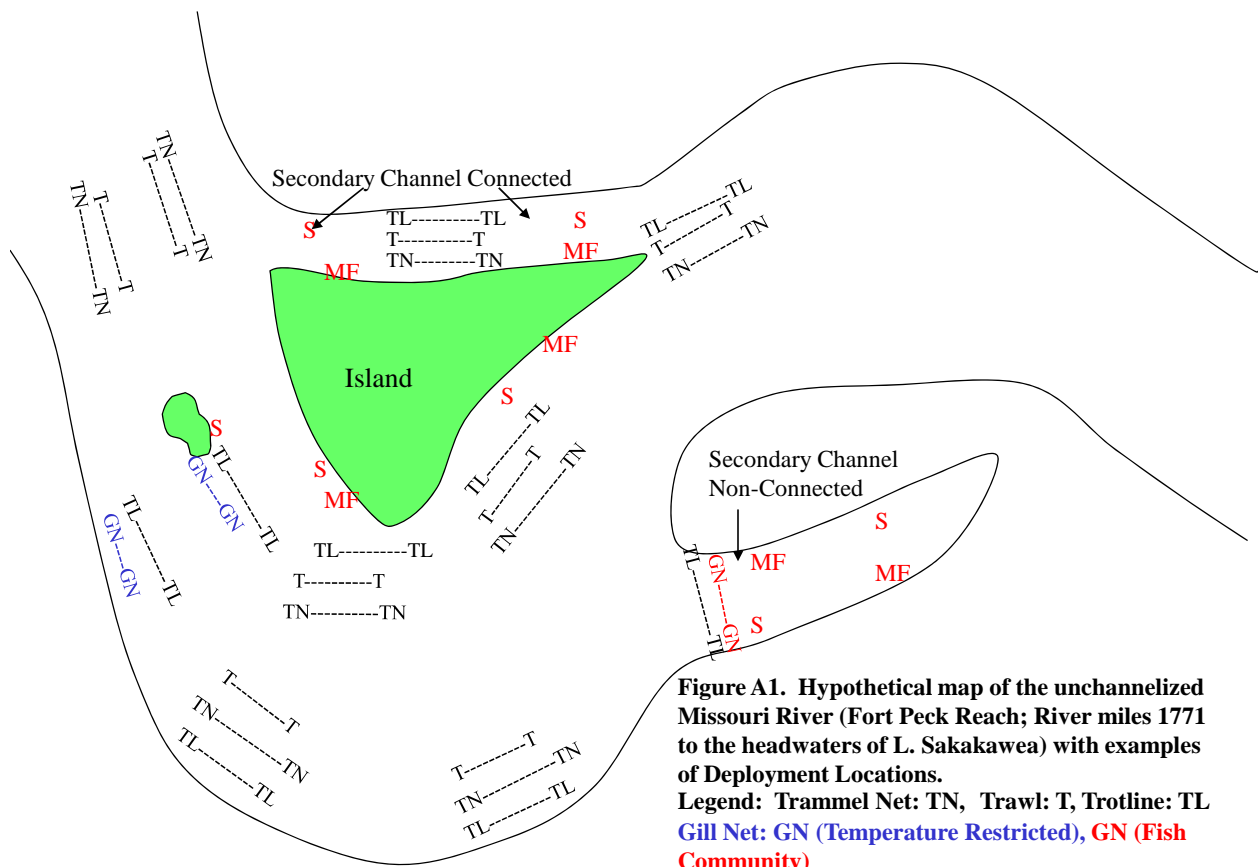


Figure A1. Hypothetical map of the unchannelized Missouri River (Fort Peck Reach; River miles 1771 to the headwaters of L. Sakakawea) with examples of Deployment Locations.
Legend: Trammel Net: TN, Trawl: T, Trotline: TL
Gill Net: GN (Temperature Restricted), GN (Fish Community)
Seine: S, Minifyke: MF (Fish Community)

Table A3. Standard (required) and Wild (optional) Gear Deployment for Each Habitat Type for the Sturgeon Season in the Fort Randall Reach and the Unchannelized Portion of the Gavins Reach (segments 5-7).

Macrohabitats	CHXO, OSB, ISB, SCCL, SCCS, DRNG, BRAD, DEND, CONF, DTWT				TRMS			TRML		
Mesohabitats	BARS	POOL	CHNB	ITIP*	B A R S	P O L	CHNB	B A R S	P O L	CHNB
Gear Type										
Trammel Net TN		W	S/**W	S/**W	W	W	S/**W	W	W	S/**W
Gill Net GN14, GN41, GN18, GN81		S	S	S	W	S	S	W	S	S
Otter Trawl OT16		W	S	S	W	W	W	W	W	S
Trotline*** TLC1	S	S	S	S	S	S	S	S	S	S

S=Denotes the Standard (required) gear type for a given habitat

E=Denotes a gear that is undergoing an experimental evaluation proposal.

