ISAP Report on the Discuss and Feedback and AM Workshop
Lied Lodge, Nebraska City, NE
July 30-August 1, 2024

Introduction

The Independent Science and Advisory Panel (ISAP) participated in the MRRIC Adaptive Management (AM) Workshop in Nebraska City, NE from 30 July to 1 August 2024. This meeting was focused on pallid sturgeon, unlike past AM Workshops where Piping Plover management was also considered. All panel members participated, with all but one in-person and the other virtually due to travel difficulties[1]. On 30 July there was a pre-workshop Discuss and Feedback (D&F) session, which was a productive format to gain additional insight from the USACE and other presenters beyond the information obtained in the webinars leading up to the AM Workshop. The AM meetings on 31 July and 1 August were more structured but allowed ample time for input from ISAP and other participants.

In this report ISAP offers and addresses the following key questions:

1. What are the factors that influence spawning success of pallid sturgeon on the UMR and LMR? What are the characteristics of spawning habitat, and under what flow conditions does it occur?
2. Is recruitment of pallid sturgeon to age-1 occurring on the Upper Missouri River (UMR) or the Lower Missouri River (LMR)? If so, when and where? If not, what are the limiting factors? What features of reservoir and Bank Stabilization and Navigation Project (BSNP) operation are leading to chronic recruitment failure on the UMR and LMR? Can gear and sampling protocols be enhanced to better detect age-1 fish (if they are present)?
3. What are the consequences of hybridization and lack of understanding of the synergy with the Middle Mississippi River for the recovery of the LMR sturgeon population?
4. What immediate population support actions are needed?
5. How can sturgeon population models be improved?
6. What lessons have been learned about incorporating Human Considerations in management decisions, implementation, and monitoring?

Question 1. What factors limit spawning success?

Several ISAP members honed-in on the USACE analysis that found a 0.67 correlation between date at which the river temperatures reach 16° C temperature and date of spawning of pallid sturgeon (PDSG), and little effect of variation in flows for a small sample of telemetered fish over the last six years. ISAP recommends that the USACE first test how geographically widespread this finding is throughout the Missouri River. If this relationship holds in multiple areas of the Missouri River, then ISAP recommends the USACE explore management actions

[1] Participating in-person were John Norder, John Loomis, Melinda Daniels, Steve Dinsmore, Mark Dixon, Quinton Phelps, and Steve Bartell (TPSN); Bill Warren-Hicks participated remotely.

to increase water temperatures for increasing spawning activity in the Missouri River, e.g., using spillways on deep reservoirs to raise water temperature or modifying dams to permit release of warmer surface waters without spillway activation.

Turbidity may also be an important spawning cue for pallid sturgeon, both for the test flows on the UMR (timing with sediment and flow contributions from the Milk River) and for the Gavins Point flow study (and possible future flow releases) on the LMR and should be investigated more thoroughly. If data on turbidity from gaging stations on the Missouri River mainstem and tributaries are limited, the USACE may want to consider developing models and/or using remote sensing methods to estimate turbidity.

The interactions between predators and prey are well established in the literature. Previous efforts indicated that PDSG were in poor condition (e.g., low relative weight) and this has been attributed to limited prey (e.g., reductions in chub) in the river. Further, the associations between poor fish condition and poor reproductive/recruitment successes are well documented. ISAP would suggest the partnership take a deeper dive into the associations between chub abundance/habitats occupied (e.g., is shallow water habitat limited?), adult pallid sturgeon condition, and reproductive success.

Despite observations of successful spawning on both the UMR/Yellowstone and LMR much still remains to be learned about the physical characteristics of successful spawning locations and the flow conditions that lead to them. With evidence of more reproduction (a greater proportion of age-0 pallid sturgeon) on the LMR in recent years (2021 and 2022), information on parentage of embryos might be combined with radio telemetry records to identify successful spawning locations.

The Fort Peck test flow generated lots of productive discussion and this test was a good learning opportunity on the UMR. Further, the announcement at the workshop that successful spawning had been observed below Fort Peck during the 2024 test flow was very encouraging. The delayed nature of spawning (about a month later than expected) underscores the importance of warm flow releases and/or synchronizing flow releases with periods of high flow from the Milk River.

