

**Evaluation Plan**  
**for the**  
**Pallid Sturgeon**  
**Conservation Propagation and Stocking Program**

*FINAL*

Prepared by:

Region 6  
Fish and Aquatic Conservation  
and  
Ecological Services

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## 1. INTRODUCTION

The Pallid Sturgeon Conservation Propagation and Stocking Program (CPSP) supports recovery of Pallid Sturgeon by augmenting or restoring wild populations with captive bred individuals, preventing extinction until threats and recovery actions are addressed. The CPSP is identified as Recovery Task 4 of the Pallid Sturgeon Recovery Plan (USFWS 2014).

For more than two decades, US FWS Regions 3, 4 and 6 (legacy regions) Fish and Aquatic Conservation (FAC), along with Ecological Services and State and Federal Partners have researched, developed and implemented a comprehensive propagation and stocking program for the endangered Pallid Sturgeon. The development of this program required extensive coordination among partners, in depth research, ongoing evaluation and adaptive program change, as well as expertise, capacity and financial support from FWS FAC and Ecological Services and from State and Federal partners. Planning and guidance for genetics, propagation and rearing, fish health, stocking, and post-stocking assessment have been collaboratively developed and implemented with partners over the past two decades. These activities are collectively referred to as the CPSP (USFWS 2014).

In addition to developing and implementing a CPSP, Task 4.2 of the Pallid Sturgeon Recovery Plan (USFWS 2014) specifically identifies the need for *evaluation of the CPSP* to ensure effectiveness and adaptive management.

Pallid Sturgeon Recovery Plan Recovery Task (USFWS 2014):

### 4.2 EVALUATE SUCCESS OF PROPAGATION AND STOCKING PROGRAM

GPMU, CLMU, IHMU, CPMU

- (1) Evaluate Pallid Sturgeon supplementation using various age classes of progeny.
  - (a) Use data to derive Pallid Sturgeon specific survival rates where stocking occurs.
  - (b) Use data to refine stocking strategies:
    - (i) Determine optimal stocking numbers,
    - (ii) Determine optimal stocking size,
    - (iii) Determine optimal stocking time and location.
  - (c) Evaluate dispersal of hatchery progeny.
  - (d) Evaluate effectiveness of hatchery products within each management unit.
  - (e) Determine when stocking is no longer needed.
- (2) Ensure that hatchery stocking and propagation records are incorporated into integrated a range-wide species recovery database.

## 2. THE CONSERVATION PROPAGATION AND STOCKING PROGRAM

In accordance with the Pallid Sturgeon Recovery Plan (USFWS 2014), the primary goal of a Pallid Sturgeon CPSP is to support efforts to achieve self-sustaining, wild populations of Pallid Sturgeon including representative population structure and genetic viability and to retain population resilience that can withstand catastrophic events and ambient levels of anthropomorphic, ecological and physical change.

**Primary CPSP Goal:  
Support efforts to  
achieve self-sustaining,  
wild populations of  
Pallid Sturgeon**

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The specific goals of the Conservation Propagation and Stocking Program are to:

- 1) Increase the number of individuals in specific management units where the population is deemed demographically threatened by low numbers (**POPULATION SIZE**)
- 2) Establish multiple year-classes in specific management units that do not have a self-sustaining population structure (lack multiple year-classes and/or successful reproduction) (**POPULATION STRUCTURE**)
- 3) Achieve a genetically diverse and representative effective population size ( $N_e$ ) across the species' range that can maintain a self-sustaining, wild-reproducing population into the future (**GENETIC VIABILITY**)
- 4) Establish and/or maintain refugia populations within the species' historic range to provide against future catastrophic loss in any one unit (**POPULATION RESILIENCE**)
- 5) Understand and learn about life history, habitat and flow needs, and effectiveness of management actions through strategic stocking (**RESEARCH**)

Implementation of the Pallid Sturgeon Propagation and Stocking Program is complex and requires long-term dedicated capacity, resources, facilities operations and funding. All activity must be part of a shared set of planning and strategies and must be coordinated among participating Federal and State field and management offices. The CPSP must also include all integral components of a captive propagation and stocking program.

Key inter-related program elements include:

- a. Genetics management
- b. Fish capture, handling, tagging and stocking
- c. Spawning in captivity and in the wild
- d. Fish rearing including hatchery conditions of temperature, water quality, nutrition, disposition and other factors
- e. Fish health diagnosis, treatment and facility certification
- f. Field sampling and follow-up analysis and modeling to estimate survival and effectiveness through recapture rates
- g. Program and data tracking and effectiveness monitoring and evaluation**
- h. Administrative oversight for permitting and approval of activities under State and Federal regulations and laws
- i. Research and adaptive management to inform the above activities using the best available science

For a complete understanding of Pallid Sturgeon, Pallid Sturgeon recovery and the Pallid Sturgeon CPSP, see the following documents:

- The Pallid Sturgeon Recovery Plan (2014)
- The Preamble to the CPSP (2019)