All other Applications are wild (W)

Applicable to all gear types and habitats: Deploy gear within a habitat type where conditions (depth, width, velocity) allow proper deployment

*Island Tips are only associated with Secondary Connected, Deranged, Braided and Dendritic Channels

**WILD gear in Segment 7

***Excludes non-flowing pools

Examples of gear deployment locations are shown in Figure A2.

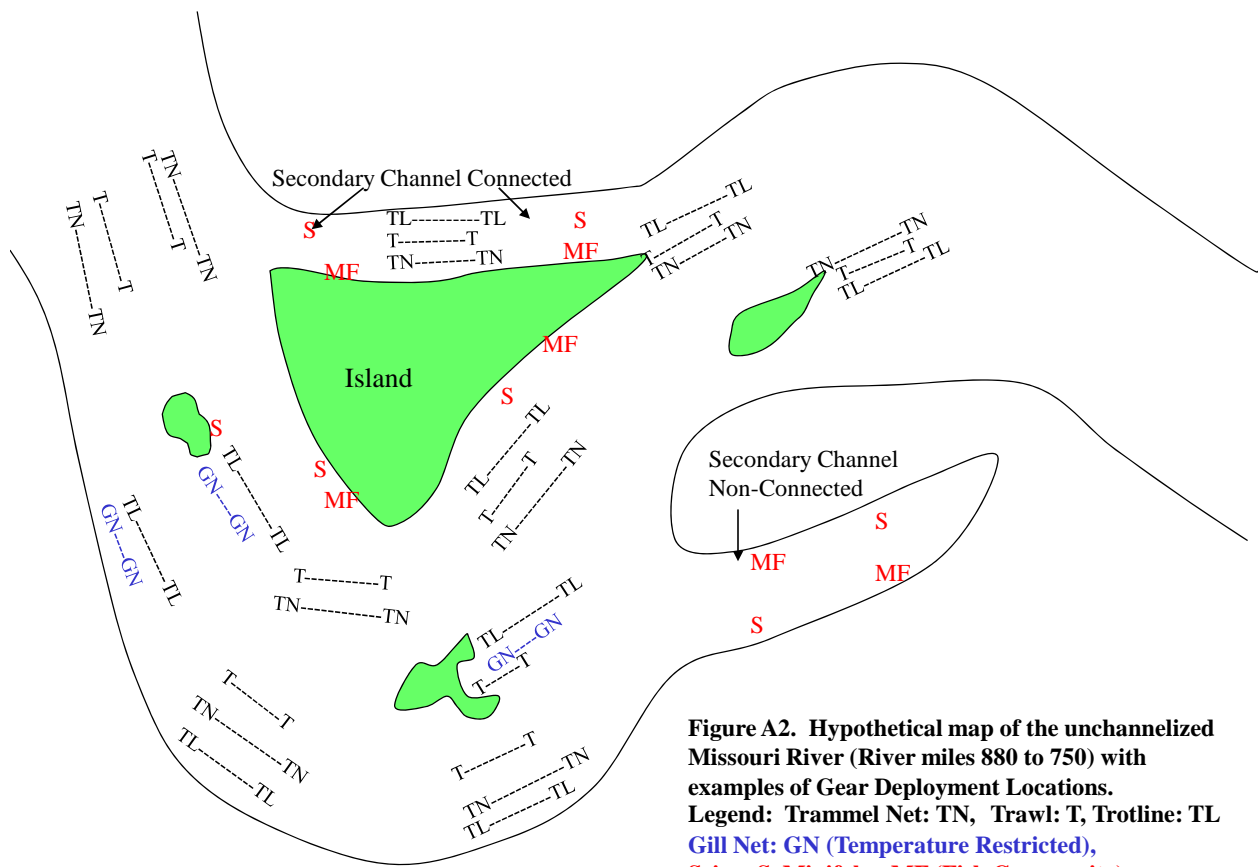


Figure A2. Hypothetical map of the unchannelized Missouri River (River miles 880 to 750) with examples of Gear Deployment Locations. Legend: Trammel Net: TN, Trawl: T, Trotline: TL Gill Net: GN (Temperature Restricted), Seine: S, Minifyke: MF (Fish Community)

Table A4. Standard (required) and Wild (optional) Gear Deployment for Each Habitat Type for the Sturgeon Season in the Channelized Portion of the Missouri River (segments 8-14) from Lower Ponca Bend to the Mouth.