Relatedly, one workshop participant noted that lower than prescribed retention flows during the Fort Peck test flow could have led to some fish leaving the area before the second flow pulse was implemented. Being able to implement planned retention flows, and perhaps even ramping them up towards the second flow peak, may be important for optimizing spawning success during future test flows. Some real-time ability to manage these retention flows, based on whether or not fish have congregated in the area below the dam, would be optimal for the success of a given test flow implementation.

Although the 2024 test flow results were promising, the relatively short drift distance available below Fort Peck Dam and the often colder than optimal temperatures of the releases, may chronically limit the potential for successful recruitment. Investing in research, monitoring, and management to further facilitate spawning and (hopefully) recruitment on the Yellowstone and

the longer tributaries, particularly the Powder River, may be a high priority for recovery of the species, if the Corps has the flexibility to direct further resources to those efforts.

Question 2. Is recruitment occurring and what are the factors limiting it?

There was considerable discussion about *recruitment*, but the ISAP is concerned that this term is not defined consistently. In most contexts recruitment was defined in relation to age 1 but in others to adult/breeding age or other age classes. It is crucial that this term be used consistently. And it should also be noted that that reproduction does not necessarily equal recruitment. This applies to efforts that promote spawning (reproduction) without also implementing actions that lead to eventual recruitment.

The biggest limiting factor for pallid sturgeon on both the UMR and LMR appears to be recruitment of age-0 to age-1 fish. However, there are questions about whether current sampling protocols are adequate to document the presence and abundance of age-1 and slightly older juvenile fish, if they are present. Experiments using releases of age-1 hatchery fish to test the efficacy of different sampling methods and gear characteristics (e.g., net mesh sizes) for catching age-1 pallid sturgeon should be a priority. Timing of sampling during the season may also need to be explored. Improved sampling methods will be important for determining whether recent strong age-0 cohorts of fish successfully recruit to age-1. In general, continued experiments using releases of age-0 and age-1 hatchery fish, with sufficient levels of monitoring, will be useful for determining the factors that limit or facilitate successful recruitment. In particular, releases of telemetry tagged hatchery yearlings could help resolve gear challenges and questions regarding habitat preferences. In general, continued experimental releases of young hatchery fish will be valuable to investigate questions about habitat usage, interception, survival, and effectiveness of sampling methods. Both the gear-testing and tagged fish releases should be conducted in both upper (less modified) and lower (highly modified) river reaches to best inform management actions directed towards pallid sturgeon habitat improvement.

Finally, the lack of a reliable means of aging captured fish greatly limits the evaluation of recruitment success. ISAP recommends immediate investment in developing epigenetic aging techniques to accurately age captured juveniles and adults. We also recommend further genetic testing to resolve the degree of hybridization occurring.

Question 3. What are the consequences of hybridization with shovel-nosed sturgeon and synergy with the Middle Mississippi River?

Along with numerous biologists on the river, ISAP believes one of the biggest threats to pallid sturgeon is the issue of hybridization with shovel-nosed sturgeon. Based on the data that Pallid Sturgeon Population Assessment Program (PSPAP) collects, the hybridization rates and subsequent hybrid sturgeon population estimates are biased (i.e., underestimated) because the only sturgeon that are genetically tested are morphometrically and meristically (based on size >450mm) pallid sturgeon. The high proportion of hybrid sturgeon on the LMR also emphasizes the importance of the propagation and augmentation program for providing “pure” pallid

sturgeon for future spawning and the importance of using or further developing genetic tools to accurately and efficiently estimate the proportion of adults, juveniles, and embryos that represent hybrids. If all sturgeon (across sizes) captured were genetically analyzed, the hybridization rates and hybrid population estimates would be more biologically and statistically appropriate.

One of the other big concerns is the lack of acknowledgement of the continuity between the LMR and the Middle Mississippi River. More efforts should be placed in better understanding of the contribution and movement of all life stages of pallid sturgeon and hybrids between these two distinct but interconnected rivers. *Scaphirhynchus* sturgeon are highly migratory, and this certainly needs to be better accounted for in the models to meet the recovery needs of the species. Furthermore, numerous research studies completed in the Middle Mississippi River have already demonstrated these connections, but they are not discussed anywhere in the effects analysis document.