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- The Range-wide Pallid Sturgeon Propagation Plan (2019)
  - The Range-wide Pallid Sturgeon Stocking Plan (2019)
  - The Pallid Sturgeon Genetics Management Plan (2013)
  - The Range-wide Pallid Sturgeon Tagging and Marking Plan (2019)
  - The Range-wide Pallid Sturgeon Handling Protocols (2019)

### **3. THE CPSP EVALUATION PLAN**

In this evaluation plan, a CPSP evaluation framework is presented to guide the USFWS and partners in successfully implementing and improving propagation and stocking of Pallid Sturgeon to support recovery. This plan is intended to describe the scope, side-boards and direction for using data and specific CPSP activities to test hypotheses and evaluate outcomes that promote CPSP goals and Pallid Sturgeon recovery.

It is understood that capacity and resources for all recovery actions are limited and dependent on funding and staff time. Therefore, not all possible courses of action can be pursued or accomplished. In addition, some information and analyses require sequential action and are dependent in nature. Furthermore, the ability to detect a response in outputs may depend on statistical power of data related to effort, data points and annual data accumulation in order to support scientifically sound conclusions. In light of these factors, this evaluation plan includes a prioritization of information needs based on achieving goals and also, in light of logistical and field sampling knowledge, likelihood and statistical power of available data and application of information to improve effectiveness of management and actions.

#### **CPSP Evaluation Plan Purpose**

- Evaluate progress toward achieving CPSP goals and benchmarks
- Inform adaptive change to improve effectiveness of CPSP activities

#### **Evaluating Program Effectiveness**

The CPSP evaluation is an integral part of the process to determine annual stocking targets and program effectiveness. On an informal level, program managers, fish culturists, and scientists have evaluated the CPSP each year since the onset of propagation and stocking in the late 90s as part of seasonal and annual meetings among partners and by the basin recovery workgroups. However, the program has evolved such that a formalized evaluation and standard analyses are needed to increase coordination and better track and achieve progress towards program goals.

This plan initiates a range-wide *formalized and standardized* evaluation of the CPSP that allows for hypothesis-based testing of CPSP goals. Much of the data is already collected and available and is used for current basin reporting. This basin-specific reporting can and should continue as it informs basin-specific discussion and decisions.

Many of the initial steps necessary for evaluating program objectives related to spawning and rearing have been conducted as part of developing successful propagation and stocking protocols. These known methods are established as final protocols while other activities

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continue to be studied in order to improve outputs and to better achieve desired outcomes. These activities will be the focus of new research and where adaptive change is expected to occur.

This plan presents a goal-based, hypothesis-driven framework for evaluating activities of the CPSP with respect to desired outcomes. The evaluation process will be piloted in the 2019-21 seasons with the aid from Federal and State partners. Continued development will follow in subsequent years using an adaptive approach, and this plan can be updated to reflect new information.

CPSP goals are stepped down as short-term, intermediate and long-term program benchmarks. For short-term benchmarks, hypotheses with criteria regarding expected outputs and outcomes related to CPSP activities are defined. Hypothesis are the basis of specific research questions or information needs that should be addressed in the 'short-term' evaluation timeframe. Intermediate and long-term benchmarks are defined as future desired conditions that signal when the program transitions to the next phase.

The short-term benchmark is defined as anticipated activities for the current phase of the CPSP that includes rearing and stocking hatchery-origin fish to augment or restore fish into the wild and to promote the recruitment of these fish into the wild. The timeframe is expected to be 1-5 years. This timeframe is for planning purposes and is not intended to define a deadline as progress may vary among river reaches and timeframes may need to be revised.

The Intermediate benchmark is achieved when hatchery-origin fish are documented and measured as a specific proportion of the population that reach maturity and spawn in the wild in numbers sufficient to sustain populations. Achievement of this benchmark would trigger a shift to the next phase of the CPSP. The timeframe to achieve this is expected to be 5-25 years (based on current knowledge of the time to maturation of hatchery-origin fish in the wild). Upon reaching this benchmark, new short-term benchmarks and hypotheses will be developed for the 5 year planning and evaluation period. Based on recapture of hatchery origin fish stocked 20 years ago, it is possible that we may be nearing a condition to achieve this benchmark in some reaches which may trigger program phase shift.

The long-term benchmark is met when the offspring of mature, hatchery-origin fish that have spawned in the wild, are documented as spawning in the wild and that their offspring are recruiting in numbers sufficient to sustain populations. Achievement of this benchmark is expected to take 25-50 years and would trigger a shift to the final phase of the CPSP. At this point, the goal of the CPSP would change significantly towards minimal activity needed to ensure recovery is reached. This could mean an eventual phasing out of the CPSP as recovery criteria are met and goals are achieved.

It is recognized that these timeframes are estimates used for planning and evaluation. It is also recognized that the population status may vary among reaches (GUs for recovery planning purposes), and as such, the shift to intermediate or long-term phases may vary among reaches.

