

## ERDC Mississippi River Studies



### Background

The Fish Ecology Team of ERDC-EL has been conducting environmental studies for MVD since 2000. Some members were involved in earlier studies during the Lower Mississippi River Research Program. Funding for pallid sturgeon studies were initiated as a result of jeopardy biological opinions (BiOp) issued by USFWS in the Missouri and Middle Mississippi River. There was concern that a jeopardy opinion would be issued for the Mississippi River and Tributaries Project. In 2000, virtually nothing was known on the status of pallid sturgeon in the Lower Mississippi River (LMR). After several years of developing effective sampling and evaluation techniques, ERDC began to regularly capture pallid sturgeon in the LMR. In 2003, the St. Louis District funded ERDC to collaborate with Missouri Dept. of Conservation and Southern Illinois University to evaluate pallid sturgeon populations in the Middle Mississippi River (MMR) in response to their jeopardy BiOp. Beginning in 2005, MVD began funding ERDC to evaluate benefits of dike notching and later other channel improvement projects. Studies have continued through FY11 and this document summarizes important findings and justification to continue these studies.

### Application to Corps Divisions and Districts

The potential range of the pallid sturgeon, including the Ohio River and other tributaries of the Mississippi River, encompasses seven Corps Districts and 3 Divisions:

#### Mississippi Valley Division

New Orleans District  
Vicksburg District  
Memphis District  
St. Louis District

#### Northwestern Division

Kansas City District  
Omaha District

#### Southwestern Division

Little Rock District

### Biological Opinions

The pallid sturgeon (*Scaphirhynchus albus*) was federally listed as an endangered species in 1990 and a recovery plan was approved in 1993. The USFWS has issued three jeopardy Biological Opinions on pallid sturgeon with an annual cost of addressing the reasonable and prudent measures of approximately \$65-70 million per year (Northwest Division and St. Louis District):

- Missouri River Master Manual – Habitat restoration and population augmentation
- Upper Mississippi River/Illinois Waterway Navigation Project – Habitat restoration (Middle Mississippi River, MMR)
- Upper Mississippi River/Illinois Waterway Navigation Project – Towboat propeller entrapment (MMR)

In addition, three non-jeopardy Biological Opinions (BiOps) were issued for entrainment of pallid sturgeon through lower Mississippi River Diversions (Bonnet Carre, White Ditch, Covenant/Blind River), and others are pending (Caernarvon, Violet, Old River, and numerous proposed diversions). Non-jeopardy opinions were the result of ERDC research demonstrating that impacts to pallid populations were minimal. The take of pallid sturgeon allowed by the BiOps ranged from 90 to over 1,000 individuals for the life of the projects as compared to only one individual for the Missouri and MMR BiOps. This disparity illustrates different policies and opinions among the different USFWS and Corps offices throughout the range of the species.

### **Significant Research Findings**

The pallid sturgeon recovery plan was based principally on information available for the upper Missouri River and the Atchafalaya River populations. Very little data existed for pallid sturgeon in the central and most extensive portion of its range: the Lower Mississippi River (LMR) and the Middle Mississippi River (MMR). Data collected by ERDC in the Mississippi River now provide the opportunity to re-evaluate paradigms established in 1993 and later.

- Prior to ERDC's research, it was assumed that pallid sturgeon remain one of the rarest fish of the Missouri and Mississippi River basins and is on the 'brink of extinction.' However, more than 500 pallid sturgeon have been collected in the LMR and MMR by ERDC and partners since 2000 and population viability models being developed by ERDC and Applied Biomathematics indicate that pallid sturgeon have a self-sustaining population in the LMR and adult abundance exceed 10,000 individuals.
- The recovery plan stated that "It is unlikely that successfully reproducing populations of pallid sturgeon can be recovered without restoring the habitat elements (morphology, hydrology, temperature regime, cover, and sediment/organic matter transport) of the Missouri and Mississippi Rivers necessary for the species' continued survival." ERDC studies have demonstrated recruitment of pallid sturgeon, at least in the LMR. Habitat studies (dike notching, secondary channel restoration) continue to show that pallid sturgeon and other riverine species are utilizing these restored habitats.
- It was assumed that hybridization with shovelnose sturgeon is occurring in the Mississippi River and that hybrids may represent a high proportion of remaining sturgeon stocks. It was further assumed that hybridization results from Corps projects degrading habitat and reducing reproductive isolation between the two species. ERDC analyzed taxonomic characters of LMR pallid sturgeon and concluded that most misidentifications were the result of allometric growth of key characters used to separate the two species. ERDC concluded that a "hybrid swarm" was not occurring in the Mississippi River. However, field identification of pallid sturgeon is still problematic for many groups, which has resulted in a USFWS study comparing taxonomic identification to genetics; ERDC is providing specimens for this study.
- There were numerous unsubstantiated accounts of elevated mortality of pallid sturgeon for various reasons, but especially related to both sport and commercial fishing activities. ERDC quantified mortality rates showing that annual mortality in the MMR, where commercial and recreational sturgeon fishing was taking place, is substantially higher (> 37 %) than in the LMR, where fishing is negligible (13%). In 2010, a Similarity of Appearance (SOA) ruling was issued by USFWS banning all commercial fishing where the two species co-occur. ERDC was instrumental in justifying the SOA based on mortality data collected over the past 10 years. In addition, the low mortality rate in the LMR further substantiated stable or expanding populations of pallid sturgeon.