Macrohabitats	OSB, ISB, CHXO, SCCL, SCCS, DRNG, BRAD, DEND, CONF, DTWT					TRMS				TRML			
Mesohabitats	BARS	POOL	CHNB	TLWG	ITIP*	B A R S	P O L S	C H N B	T L W G	B A R S	P O L S	C H N B	T L W G
Gear Type													
Trammel Net TN			W		W			W				W	
Gill Net GN14, GN41, GN18, GN81		S	S		S		S	S			S	S	
Otter Trawl OT16	S	S	S		S	S	S	S		S	S	S	
Trotline** TLC1	S	S	S		S	S	S	S	S	S	S	S	S

S=Denotes the Standard (required) gear type for a given habitat

E=Denotes a gear that is undergoing an experimental evaluation proposal.

All other Applications are wild (W)

Applicable to all gear types and habitats: Deploy gear within a habitat type where conditions (depth, width, velocity) allow proper deployment

*Island Tips are only associated with Secondary Connected, Deranged, Braided and Dendritic Channels

**Excludes non-flowing pools

Examples of gear deployment locations are shown in Figure A3.

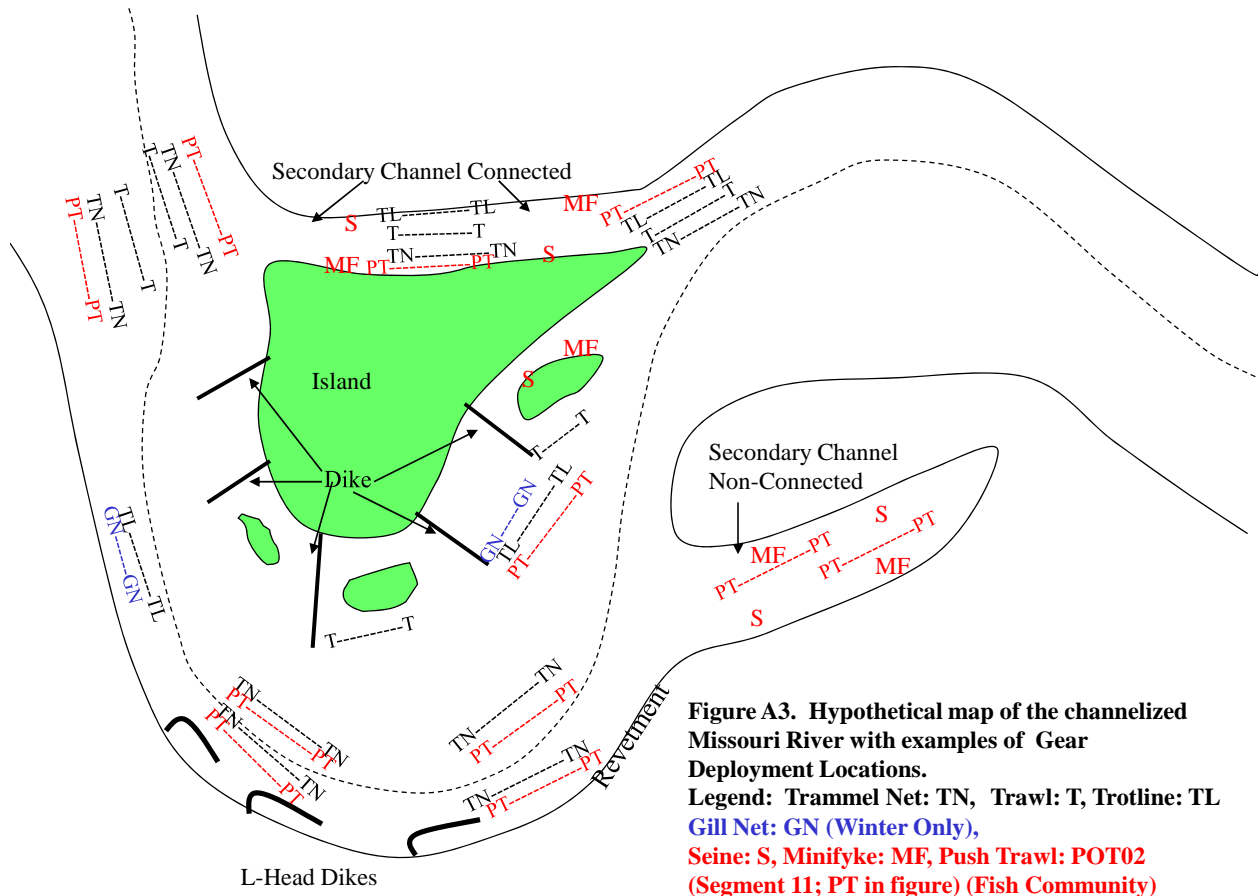


Figure A3. Hypothetical map of the channelized Missouri River with examples of Gear Deployment Locations.
Legend: Trammel Net: TN, Trawl: T, Trotline: TL
Gill Net: GN (Winter Only),
Seine: S, Minifyke: MF, Push Trawl: POT02 (Segment 11; PT in figure) (Fish Community)