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Criteria for each benchmark should be quantified and qualified as interim demographic population targets in relation to recovery planning and implementation to ensure progress and progress towards benchmarks can be tracked and identified. This task is included in this plan as an information need to be addressed in the next 2 years.

### **Framework Structure**

The following outlines how the framework is structured:

Goal (list relevant assumptions)

1. Benchmarks
  - Short-term (1-5 years)
    - Hypotheses that relate activities to outcomes with measureable criteria
      - ✓ Research questions, information needs to inform adaptive change to CPSP activities
  - Intermediate (5-25 years)
    - Future desired conditions to inform H0 development as relevant
  - Long-term (25-50 years)
    - Future desired conditions to inform H0 development as relevant

Hypotheses are only fully described under 'short-term' benchmarks because Intermediate and Long-term benchmarks will convert via program phase shift as progress is made. When these benchmarks become relevant in time and action, specific, relevant hypotheses will be developed. Until then, the 'Intermediate' and 'Long-term' benchmarks are described simply as future desired conditions.

The framework itself must be put in context of management actions in order to be able to cross-walk the activities of the CPSP with the short-term hypothesis. This crosswalk will identify which information needs are a priority and where conditions have been achieved. Activities of the CPSP are described as: 1) Factors (conditions affecting the activity), 2) Outputs (results of the activity) and 3) Desired Outcomes (what is achieved when results are applied, framed or interpreted with respect to the goal). In Table 1, activities of the CPSP are crossed with short-term benchmark hypothesis to highlight where conditions of goals are either achieved or where information or more research is needed.

### **Activities of the CPSP**

CPSP activities are those actions that can be manipulated or controlled to some extent to adapt and improve CPSP outcomes. Some activities are primarily designed as part of the propagation and stocking program such as culture, rearing and stocking (i.e. *CPSP dependent activities*). These are activities that would not occur, but for the CPSP.

Other activities such as field sampling methods and population modeling are designed primarily to understand Missouri River management actions and to support broader goals or related to ESA Section 7 Inter-agency Consultation. The information collected from these activities can be used to help evaluate the CPSP but are not primarily designed for that purpose. These activities would likely be occurring in the absence of a CPSP and are herein referred to as interdependent

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CPSP activities. In general, there is less flexibility in manipulating or controlling factors associated with interdependent CPSP activities.

A. Dependent CPSP Activities:

1. Identification and capture of wild adults for use in captive breeding.
  - Factors of consideration
    - Maturity, sex, age, reproductive stage and condition
    - Genetic ancestry and/or previous contribution (e.g. unique, novel or previously used) to captive breeding
    - Geography (e.g. reach or management unit contribution)
  - Outputs (to be evaluated)– Captive adults to be spawned with measures of wild and hatchery-origin wild maturation, age, and condition
  - Desired Outcome (to be achieved) – Complete demographic and genetic representation of extant wild population as related to recovery goals
2. Genetic evaluation and mating strategies to promote genetic diversity in wild and to increase the effective population size of wild populations.
  - Factors –
    - Genetic identification
    - Purity
    - Ancestry or contribution (e.g. unique, novel or previously used)
  - Outputs – Measures of genetic relatedness, hybridization and calculation of  $N_e$
  - Desired Outcome – Genetically appropriate and representative, hatchery-origin pallid sturgeon contributing to effective population size
3. Spawning protocols
  - Factors –
    - Optimal holding conditions (tank size, flows, water quality, lighting and temperature)
    - Assessment of oocyte maturation and sex determination
    - Initiating ovulation to coincide with oocyte development
    - Condition of milt, proper fertilization practices followed for fresh or cryopreserved milt
    - Hatching success
  - Outputs – Successful ovulation/spermiation producing high quality eggs that represent spawning matrix identified by genetics advisors utilizing Genetics Management Plan
  - Desired Outcome – Successful captive spawning and viable embryos available from hatcheries as appropriate and needed

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#### 4. Rearing protocols

- Factors –
  - Initiation to feed, optimal feeds for sturgeon rearing that minimize hatchery selection
  - Water quality, environmental conditions
  - Water sources and hatchery infrastructure (locality differences)
  - Density, disease and fish health or condition
- Outputs – Fish to be stocked (at targeted genetic representation, size, year class, or time of year)
- Desired Outcomes – Robust disease-free, hatchery-origin fish with minimal hatchery induced selection to be stocked (at targeted size, year class, or time of year)

#### 5. Stocking activities

- Factors –
  - Capacity of Facilities
  - Seasonal timing
  - Location (access points, reaches and geographic units, forage availability)
  - Stocking (transport conditions, duration of travel) and tagging
- Outputs – Fish of targeted size stocked into river reaches distributed geographically
- Desired Outcome – Stocking strategy that promotes survival and recruitment to maturity of hatchery-origin fish in targeted reaches within appropriate geographic unit

#### B. Interdependent CPSP Activities:

1. Field sampling to detect recapture of stocked fish and evaluate stocking effectiveness. This activity is designed to provide greatest recapture rate among life-stages in order to analyze management actions and improve population estimates.