ERDC has also conducted studies on swimming performance of pallid sturgeon used to evaluate entrainment risk through water diversions and dredges, quantified before and after utilization of restored

secondary channels by pallid sturgeon and other species, continued to measure environmental benefits of certain types of channel improvements (hard points, chevrons, notching), collaborated with other researchers to document gravel bar habitat in the LMR, which is where pallid sturgeon spawn, and develop sturgeon distribution maps that can be used by District personnel for planning purposes. Numerous papers have been completed as a result of funded studies by MVD and Districts (see below), and more articles are being prepared.

### **Benefits of Corps' Research to Protection and Conservation of Pallid Sturgeon**

- The Corps will have adequate information to either support or refute statements made concerning the status of pallid sturgeon relative to potential threats (e.g., habitat degradation, entrainment).
- The Corps will have quantified benefits of creating habitat diversity as part of the Channel Improvement Program of the MR&T
- Collaboration with other groups and agencies (e.g., Lower Mississippi River Conservation Program, Audubon, The Nature Conservancy) is facilitated by Corps participation in data collection and presentations
- Research information will be used to prepare or support documentation related to the Endangered Species Act including Conservation Plans and Biological Opinions
- Information sharing at the annual Channel Improvement Interagency meetings conducted by Memphis and Vicksburg Districts legitimizes MVD's environmental stewardship goals in the Mississippi River.
- Development of a long-term data base results in a better understand of demographic trends of pallid sturgeon and other riverine species related to habitat changes and hydroperiod (e.g., affects of 2011 flood).
- The database developed over the last 12 years was used in the Lower Mississippi River Resource Assessment (LMRA) to describe baseline conditions and will be used to address future goals related to implementation of the LMRA
- The Corps environmental database (fish and habitat data combined) in the Mississippi River extends from the mouth of the Missouri River to the mouth of the Mississippi River. Information has been obtained from the database to update GIS maps where sturgeon were collected, analyze effects of water diversions in the southern portion of the LMR on pallid sturgeon entrainment, assess potential impacts of dredging, and used by outside agencies under Data User Agreements to evaluate environmental assessment of proposed hydrokinetics.
- Corps research includes pallid sturgeon assessment in MMR to support St. Louis District's obligations to meet the requirements of jeopardy Biological Opinions and will ensure that studies are compatible between the four Districts in the free-flowing Mississippi River.
- Tagging studies have demonstrated that sturgeon can move more than 1,000 miles between the LMR and Missouri Rivers, indicating the need for a range-wide assessment.
- Collections of pallid sturgeon continues to provide tissue samples to USFWS in their efforts to better understand genetic integrity of pallid sturgeon.
- Most importantly, continued sturgeon studies in the Mississippi River will ensure that the Corps complies with the Endangered Species Act using scientifically defensible information.

### **Basin-wide Perspective**

The Corps does not currently have an organized, basin-wide perspective on pallid sturgeon research and recovery goals. A range-wide assessment is being considered and some major benefits of a coordinated program are as follows:

- Research has shown that pallid sturgeon move between Corps Divisions (i.e., between the lower Missouri and MMR), so the stocking questions related to hybridization and genetic integrity of sub-populations have become more controversial. Documented examples of long-range

movement of pallid sturgeon clearly indicate that a basin-wide research and recovery program is warranted.

- Pallid sturgeon in the LMR represent a stable and possibly expanding population that could be used a reference to population recovery goals in the MMR and Missouri River.
- In some Missouri River studies, the more abundant shovelnose sturgeon is being used as a surrogate due to the difficulty in collecting pallid sturgeon. Therefore, information on pallid sturgeon spawning, rearing, and habitat use derived in the MMR and LMR will support interpretation of data obtained for shovelnose sturgeon in the lower Missouri River.
- Telemetry is being used in the Missouri and Mississippi Rivers to track movements of fish. Additional coordination is necessary to establish compatibility of all telemetry gear used by the Corps and create a series of remote receivers that provide continuous monitoring of pallid sturgeon moving between the Missouri River, MMR, and LMR.
- The Corps continues to plan and construct habitat restoration features in the Missouri and Mississippi rivers despite the uncertainty in benefits and population recovery goals. Habitat restoration guidelines for pallid sturgeon need to be developed for all Corps Districts.

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