Fish Community Sampling Season

The Fish Community Season will be July 1 through October 30 throughout the geographic range of the PSPAP. In addition to the efforts of the Sturgeon Season, the use of seines and mini-fyke nets will be a part of the Fish Community Season's required efforts. Tables A5 through A7 serve as a guide for sampling during the Fish Community Season for the unchannelized reach in Montana, the unchannelized reaches below Fort Randall and Gavins Point Dams, and the channelized river from lower Ponca Bend to the mouth near St. Louis. A secondary guide to the effort outlined in Tables A5 through A7 for the Fish Community Season will require that a minimum gear effort be deployed per bend. These minimums will include 8 sub-samples of each standard gear per bend. Mini-fyke nets will be deployed based on available habitat within a bend (8 mini-fyke nets sets are optimum per bend). When the effort prescribed in the tables do not meet the minimum requirements, then the sampling effort will be distributed proportionately among the habitats that are available. Within each segment, half (half of the bends) of the required effort for trammel drifting, trawling, and mini-fyke netting will be completed in July and August and half will be completed in September and October.

Once a river bend is selected, all macrohabitats and mesohabitats should be identified.

1. Each mesohabitat within a macrohabitat requires sampling using the standard gear (2 or 3 gear types/mesohabitat) identified in Tables A5 through A7.
2. A minimum of two sub-samples are required for each standard gear type for the habitats identified within a bend. A minimum of 8 sub-samples/bend will be collected for each standard gear.
 - a. In segments 1-14, the minimum sub-samples required within a bend will remain at 8, but will be determined by the available macrohabitats within the bend. Crews will focus on increasing the number of randomly selected bends as time allows. Following discussion from the Team meeting held on July 8, 2008, **for the time available from not using the push trawl, a crew utilizes a gear of choice (preferably a standard gear) with an equivalent effort to catch more pallid sturgeon. This gear cannot have an effect on your standard sampling effort (separated in space and time). Also, preferably the same gear in segment 1-4, 5-6 and 7-14. This should be set up and written up as well as work the logistics into the overall sampling design.**
3. Habitat characteristic data collection (velocity, substrate, turbidity) is required in conjunction with one sub-sample per mesohabitat (within a macrohabitat) for each gear type. Habitat characteristic data will be collected at a minimum of 25 percent of all sub-samples collected within a mesohabitat for each gear type.
4. Depth and temperature will be collected at all sampling locations.

Table A5. Standard (required) and Wild (optional) Gear Deployment for Each Habitat Type for the Fish Community Season in the Fort Peck Reach (segments 1-4).

Macrohabitats	CHXO, OSB, ISB, SCCL, SCCS, DRNG, BRAD, DEND, CONF				SCN	TRMS			TRML		
Mesohabitats	BARS	POOL	CHNB	ITIP*		B A R S	P O L	C H N B	B A R S	P O L	C H N B
Gear Type	S				S	S			S		
Mini-fyke Net MF											
Trammel Net TN			S	S				S			S
Otter Trawl OT16			S	S				S			S
Trotline** TLC1	S	S	S	S	S	S	S	S	S	S	S
Pallid Sturgeon Gear of Choice			S	S				S			S

S=Denotes the Standard (required) gear type for a given habitat

E=Denotes a gear that is undergoing an experimental evaluation proposal.

All other Applications are wild (W)

Applicable to all gear types and habitats: Deploy gear within a habitat type where conditions (depth, width, velocity) allow proper deployment

*Island Tips are only associated with Secondary Connected, Deranged, Braided and Dendritic Channels

**Excludes non-flowing pools

Pallid Sturgeon Gear of Choice

For the time available from not using the push trawl, a crew utilizes a gear of choice (preferably a standard gear) with an equivalent effort to catch more pallid sturgeon. This gear cannot have an effect on your standard sampling effort (separated in space and time). Also, preferably the same gear in segment 1-4, 5-6 and 7-14. This should be set up and written up as well as work the logistics into the overall sampling design.

Examples of gear deployment locations are shown in Figure A1.

Table A6. Standard (required) and Wild (optional) Gear Deployment for Each Habitat Type for the Fish Community Season in the Fort Randall Reach and the Unchannelized Portion of the Gavins Reach (segments 5-7).