- Factors –
  - Effort and effectiveness of sampling crews
  - Sampling gear types effectiveness among habitats and for life-stage
  - River, boating and sampling expertise
  - river conditions and weather events

- Outputs (data outputs v. physical outputs) - Fish recapture data
- Desired Outcomes (knowledge outcomes v. physical condition outcomes) - Analyses to support results that measure and inform stocking success

The information available from this activity will depend on methods and design of the population assessment program or, where feasible, as a specific CPSP research need. Some sampling and recapture data may be statistically limiting for making certain

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conclusions (i.e. it may be unlikely there will be enough recaptures in the next 10 years to compare survivorship by stocking location within reaches based upon recapture rates to date).

## 2. Population estimates and projections

This activity is designed to understand progress towards recovery and effectiveness of recovery actions for population response and not specifically to understand the CPSP. The data collected is not designed solely to understand CPSP activity. This activity also provides data outputs and knowledge outcomes. Regardless, population estimates and projections are important for developing stocking targets and understanding stocking effectiveness.

- Factors –
  - Model applicability
  - Quality of data (accuracy and precision)
  - Expertise and capacity
- Outputs (data outputs v. physical outputs) – Population estimates (current and future) and population structuring and trends
- Desired Outcomes (knowledge outcomes v. condition outcomes) – Population estimates and projections that support necessary analyses to evaluate and predict census population and population trajectories

## **Evaluation Framework**

### Goals and Benchmarks

#### **Goal 1&2: Population size and structure**

##### Assumptions

- CPSP efforts continue to operate successfully and are adequately staffed and funded
- hatchery conditions are not compromised
- capacity and expertise is available to conduct CPSP workload

##### Benchmarks:

- A. Short-term (1-5 yrs): Meet stocking targets by rearing healthy fish in quality condition likely to survive in wild
  - Hypothesis 1: Hatchery-origin fish are stocked in quality condition
    - Criteria for evaluation: hatchery-origin fish are disease free and within a range of condition to thrive
      - ✓ Research Question: What is a range of condition to thrive, robustness for different life stages stocked?
  - Hypothesis 2: Stocking protocols and locations/reach/GU are sufficient to allow for survival post-stocking while optimizing logistic practicability
    - Criteria for evaluation: All stocked locations/reach/GU can adequately support/contribute to GU population goals
      - ✓ Research Question: Is survival and recruitment within GUs sufficiently supported by stocking protocols?

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✓ Research Question: Does Hatchery of origin impact survival in the wild?

- B. Intermediate (5-25 yrs): Hatchery-origin fish are recruiting to adult year classes in the wild
  - Hatchery-origin fish reach maturity and spawn in the wild
- C. Long-term (25-50 yrs): Hatchery-origin fish are supporting a wild sustainable population
  - Hypothesis 1: Life stages are present in population structure of wild population resulting from hatchery-origin to promote population persistence
  - Hatchery-origin fish behave and respond similar to wild fish such that the wild population is sustainable

### **Goal 3: Genetic diversity**

#### Assumption

- Genetics expertise and analysis continue
- Genetic summary and updated genetics management plans support current strategy

#### Benchmarks:

- A. Short Term (1-5 yrs): Optimize genetic diversity and genetic representation of wild population using stated propagation strategies (paired matings, cryopreservation etc)
  - Hypothesis: Recruitment of hatchery-origin fish contributes to  $N_e$  of wild population
    - Criteria:  $N_e$  reflects hatchery-origin contribution
      - ✓ Research Question: Has variability in survival influenced  $N_e$  in the RPAs/GUs?
- B. Intermediate (5-25 yrs): Wild-recruited, hatchery-origin fish are representative of wild population
  - Genetic diversity of wild population is adequately represented in wild-recruited, hatchery-origin fish
  - $N_e$  is appropriate for genetically viable population
- C. Long-term (25-50 yrs):  $N_e$  is sufficient to support population persistence in future generations
  - $N_e$  of F2 generation can sustain population persistence, promote genetic diversity, prevent inbreeding and minimize prevalence of deleterious genes

### **Goal 4: Resilience**

#### Assumption

- Facilities/capacity/funds continue to be available to support Pallid Sturgeon production
- Captive broodstock can be maintained

#### Benchmark:

- A. Short Term (1-5 yrs): Production at 2 or more facilities is proximal to management units with stocking needs
  - Continued development and maintenance of captive broodstock protects against catastrophic loss and for future productions needs

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- Maintain Pallid Sturgeon populations throughout historic range to ensure resilience into the future
  - o Hypothesis:
    - Production occurs at sufficient number of facilities to ensure meeting production goals in GUs
    - Captive broodstock are supplemented as possible to ensure genetic representation
    - Captive broodstock support production and stocking targets as needed for achieving appropriate  $N_e$  for population persistence
      - ✓ Criteria: Fish are sufficiently produced in quality and quantity to meet stocking targets
      - ✓ Criteria: Broodstock supports stocking targets as needed