Question 4. What immediate population support actions are needed?

While investigations into the ecology of the pallid sturgeon should continue, these studies should not prevent immediate management actions from proceeding. For example, land purchases, levee setbacks and near-channel modifications can increase floodplain connectivity and improve the overall system productivity, including pallid sturgeon production (as observed with the boost in fish condition in years 2 and 3 following 2019 flooding). ISAP raised the issue that given the funding constraints that the Recovery Plan faces and the funding available in the BSNP, while they are different statutory programs, there would seem to be some potential complementarity. For example, acquisition of land along the river might simultaneously contribute to BSNP goals and aid recovery of the pallid sturgeon. This possibility seemed to resonate with several stakeholders. The USACE suggested some acquisitions of land that gets flooded at high water, particularly land between the levees and the river, would be a possibility for such complementarity. Previously constructed Shallow Water Habitat (SWH) or existing off-channel areas on BSNP mitigation lands could also be investigated and potentially modified to enhance interception and rearing habitat for young sturgeon, particularly if further construction Interception Rearing Complex (IRCs) is off the table. ISAP encourages the USACE to consider exploring potential synergistic gains to pallid sturgeons from considering BSNP actions as the agency and its partners continue to develop their models of pallid sturgeon.

Navigation is one of USACE's authorized purposes for managing the Missouri River system. However, maintaining the navigation channel has created a deep swift thalweg (e.g., "theoretical fire hose") with minimal off-channel habitat. IRCs were put in place to offset these perturbations. ISAP members believe without the off-channel or interception habitat young pallid sturgeon will have poor survival and recruitment (or just potentially end up in the Middle Mississippi River). The USACE needs to identify other mitigation measures and essentially address, "What are the alternatives to the IRC?" If this type of habitat can no longer be created, have we created (through urbanization and development) the inability to restore a naturally occurring self-sustaining pallid sturgeon population in the LMR? In the absence of any other identified feasible pathway to modify the engineered navigation channel environment to support

pallid sturgeon recovery, the difficult question needs to be addressed as to whether mitigation of the BSNP is possible. All indications suggest that mitigation will require physical modifications, such as increased floodplain connection/lateral complexity at multiple river stages, that are not compatible with navigation support as it currently exists on the lower river.

Question 5. How can population models be improved?

The PDSG population modeling and data analysis supporting our understanding of population dynamics and health continues along the same reasoning as in past meetings. The population models continue to grow in complexity and include measures of expected population growth and abundance. We strongly recommend that additional detail be provided linking the population model outputs to expected management actions. While the model itself seems appropriate, how the outputs can be used for management actions is unclear.

ISAP would enjoy additional communications about the population model details. For example, we recommend that details of model equations, approaches for model parameterization, and details on model verification be communicated in as much detail as possible. One issue that arose during the meetings was the amount and quality of information available for data parameterization. Additional information on how information from monitoring studies is used to support the population model findings would be useful.

The ISAP believes that it is critical to invest in efforts that result in more precise parameter estimates of larval/juvenile survival and related parameters. This is needed for the IPSPM, which currently relies on sparse data and imprecise parameter estimates yet is (or appears to be) being used to evaluate management actions.

The ISAP would like to see a clearer presentation of how data from targeted and random sampling are used to guide pallid sturgeon models and management. Targeted sampling is by definition non-random, raising potential concerns about the validity of inferences, resulting demographic parameters, and more. Fish from targeted samples are valuable and we suggest that their use be carefully defined and clarified.

A longstanding ISAP issue was raised again whether the newer pallid models being developed were capable of assessing pallid sturgeon response to different current management actions. In addition, were the models capable of simulating how large would a management action have to be in order to increase the likelihood of detecting a change in pallid sturgeon populations.

Question 6. What lessons have been learned about incorporating Human Considerations in management decisions, implementation, and monitoring?

ISAP was encouraged to see USACE taking greater initiative and seeing increased value in broader stakeholder engagement on specific projects, e.g., Fort Peck test flows. This engagement is critical when other key management actions are being planned in order to reduce the delay in implementing these management actions. ISAP also felt the Human

Considerations (HC) monitoring concurrent with the fish monitoring associated with the Fort Peck test flow will aid in building long term trust between the USACE and the stakeholders. HC monitoring will also provide valuable information on what actual impacts were compared to predicted impacts, a valuable source of information for either validating the HC models or refining them, e.g., the impact of the flow releases on irrigation intakes.