Macrohabitats	CHXO, OSB, ISB, SCCL, SCCS, DRNG, BRAD, DEND, CONF, DTWT				SCN	TRMS			TRML		
Mesohabitats	BA RS	POOL	CHNB	ITIP*		B A R S	P O L	C H N B	B A R S	P O L	C H N B
Gear Type	S				S	S			S		
Mini-fyke Net MF											
Trammel Net TN			S	S				S			S
Otter Trawl OT16			S	S				S			S
Trotline** TLC1	S	S	S	S	S	S	S	S	S	S	
*Pallid Sturgeon Gear of Choice			S	S				S			S

S=Denotes the Standard (required) gear type for a given habitat

E=Denotes a gear that is undergoing an experimental evaluation proposal.

All other Applications are wild (W)

Applicable to all gear types and habitats: Deploy gear within a habitat type where conditions (depth, width, velocity) allow proper deployment

*Island Tips are only associated with Secondary Connected, Deranged, Braided and Dendritic Channels

**Excludes non-flowing pools

Examples of gear deployment locations are shown in Figure A2.

Table A7. Standard (required) and Wild (optional) Gear Deployment for Each Habitat Type for the Fish Community Season in the Channelized Portion of the Missouri River (segments 8-14) from Lower Ponca Bend to the Mouth.

Macrohabitats	OSB, ISB, CHXO, SCCL, SCCS, DRNG, BRAD, DEND, CONF, DTWT					SCN	TRMS				TRML			
Mesohabitats	BAR S	POOL	CHNB	TLWG	ITIP*		B A R S	P O L	C H N B	T L W G	B A R S	P O L	C H N B	T L W G
Gear Type	S					S	S				S			
Mini-fyke Net MF														
Trammel Net TN			S	S	S				S	S			S	S
Otter Trawl OT16			S	S	S				S	S			S	S
Trotline** TLC1	S	S	S	S+	S	S	S	S	S	S	S	S	S	S+
Push Trawl*** POTO2	S		S		S	S	S		S		S		S	
*Pallid Sturgeon Gear of Choice			S		S				S				S	

S=Denotes the Standard (required) gear type for a given habitat

E=Denotes a gear that is undergoing an experimental evaluation proposal.

All other Applications are wild (W)

Applicable to all gear types and habitats: Deploy gear within a habitat type where conditions (depth, width, velocity) allow proper deployment

*Island Tips are only associated with Secondary Connected, Deranged, Braided and Dendritic Channels

**Excludes non-flowing pools

***Standard gear only in Segment 11

+Only deployed if conditions allow (e.g., low probability of “silting in”)

Contingency Sampling

River conditions (e.g., high flows) can impair the ability of field crews to conduct standard sampling in an effective and safe manner. In situations where these conditions persist, or are likely to persist, for extended periods of time, contingency work may be conducted in lieu of the required, standard sampling. This type of sampling should only be conducted after receiving approval from the USACE PSPAP lead (Tim Welker). Crews should contact the USACE PSPAP lead as soon as possible to discuss contingency sampling options. Discussions will focus on the conditions at hand, safety of field crews, the Scope of Work, and the possible sampling

opportunities with a focus on those that will provide data toward achieving PSPAP objectives. The priority under perilous river conditions is always safety of the field crews. The monitoring priority is to maintain dataset integrity and as consistent a dataset as possible across years to provide the data to monitor trends of the various fish species over time. Therefore, the required, standard sampling is always the monitoring priority.

Contingency monitoring protocols will be developed and implemented that best monitor fish populations given the conditions on the river. Therefore, gear types, habitats, and sampling protocols for contingency monitoring will be documented in reports and listed in tables or Appendices within the Missouri River Standard Operating Procedures for Fish Sampling and Data Collection (Welker and Drobish 2016), but not described in detail within this document or the SOP.

Targeted Capture-Recapture Sampling

Monitoring CPUE data in pallid sturgeon populations over time can provide insight into annual changes in abundance or geographic distribution; however, certain demographic parameters (e.g., population size, emigration, immigration, births, deaths) are difficult to estimate using this type of data. In comparison, mark-recapture programs work by repeatedly sampling a population over a series of defined time periods. The metric of interest is not the gear set, but rather the capture or recapture of individuals. Individuals are marked with unique and lasting identifying marks, and released back into the population. By assessing the proportion of recaptures of these marked individuals to the capture of unmarked individuals over multiple recapture periods, population demographics including survival, recapture probability, and population size are estimated. Mark-recapture sampling designed to derive these parameters may be implemented as a pilot study within the PSPAP. However, such designs will be implemented only after approval by the USACE PSPAP lead (Tim Welker).