**B. Intermediate (5-25 yrs)**

- o Review functionality of wild and captive refugia to adequately contribute to persistence of restored pallid sturgeon populations.
- o Assess sustainability and genetic health of captive broodstock
- o Continue to assess captive and wild broodstock program

**C. Long-term (25-50 yrs)**

- o Determine need to maintain and use captive and wild broodstock for production or redundancy after wild recruitment occurs

**Goal 5: Research**

**Assumption:**

- o Research contributes to adaptive management and improved strategies for recovery
- o Funds and expertise are available for research
- o Research needs are identified and prioritized as needed to support recovery.

**Benchmark:**

- Short Term (1-5 yrs): Make hatchery origin fish available to use for research priorities to fill critical information gaps
  - o Hypothesis: Hatchery origin pallid sturgeon support information needs
    - Produce hatchery origin fish of needed size and other characteristics and make available for priority research efforts
      - ✓ Criteria: Production supports research needs
- Intermediate (5-25 yrs): Make available and prioritize as needed hatchery origin fish for use in research priorities to fill critical information gaps
  - Assess need for production fish for future research
- Long-term (25-50 yrs)
  - Make available and prioritize as needed hatchery origin fish for use in research priorities to fill critical information gaps
  - Assess need for production fish for future research

**Table 1. Framework for Short Term Benchmark (0-5 year) – Evaluation Matrix**

| CPSP Activities                                     | G 1&2 H1<br>Rear healthy fish in good condition            | G 1&2 H2<br>Stocking protocols & locations | G 3 H1<br>Recruitment of HOP ^ Ne  | G 4 H1<br>Redundant rearing/stocking | G4 H2<br>Captive Broodstock  | G 5<br>Provide HOP for research |
|---|--|--|--|--------------------------------------|--|---------------------------------|
| <b>A1: Capture of wild adults</b>                   |  |  |  |                                      |  |                                 |
| A1 F1: Maturity, age, ripeness, condition           | Propagation Plan   |  |  |                                      |  |                                 |
| A1 F2: Genetic disposition                          | Genetics Management Plan                                   |  | Genetics Management Plan   | Genetics Management Plan             | Genetics Management Plan<br>Q: Revise and implement Broodstock Management Plan and monitoring  |                                 |
| A1 F3: Geographic disposition                       | Recovery Plan  |  |  |                                      |  |                                 |
| <b>A2: Genetic evaluation and mating strategies</b> | Updated Genetics Management Plan to be completed           |  |  |                                      |  |                                 |
| A2 F1: Genetic ID                                   | Genetics Management Plan; Genetic identification protocols |  | Genetics Management Plan; Genetic identification protocols   |                                      | Genetics Management Plan<br>Q: Develop and implement Broodstock Management Plan and monitoring |                                 |
| A2 F2: Purity                                       | Genetics Management Plan; Genetic identification protocols |  | Genetics Management Plan; Genetic identification protocols<br>Q: awaiting the Genome Project to inform purity assessment |                                      | Genetics Management Plan; Genetic identification protocols                                     |                                 |
| A2 F3: Ancestry                                     | Genetics Management Plan; Genetic identification protocols |  | Genetics Management Plan; Genetic identification protocols   |                                      | Q: Develop and implement Broodstock Management Plan and monitoring                             |                                 |
| <b>A3: Spawning Protocols</b>                       |  |  |  |                                      | Q: Develop Broodstock Hatchery Operations and Culture Plan to refine                           |                                 |

|   |   |   |                                |                                   | Broodstock Management    |                              |
|---|---|---|--------------------------------|-----------------------------------|--------------------------|------------------------------|
| CPSP Activities   | G 1&2 H1 Rear healthy fish in good condition  | G 1&2 H2 Stocking protocols & locations | G 3 H1 Recruitment of HOP ^ Ne | G 4 H1 Redundant rearing/stocking | G4 H2 Captive Broodstock | G 5 Provide HOP for research |
| A3 F2: Assessment of oocyte maturation and sex determination                                      | Propagation Plan  |   |                                |                                   | See above                |                              |
| A3 F3: Initiating ovulation to coincide with oocyte development                                   | Propagation Plan  |   |                                |                                   | See above                |                              |
| A3 F4: Condition of milt, proper fertilization practices followed for fresh or cryopreserved milt | Propagation Plan  |   |                                |                                   | See above                |                              |
| <b>A4: Rearing Protocols</b>  |   |   |                                |                                   |                          |                              |
| A4 F1: Initiation to feed, optimal feeds for sturgeon rearing that minimize hatchery selection    | Q: Protocols for initiation to feed need to be assessed<br>Q: Improve understanding of early life-stage mortality   |   |                                |                                   | See above                | See G1&2 H1 and H2           |
| A4 F2: Water quality, temp, environmental conditions  | Propagation Plan and Hatchery Reviews conducted for specific protocols<br>Q: Improve understanding of early life-stage mortality<br>Q: Understand conditions needed to prevent fin curl |   |                                |                                   | See above                | See G1&2 H1 and H2           |
| A4 F3: Water sources and hatchery infrastructure (locality  | Hatchery reviews conducted for specific protocols.  |   |                                |                                   | See above                | See G1&2 H1 and H2           |