Within the overall Adaptive Management framework for project development and implementation, ISAP would recommend that the process of Tribal, HC, Stakeholder consultation be aligned with any and all aspects of the revised Science and Adaptive Management Plan (SAMP) that include management actions affecting HC issues of concern, e.g. test flows, Emergent Sandbar Habitat (ESH) construction, etc. The AM process, while driven by ESA compliance, should include initial consultation for proposed management actions with the potential for HC impacts and build in mitigation processes. As noted, this will increase trust between USACE and the previously mentioned participants.

In addition to inclusion in the upcoming revised SAMP, ISAP would further recommend that HC engagements and proposed or taken mitigation actions should be reported in greater detail in a summary tabular form in the body of the draft Adaptive Management Compliance Report (AMCR) to further promote transparency of process and to recognize the significance and value of Tribal and Stakeholder input. Both of these actions - inclusion in the SAMP and annual AMCR - would serve to answer questions ahead of workshops and plenaries regarding USACE efforts and actions to include HC's more proactively. As a final note, one Stakeholder at the recent AM workshop asked that MRRIC be included in the SAMP. ISAP would encourage that a discussion be had with the current MRRIC Chair and the HC Leads to address this question in relation to the MRRIC Charter. ISAP has no other specific opinion on this last matter concerning the Charter.

ISAP notes that Tribes have little influence on the Missouri River adaptive management process. On November 15th, 2021, the Executive Office of the President, the Office of Science and Technology Policy, and Council on Environmental Quality issued a memorandum directing Federal Agencies to work towards informing federal decisions and scientific inquiry, where appropriate, with Indigenous Traditional Ecological Knowledge (ITEK or Indigenous Knowledge (IK)). On November 30, 2022, specific guidelines on Indigenous Knowledge were released by the same Office along with establishment of a Subcommittee on Indigenous Knowledge under the committee on the Environment, Natural Resources, and Sustainability of the National Science and Technology Council. While Tribes are already members of MRRIC, the Federal Memorandum and subsequent guidelines require that Federal Agencies, including USACE, develop policies for engaging with Tribes and their Indigenous Knowledge in federal undertaking and scientific studies.

ISAP notes that to date, there has been no observable action taken by the USACE - Omaha District on this matter. Because MRRIC includes Tribes as part of its membership, ISAP strongly recommends that USACE move forward with engaging the Missouri River basin Tribes more actively in a Nation-to-Nation consultation process to determine the potential role and

significance that these Tribes' Indigenous Knowledges may have in USACE undertakings under MRRP and not just MRRIC. This would also include the BNSP mitigation lands projects. At this point there are abundant examples of U.S. Federal Agencies working with Tribes on issues related to endangered species, species management, natural resource management, and other issues that are co-informed by Indigenous Knowledge.

As ISAP has noted the lack of Tribal influence on the AM process, ISAP is concerned that this continued absence will further erode trust and engagement between USACE and the Tribes on all aspects of both the ESA actions for the pallid sturgeon and piping plover in MRRIC, as well as the BSNP mitigation lands managed on historically recognized Tribal lands along the Missouri River under the broader MRRP. ISAP recognizes that meaningful engagement is a challenge for USACE as it has been for other Federal Agencies, but, again, successful engagements have already occurred and could serve as a model for successful inclusion of ITEK by USACE in the revised SAMP.

Final Recommendations on Revising the Science and Adaptive Management Plan (SAMP)

The meeting closed with a productive discussion of planned updates to the Science and Adaptive Management Plan (SAMP). The ISAP suggests the following key considerations for this update:

1. In Chapter 1 we need a clearer definition of Adaptive Management and how it should/will be integrated with science and management actions.
2. In Chapter 3 consider eliminating Least Terns (no longer federally listed) and update management actions and effectiveness for the piping plover.
3. In Chapter 4 please clearly state the current status of the AM process.
4. In Chapter 6 consider a simpler approach given the newer Information Management System (IMS).
5. Where relevant, HC issues and Tribal ITEK should be incorporated into the AM process.