General Data Collection Requirements

Information will be collected on all pallid sturgeon and a representative subset of native Missouri River Fishes specific to age, growth and relative weight (**collection of ageing structures is no longer required for the PSPAP**). Table A8 provides a list of these target native species. In addition to collecting data specific to fish, information relative to the incidental capture of turtles may also be collected and recorded. Turtle codes have been developed and are included within the fish species codes lists in the document, “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection”. Detailed information must be collected for all pallid sturgeon collected in accordance with pallid sturgeon handling protocols. Lake Sturgeon should be treated in the same manner as the pallid sturgeon regarding checking for tags and inserting PIT Tags. A genetic sample should also be collected and sent to Dave Herzog of the Missouri Department of Conservation. Refer to Appendix D for Dave’s mailing address and the data sheet instructions section of the document, “Missouri River Standard Operating Procedures for Fish Sampling and Data Collection (Welker and Drobish 2016)” for more information.

Table A8. Target Native Missouri River Fish Species included in the 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 <i>Macrhybopsis meeki</i> 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 <i>Macrhybopsis gelida</i> 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 <i>Sander Canadense</i> (≥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 <i>Scaphirhynchus platorynchus</i> (≥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

I. Specifications

- A. Refer to Missouri River Standard Operating Procedures for Fish Sampling and Data Collection (Welker and Drobish 2016) for detailed guidance relative to age-growth data collection.

**PALLID STURGEON
POPULATION ASSESSMENT PROJECT**

APPENDIX B

**STANDARD OPERATING
PROCEDURES FOR
DATA ENTRY, DATABASE MANAGEMENT,
DATA ANALYSIS AND
QUALITY ASSURANCE**

DATA ENTRY, DATABASE MANAGEMENT, DATA ANALYSIS and QUALITY ASSURANCE

Data collected utilizing standardized protocols and terminology enhances the quality and the usability of the data by providing complimentary data sets among various projects. Data must be collected, accurately recorded, uploaded, and reviewed for quality control in a timely manner to facilitate data management, use, and analysis.

I. Data Recording

- A. Data will be entered as follows:
 1. All required fields must be completed using approved electronic entry hardware and software.
 2. Appropriate standardized codes will be used to ensure data consistency.

II. Data Quality Assurance

- A. Field crews will review all data for errors and correct errors prior to upload.

III. Data Entry and Upload

- A. All data will be uploaded to the website database by the monitoring office within 7-days of collection.

IV. Data Quality Control

- A. The monitoring office field crew leader is responsible for reviewing the data within 1 week following upload.
 1. The monitoring office field crew leader will ensure that all data is accurate.
 2. Errors identified will be corrected prior to marking records as ‘checked by’.

V. Data Approval

- A. The monitoring office admin is responsible for final data approval and error reporting.
 1. The monitoring office admin will approve all data within 1 month of the data being checked by the field crew leader. Standardized queries are built into the website to be used by the admin for identifying errors.
 2. Any errors found will be reported back to the field crew via the error log on the website.
 3. All errors must be resolved within 7 days of reporting the error unless extenuating circumstances prevent the error from being resolved.

VI. Data and Database Entry Changes

- A. All suggested database or data entry changes will be submitted to the USACE PSPAP Lead.
- B. The USACE PSPAP Lead will review suggestions, determine the feasibility of the proposed change, and submit to the PSPAP Team with recommendation (if appropriate) for final decision-making. Any suggested change that is not already part of the SOP must be approved by the PAT. Any suggested changes that are

already part of the SOP can be made by the database technical support team without PAT approval.

- C. Final decisions that require additional monetary support will be based on funding availability and prioritization.

VII. Database Management

MDC will provide basic analysis to facilitate the reporting requirements of the contracting offices. Refer to Appendix C for additional information regarding reporting.

The PSPAP has incorporated measures to ensure the quality and consistency of the data collected, data entry and the reporting aspects of the PSPAP. The PSPAP has been implemented utilizing the knowledge and experience of individuals from throughout the Missouri River basin. In general, the basin's State and Federal agencies are the employers of these individuals; therefore, the PSPAP has been implemented by working directly with these agencies. In addition to utilizing this expertise, the PSPAP contains three levels of quality assurance.

VIII. Quality Assurance

A. Annual Training

Two types of crew training may be utilized during each field season:

1. Single location training:
 - a. At a minimum, each field crew leader from each contracting office will attend the annual training to ensure they stay current with the Standard Operating Procedures which may change as the PSPAP evolves.
 - b. Since the PSPAP utilizes the expertise of the basin, the crew leaders from various contracting offices will also lead training in different areas specific to their area of expertise.
2. Crew leader exchange:
 - a. Field crew leaders from each contracting office visits another contracting office for a period of 3 days to examine gear and equipment use in other portions of the river. Each visiting crew leader will submit a short report to the USACE PSPAP Manager detailing their experience.