|  |  |  |  |  |   |  |
|--|--|--|--|--|---|--|
| differences)   |  |  |  |  |   |  |
| A4 F4: Density, disease and fish health or condition | Q: Define condition range to thrive;<br>Ensure disease control as per Propagation Plan and Hatchery Review |  |  |  | See above   | See G1&2 H1 and H2                           |
| <b>CPSP Activities</b>                               | <b>G 1&amp;2 H1 Rear healthy fish in good condition</b>  | <b>G 1&amp;2 H2 Stocking protocols &amp; locations</b>             | <b>G 3 H1 Recruitment of HOP ^ Ne</b>  | <b>G 4 H1 Redundant rearing/stocking</b> | <b>G4 H2 Captive Broodstock</b>                           | <b>G 5 Provide HOP for research</b>          |
| A5 F1: Tagging/Marking                               |  | Q: Define tagging/marking needs                                    |  |  |   | Defined by study                             |
| A5 F2: Seasonal timing                               |  | Stocking Plan; WGs and managers<br>Q: Annual reporting diagnostics |  |  |   | Defined by study                             |
| A5 F3: Location                                      |  | Determined by WGs and managers<br>Q: Annual reporting diagnostics  |  |  |   | Defined by study                             |
| A5 F4: Transport Protocols                           |  | Stocking Plan; WG, Managers and Hatchery Review                    |  |  |   | Defined by study                             |
| <b>B1: Field sampling to recapture - data</b>        | Results available<br>Q; Describe Analyses and Data needed  | Results available<br>Q; Describe Analyses and Data needed          | Results available<br>Q; Describe Analyses and Data needed  |  | Results available<br>Q; Describe Analyses and Data needed | Q; Annually describe Research and Data needs |
| <b>B2: Population estimates - data</b>               | Results available<br>Q; Describe Analyses and Data needed  | Results available<br>Q; Describe Analyses and Data needed          | Results available<br>Q; Describe Analyses and Data needed<br>Q; Define population criteria to meet benchmarks for CPSP Phase Shift |  | Results available<br>Q; Describe Analyses and Data needed | Q; Annually describe Research and Data needs |

### Information Needs, Research Questions and Data Analyses

Based on questions described in Table 1, the following are considered priority information needs and research questions to improve the effectiveness of the CPSP. *All products resulting from information needs and research questions must include recommendations for change to the CPSP.*

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### *Information Needs – summary, plan, assessment or data gap*

- Genetics Management Plan – needs to be updated with new information and to direct CPSP under current goals and guidance range-wide.
- Genetics protocols – some work is underway; continue to adopt new genetics protocols and use information to improve genetics management
- Define criteria as population targets to meet CPSP benchmarks (Phase shift 1: stocked fish maturing, spawning and offspring (F1) recruiting; Phase shift 2: F1 of HOPS maturing, spawning and offspring recruiting.
- Hatchery Reviews need to be conducted regularly and as needed when problems occur to inform hatchery-specific protocols
- Ensure disease control as per Propagation Plan and Hatchery Review process – process and protocols need to continue and be adequately documented and improved as new issues emerge
- Define and address any new tagging or marking needs and develop protocols as needed
- Define and refine annual reporting diagnostics, statistics and information summaries
- Revise and implement Broodstock Management and Monitoring Plan – initiated at Gavins Point NFH and expected to be complete in FY21
- Develop Broodstock Hatchery Operations and Culture Plan for Broodstock Management – will ensue subsequent to Broodstock Management and Monitoring Plan
- Annually describe PS Recovery/MR Management research needs that require hatchery production and stocking

### *CPSP Research Questions – study needed to address unknowns related to the CPSP (v. recovery)*

- Protocols for initiation to feed - Much of this information has been explored but issue should be fleshed out and standard protocol adopted.
- Improve understanding of early life-stage mortality – Some of this information is available but issue should be further evaluated to determine if additional studies can improve protocols
- Understand conditions needed to prevent fin curl
- Define condition range to thrive – Much information is available but a specific protocol has not been developed to assess the issue and define a standard
- The Genome Project – project is underway; results will inform assessment of hybridization (purity) as it is understood and used in the CPSP

### Data, Analysis and Diagnostics

- Describe data and complete analyses needed for annual reporting and in response to recommendations that result from research and information listed above.
- See below section for annual reporting data and analyses

## **4. DATA AND REPORTING**

### **Data Management**

Standardization of data and reporting is identified as part of recovery actions in the Pallid Sturgeon Recovery Plan (USFWS 2014). Standardized data forms and standardized reporting are critical and facilitate timely transfer and adaptive use of information for the CPSP as well as more broadly for Pallid Sturgeon recovery and Missouri River management.

The USFWS will work with Federal and State partners in Pallid Sturgeon recovery to develop a Pallid Sturgeon Recovery Data Management Plan in upcoming years. This will include a description of all data available, where

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it is housed, meta-data, and will address data security, access and hosting. Until that is available, this plan prescribes how data related to CPSP dependent activities are handled.

Data records related to the CPSP are maintained by the Data Supervisor in the Missouri River Fish and Wildlife Conservation Office in Bismarck ND or by a delegate as determined by the USFWS Ecological Services and Fish and Aquatic Conservation Program Recovery Lead(s).

For propagation activities, data include:

- information collected as part of the Family Lot History and Health Assessment (Range-wide Pallid Sturgeon Propagation Plan; USFWS 2019b).

For stocking activities, data include:

- brood stock source and parentage
- hatchery of origin
- stocking date
- location of stocking
- number of fish stocked
- size and average weight of fish prior to stocking when batch marked
- individual size and weight when PIT tagged
- method of marking and tag numbers

## **Reporting and Evaluation**

Analysis and annual CPSP report completion is overseen by USFWS Fish and Aquatic Conservation Program whom retain primary responsibilities for the CPSP activities. Analyses and reporting are done in conjunction with USFWS Recovery Leads, Ecological Services and in coordination with Pallid Sturgeon Basin Recovery Workgroups. Further coordination on data management, analyses and reporting can be expanded and/or designed to support needs of State and Federal partners to Pallid Sturgeon recovery or the Missouri River Recovery Program

### *CPSP Annual Report*

A Range-wide CPSP Annual Report will be compiled by FAC or their delegate each year to reflect Fiscal Year activities (ending September 30). A completed report will be available by the end of each calendar year. This report will include:

- A. Record of decisions made and chain of custody as identified in decision process in Stocking Plan which includes:
  - Annual stocking targets by RPMA/GUs
  - Brood stock availability (wild and captive/cryopreserved milt)
  - Progeny Produced
  - Number of fish requested
  - Number of fish stocked
  - Data Management and Decision Tracking
  - Program Evaluation to inform out-year stocking
  - Reporting

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B. Hatchery Status (information by each hatchery) -

- Status of all Pallid Sturgeon on station
- Spawning results (individuals crossed, families produced)
- Fish Health and Family Lot History Assessment (USFWS 2019b)
- Marking/tagging
- Rearing conditions (water source, feed, temperature and other)
- Hatchery infrastructure changes/improvements

C. Stocking

- Family lot, number and size of fish stocked
- Mark/Tag info (if different than associated with family lot)
- Date and location of stocking (and environmental conditions to be noted)
- Hatchery origin and family lot identification
- Stocking crew

D. Analysis

Each year, results will be presented for standard summaries and analyses to reflect information critical to CPSP legacy activity tracking such as:

- Genetics, matings, disposition and spawning actions
- Hatchery-origin, size/age, condition (when standard is defined), stocking event survival rates over time
- Hatchery-origin abundance, length-at-age, growth rates and condition (when defined)
- Family lot identity, history and health.
- Other factors assessed to affect post-stocking survival (transportation or equipment problems, fishes' response to handling and transportation, etc.)

E. Evaluation

To evaluate the CPSP, the report will provide a summary of progress towards benchmarks and outcomes based on analyses and new information; how research questions and information needs are being addressed; and recommended changes for future years.

Each year research questions identified in the priority list that are completed and which provide information and analyses to support CPSP recommendation for change will be included, summarized or referenced in annual reports. This new information will be included depending on status of completion of studies or summaries. Incomplete studies will be references with respect to status and progress.

Recommendations from summaries and studies will be reviewed through the CPSP decision process to determine necessary adaptive response and change to the CPSP. If recommendations include the need for subsequent research or analyses, that will be considered in the decision process to be included for future years. Expected analyses (as data is available) include those listed in research priorities above but may generally be related to:

- Hatchery-related effects on survival rates.
- Condition to thrive
- Fish Health issues
- Nutrition for early life stages
- Early life-stage mortality

F. Adaptive Change to CPSP

All recommendations for change to CPSP plans, protocols, process or information will be reviewed according to the decision process laid out as part of the CPSP for routine and non-routine decisions (See Figures 1 and 2). Recommendations will be considered for adoption and implementation by Recovery Coordinator(s), Recovery Team (as requested), and Basin Recovery Workgroups and Propagation Team.

Follow up will include a description of the change that is to be made, which plan, protocol, process or information is impacted, the expected output/outcome, and who is responsible for overseeing the change. Each recommended change will be reviewed in the following year to assess status of change.