B. Field Inspections

- a. Field crew leaders will rotate amongst the crews to review techniques, data collection and data recording to ensure this work is being conducted in accordance with the Standard Operating Procedures and Statistical Design of the PSPAP. Each crew will be reviewed by a crew leader from a different office for at least two days during each of the sampling seasons.
- b. In addition to the rotation of the crew leaders, the USACE may review techniques, data collection and data recording to ensure this work is being conducted in accordance with the Standard Operating Procedures and Statistical Design of the PSPAP.

C. Data Entry and Quality Assurance

The new process of collecting data in the field with hand-held computers and uploading the information to the database will eliminate most of the manual entry of data and will continue as new database routines are completed. Some quality insurance checking of

entered data will be required by the database manager; however, data-entry errors will be reduced with the hand-held computer through limited choices. Many of the quality assurance checks will be performed as the data is loaded into the database.

**PALLID STURGEON
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APPENDIX C

**STANDARD OPERATING
PROCEDURES FOR
REPORTING, PUBLICATION AND ACKNOWLEDGEMENT**

REPORTING, PUBLICATION, AND ACKNOWLEDGEMENT

Each field station conducting population assessment activities will provide an Annual Summary Report for each of the segments for which they have conducted sampling. The Annual Summary Reports will be combined into a Comprehensive Annual Report for submission to the Service. The Annual Summary Reports and Comprehensive Annual Report will utilize a standardized format to ensure consistency and compatibility. The PSPAP has six objectives based on RPA elements VI A & B of the 2000 Opinion. A standardized template has been developed to provide for uniform reporting for all segments.

I. Annual Reporting Information

- A. An Annual Summary Report will include all data collected from the onset of the Sturgeon Season through the following Fish Community.
- B. This summary report will be due to the USACE not later than April 31, following the conclusion of the sampling year.
- C. Annual Summary Reports will be in a uniform format by segment and the Team will be responsible for developing this format/template.
- D. The USACE will provide the Service with the Annual Summary Reports in accordance with the requirements of the 2000 BiOp and 2003 amendment.

II. Additional Reporting

- A. In addition to annual reporting, multiple year analysis (e.g., 3-year analysis) may be periodically conducted to provide more rigorous evaluations.
- B. Additional reporting information may be incorporated into future reports, as needed. This information will be incorporated into appendices in addition to the standard reporting template.
- C. Additional analysis, as described under item A, will be determined by the PAT and/or the USACE PSPAP Manager.
- D. Additional analysis may be initiated at the request of the Service or other entity.

III. Data Use

- A. All data will be utilized within the “Adaptive Management” framework to guide future management decisions.

IV. Proprietary Rights

- A. All data collected through the PSPAP using USACE funding and/or equipment are the property of the USACE. Annual funding is appropriated by the US Congress so that the USACE can meet the requirements of the 2000 BiOp (USFWS 2000) and 2003 Amendment (USFWS 2003). Funding is provided by the USACE to members of the PAT for this specific purpose; therefore, the USACE maintains ownership and proprietary rights to all PSPAP data.

The database management agency or agencies have no additional rights or ownership of the data and may not publish or provide the raw data to a non-participating Contracting Office without the permission of the Governance Committee.

- B. Each PAT member office and the USACE will reserve the right to the first opportunity to publish information resulting from the data that they were

responsible for collecting for the PSPAP. The USACE and each PAT member office that collected the data will reserve this right for a one year grace period from the date which the data was collected to utilize this data for additional analysis and/or the purpose of publication. After one year, the data will be available to the remaining contracting offices participating in the PSPAP for the purpose of additional analysis and/or publication. The PAT member office collecting the data may also waive their right to using the data for additional analysis and/or the purpose of publication prior to the one year grace period. Although a formal request to use the data collected by a PAT member office is not required, the PAT member office will still provide a summary of their use of data to facilitate communication among PAT members. This communication should be in the same detail as required for a “Request for Data Use Proposal” (see Table C1).

- C. More than one PAT member office may collectively pool the data that they collected to strengthen the analysis (publication). In this situation, a “Request for Data Use” is not necessary; however, a summary of data use/analysis will be networked with the Team to facilitate good communication.
- D. If additional data is desired by a PAT member office for data collected in segments other than the segments for which they collected the data, a formal “Request for Data” will be made via a proposal and networked with the Population Assessment Team following the Standard Data Request Format.
 - 1. Only the offices that collected the data being requested will have a vote on the specific data request under review with the exception that the USACE and USGS will vote on all data requests.
 - 2. The office requesting the data may vote on their own request if they were also one of the data collectors.
 - 3. The USGS will abstain from voting on data requests that they submitted since they are not one of the data collectors.
 - 4. A simple majority vote will determine whether data is approved or disapproved.
 - 5. If an office votes against a particular data request, that office will provide a concise rationale for their “No” vote to the USACE’ PSPAP Manager. This rationale will be sent (anonymously) back to the individual that submitted the request to aid that individual in refining the request to address the rationale for the “No” vote.
- E. If neither the PAT member office that collected the data nor the remaining participating contracting offices desire to utilize the data for specific analysis and/or publication, the data will be available to an outside source.
- F. Regardless of the analysis/publication, a proposal must be submitted to the PAT prior to release of the data following the Standard Data Request format (refer to Table C1).
 - 1. Requests for Data Use will specifically articulate the components of the analysis excluding the details of the methods to be used.
 - 2. The Requests for Data Use will be “Product Driven” clearly articulating what product or products will be generated from the data use effort.
 - 3. All Requests for Data Use will identify a Timeline/Deadline providing the products back to the Team.

4. Authorships and acknowledgements will be incorporated into the Data Request to ensure that all whom deserve recognition are appropriately recognized.
 5. Responsibilities of authors relative to the analysis/publication will be included in the Request for Data Use.
 6. Data being requested. In accordance with Table C1, data requests will be complete and detailed.
- G. The Governance Committee will review all proposals on a “Case by Case” basis to utilize the data prior to any analysis and/or publication for all reporting outside the framework of the standardized reporting for the PSPAP.
- H. The same process as outlined above will determine the fate of data requests regardless of whether they are participating Team members or outside sources.
- I. All entities publishing data with the required permission of the Governance Committee will appropriately recognize the agencies and individuals via co-authorships or acknowledgements in the publication.
- J. All Data Requests will include Timelines with Deadlines.
- K. Permissions and details of co-authorships and acknowledgement will be agreed upon in writing prior to release of the data.
- L. All data request will be responded to within one week of the request. Failure to respond by any PAT within the one-week period will void the team’s vote from consideration.

Table C1. Standard Form for Requesting Data for Analysis and/or Publication.

Request for Data Use Proposal	
Requesting Office	
Requesting Individual	
Purpose of Data Request:	
Components of the Analysis	Description of Components
1.	
2.	
3.	
4.	
Products	Description of the Products
1.	
2.	
3.	
Completion Date for Products	
Data Needed by:	Date
Authorship	Description of Responsibilities of Each Author
Author	
Co-Author	
Co-Author	
Co-Author	
Co-Author	
Co-Author	
Acknowledgments	
Data Being Requested	
Project	1, 2, or 3
Segments	For which segments
Date Range	
Season	
Bend	Randomly or Non-randomly selected data, or all
Gear	Specific gear, All Standard, Other
Physical Habitat Data	Specify which (e.g., Temp, Turbidity, other)
Habitat Classification	Specify which (Macro, Meso, micro)
Panel/hook information	

Bait	
Species	Specify which species
Length	
Weight	
Count	
Aging information	Specify which species
Floy Tag Information	
Other (e.g., “Check Mark information, or tagging information	Specify which species
Other	
Other	

To calculate CPUE remember to request the NFSH category to get the zeroes and that you also need all unique IDs for that gear.

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APPENDIX D

**PALLID STURGEON
POPULATION ASSESSMENT TEAM**

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APPENDIX E

LITERATURE CITED

Literature Cited

- U.S. Fish and Wildlife Service. 2000. Biological opinion on the operation of the Missouri River main stem reservoir system, operation and maintenance of the Missouri River bank stabilization and navigation project, and operation of the Kansas River reservoir system: U.S. Fish and Wildlife Service. 296 p.
- U.S. Fish and Wildlife Service. 2003. Amendment to the 2000 biological opinion on the operation of the Missouri River main stem reservoir system, operation and maintenance of the Missouri River bank stabilization and navigation project, and operation of the Kansas River reservoir system: U.S. Army Corps of Engineers. 308 p.
- Welker, T. L., and M. R. Drobish (editors). 2016. Missouri River Standard Operating Procedures for Fish Sampling and Data Collection, Volume 1.8. U.S. Army Corps of Engineers, Omaha District, Yankton, SD.
- Welker, T.L., M.R. Drobish, and G.A. Williams (editors). 2016. Pallid Sturgeon Population Assessment Project, Guiding Document, Volume 1.8. U.S. Army Corps of Engineers, Omaha District, Yankton, SD.