**CPSP Decision Process**

Figure 1 describes an overview of the CPSP decision-process as part of routine decision-making. Figure 2 outlines the process followed for non-routine decisions that are outside the scope of CPSP planning documents and guidance, or are controversial or contentious. (Names may change with personnel changes; the vice or most current person in that position applies)

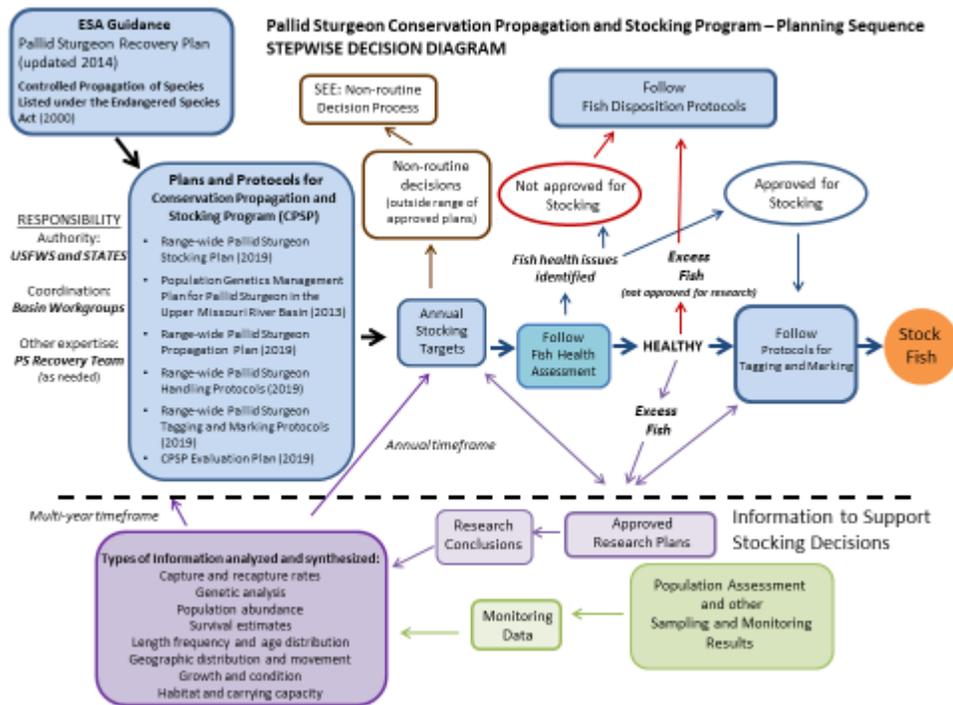


Figure 1. . CPSP Routine Decision-Making Process

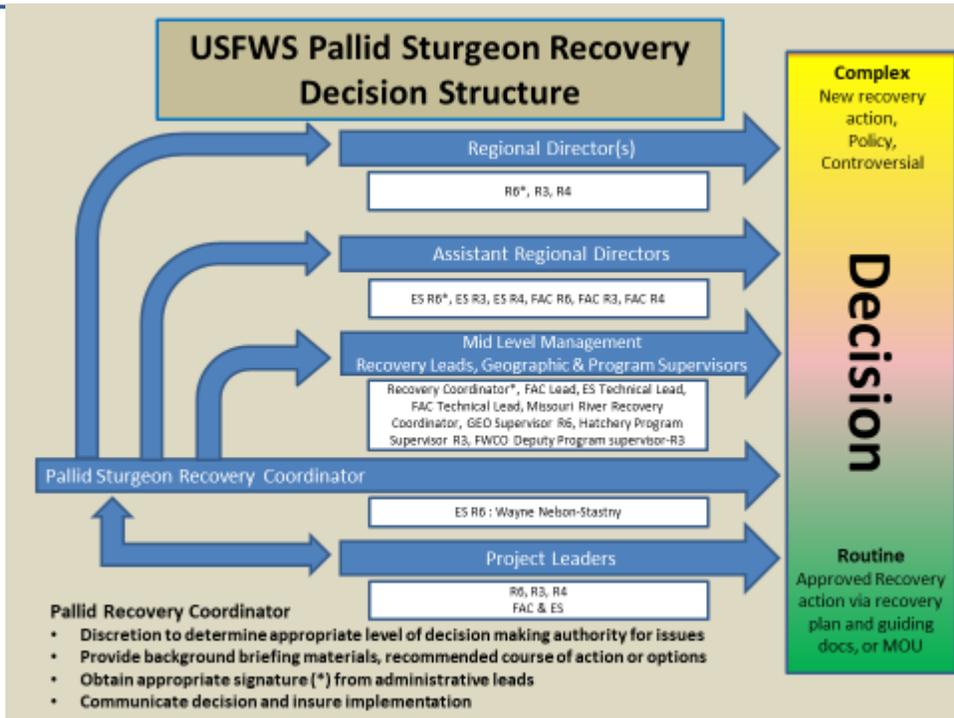


Figure2. Non-Routine Decision Making Process: