MICRA Paddlefish Stocking Protocols

Paddlefish inhabit large river systems of the Mississippi River Basin and other river systems draining into the Gulf of Mexico from Texas, Louisiana, Mississippi, and Alabama. Although paddlefish still occupy most of their historical range, their distribution has been reduced and paddlefish are no longer abundant in many areas within Mississippi River basin (Bettoli et al. 2009).

Hatchery-reared paddlefish have been introduced into waters within their native range to restore extirpated populations, mitigate for habitat loss, and to support recreational fisheries (Grady and Elkington 2009). Although introductions were justifiable, biological and ecological complexities were not often fully understood. Stocking artificially propagated paddlefish can alter the genetic composition of recipient populations (Sloss et al. 2009; Heist and Mustapha 2008) and can increase the risk of spreading fish pathogens and aquatic invasive species (AIS; Pegg et al. 2009; Fuller et al. 1999; Hirsch 1998). Additionally, stocking hatchery-reared paddlefish, as a panacea management strategy, has been inappropriately proposed and unilaterally applied as a substitution for mitigating gross habitat degradation or in lieu of enacting appropriate management actions to prevent overfishing. If paddlefish augmentation is regarded as the sole solution to habitat destruction and overexploitation, then underlying problems will persist and populations will require perpetual maintenance.

Introduction of hatchery-reared paddlefish is not a management strategy that is practiced by all states within their native range, but due to their migratory nature, it can be assumed that hatchery-reared paddlefish have the same potential to move as wild fish. It is a basic assumption of fisheries management that introduced fish may move. This is especially true for paddlefish, given their migratory behavior and under certain situations, such as severe weather events, dam failures, and human intervention. Because paddlefish are known to migrate great distances and pass through dams, management strategies implemented in one state can impact management strategies elsewhere. Consequently, it is important that communication and cooperation exists amongst entities managing paddlefish populations since all jurisdictions are directly or indirectly affected by the decisions of others.

Due to the variety of paddlefish management strategies employed, interjurisdictional nature of paddlefish management, and varied opinions regarding introduction of hatchery-reared paddlefish, it is essential that a basic set of protocols for all paddlefish introductions be implemented consistently throughout the species' range. This document provides protocols developed by the Mississippi Interstate Cooperative Resource Association (MICRA) Paddlefish-Sturgeon Subcommittee to provide an interjurisdictional management approach based on best available science.

Ultimately, paddlefish management and implementation of these protocols are the responsibility and authority of the agency which has legal jurisdiction over a water body. This document shall in no way limit this authority.

MICRA strongly recommends that paddlefish introduced into waters within their native range be spawned, reared, and stocked in accordance with the following three interjurisdictional management goals:

- To maintain a reproductively viable and genetically diverse paddlefish population;
- To allow for differentiation of artificially propagated paddlefish from wild fish; and
- To minimize spread of fish pathogens and AIS associated with propagation and stocking of paddlefish.

It is further recommended that any managing unit that is considering a strategy partially or solely based on introductions of hatchery-reared paddlefish should develop an operational stocking plan and associated timelines. These plans should be shared with all MICRA states via the Paddlefish-Sturgeon Subcommittee prior to implementation. Several states are currently stocking artificially propagated paddlefish as a management strategy, and it is hoped that these states will share their operational stocking plans. Although the decision to implement management strategies for paddlefish is the responsibility of the agency which has legal jurisdiction of the waterbody, the interjurisdictional nature of this species requires interstate and interagency coordination.

There are many local, regional, and basin-wide factors that should be considered during development stages of an operational stocking plan. Although this is not an inclusive list, several basic factors to consider:

- What is the long-term objective of the stocking program?
- Are paddlefish currently present and are paddlefish an endemic species?
- Is suitable habitat available for all life stages?
- Is reproduction/recruitment occurring and/or adequate if not why?
- When stocked-fish escape, how will the proposed stocking program or the movement of propagated paddlefish from target waters affect paddlefish management in the watershed, sub-basin, or basin? What will be the biological effects when stocked-fish emigrate?
- What steps will be taken to prevent disease, parasite, and AIS issues?
- How will the stocking program be evaluated?
- Are there options other than stocking?

BASIC OPERATIONAL ACTIONS

<u>Goal 1</u>: To maintain a reproductively viable and genetically diverse paddlefish population

MICRA recommends these protocols to protect and provide sound management of paddlefish and its component genetic stocks. Paddlefish artificially propagated using any other approach should not be stocked into waters of their native range or its watershed.

Studies of paddlefish movement have documented spawning runs of greater than 100 miles, indicating that paddlefish may exhibit a migratory behavior that would eventually lead to genetic divergence among paddlefish from different spawning sites. Paddlefish in particular exhibit strong spawning site fidelity (Stancill et al. 2002; Firehammer & Scarnecchia 2007; Braaten et

al. 2009) and this is likely a major contributor to their genetic divergence. Genetic divergence among stocks allows each spawning unit to adapt to local conditions over multiple generations. Stocking of fish originating from other locations may introduce genes inadequately adapted to local conditions and reduce fitness of native stocks.

Protocols:

- Wild broodstock should be used for paddlefish propagation. Use of hatchery-origin fish as broodstock could reduce fitness of stocks through inbreeding and domestication. Because recent stocking practices in some areas used relatively small numbers of brood fish and did not control for variation in family size, there may be a high degree of relatedness among stocked fish, particularly in reservoirs (Heist and Mustapha 2008). Use of related fish as broodstock may cause inbreeding, which has been shown to reduce fitness through mechanisms including decreased fertility, increased frequency of developmental abnormalities, and decreased disease resistance. Differential survival of fish under hatchery conditions compounded over multiple generations can result in domestication, where fish become more adapted to the hatchery environment and less adapted to wild conditions. When these fish cross with wild stock, these issues can negatively affect their "wild" progeny and in turn, the population. Both inbreeding and domestication can be prevented through collection of wild broodstock from self-sustaining populations.
- Use broodstock from only proximal sources within the sub-basin that is to be stocked. Reservoir populations may use fish collected from the tailwaters (Heist and Mustapha 2008)
- Hatchery produced progeny should only be stocked into the sub-basin from which their parents were acquired. This is an important consideration for hatcheries that propagate paddlefish to be stocked into more than one sub-basin.
- If hatchery-reared paddlefish are transferred between sub-basins, transfers will be preapproved by the agency with legal jurisdiction over the waters being stocked and the agency with legal jurisdiction over wild paddlefish stocks in the state where the producing hatchery is located.
- Distinct sub-basins are identified as:
    - Mobile River (including Alabama and Tombigbee rivers)
    - Lower Mississippi River (including Arkansas and Red rivers)
    - Missouri River
    - Ohio River (including Tennessee and Cumberland rivers)
    - Upper Mississippi River
    - Isolated Gulf coast drainages (each system that drains into the Gulf of Mexico should be treated as a separate sub-basin)
- If broodstock are to be returned to the wild, tag all broodstock prior to release with MICRA jaw tags.
- An individual brood fish should never be spawned again during subsequent years. If jaw tagged fish are encountered during broodstock collection, the proper data bases should be consulted to insure that this fish was not previously used for propagation.
- Preservation of genetic variation will be maximized by using a minimum of 25 pairs of adults for restoration efforts. Supplemental stockings do not require, on an annual

basis, a large number of adults, so fewer family groups can be used for supplemental stocking. However, multiple year classes should comprise a large number of adults, on the order of 25 pairs over five years, for populations largely consisting of artificially propagated paddlefish.

- Ideally, family groups should be segregated until hatching and culturist should insure that family groups are similarly represented in stocked fish. Keeping families separate allows quantification of contributions from each parent. Minimizing the variance in family representation (i.e., preventing offspring from a small number of families from dominating the production) is important to prevent inbreeding, so it may be necessary to discard or redirect surplus fry from disproportionately represented family groups.

Goal 2: To allow for differentiation of artificially propagated paddlefish from wild fish

MICRA recommends these protocols to allow for the long-term identification of artificially propagated paddlefish from wild paddlefish in a coordinated and range-wide approach.

Paddlefish are managed throughout the basin using a wide range of management strategies. In some areas paddlefish are managed as an endangered or jeopardized species and efforts are underway to restore this species to waters from which they were previously extirpated. In other areas, self-sustaining paddlefish populations support recreational and commercial fisheries. Given this species' ability to migrate long distances and pass through dams, the potential influence of hatchery-reared and introduced paddlefish must be considered basin-wide. Consequently, for states to properly evaluate their fisheries, the ability to distinguish wild fish from stocked fish is imperative.

Standard protocols are needed to ensure that all states have the ability to distinguish artificially propagated paddlefish from wild paddlefish. Although many tagging techniques exist, methods described in the MICRA Paddlefish Tagging Protocols are available and widely used. Thus, MICRA recommends that the MICRA Paddlefish Tagging Protocols be incorporated into all stocking plans.

Protocols:

- All hatchery-reared and introduced paddlefish stocked into any waters within their native range and its watershed will be tagged in accordance with the MICRA Tagging Protocols.
- Tagging information will be provided to a sub-basin tagging coordinator for entry into the MICRA Paddlefish Tag Database following standard protocols.
- All broodstock will be jaw tagged prior to release per the MICRA Tagging Protocols. Tagging information will be provided to a sub-basin tagging coordinator for entry into the MICRA Paddlefish Tag Database.
- Genetic samples of all broodstock used and a subsample of each family will be archived in the MICRA repository for future parentage analysis and to aid improvements of propagation techniques.

Goal 3: To minimize spread of fish pathogens and Aquatic Invasive Species (AIS) associated with propagation and stocking of paddlefish.

MICRA recommends the implementation of these protocols to minimize risk of spreading fish pathogens or AIS when propagating or introducing hatchery-reared paddlefish.

Fish pathogens and AIS related problems can reduce survival of wild and stocked paddlefish, resulting in significant losses to wild paddlefish populations and fisheries. Potential exists for pathogens and AIS to spread during propagation, transportation, and introduction of paddlefish. Unwanted pathogen and AIS introductions can be prevented or curtailed by including appropriate biosecurity, disinfection, and Hazard Analysis and Critical Control Point (HACCP) procedures. Existing diagnostic and disinfection techniques are adequate to initiate effective disease control and to prevent the spread of pathogens and AIS. Each state agency should take appropriate measures to restrict the spread of fish pathogens and AIS associated with propagating, transporting, and introducing paddlefish.

Protocols:

- All hatchery facilities used for paddlefish propagation should incorporate a HACCP plan or similar approach. This plan should address propagation and stocking activities. Plans will be preapproved by the agency with legal jurisdiction over the waters being stocked and the agency with legal jurisdiction over wild paddlefish stocks in the state where the producing hatchery is located.
- Hatchery–reared paddlefish should only be stocked into the sub-basin from which their parental stock was acquired.
- Ideally, the producing hatchery will be located within the sub-basin to be stocked to avoid transfer of pathogens and AIS between sub-basins. If hatchery-reared paddlefish are transferred between sub-basins, transfers will be preapproved by the agency with legal jurisdiction over the waters being stocked and the agency with legal jurisdiction over wild paddlefish stocks in the state where the producing hatchery is located.
- Broodstock that are brought into a hatchery should be treated using appropriate techniques prior
    - To introduction into the hatchery facility environment,
    - To transport to the release site, and
    - To release back into the waters from which they were collected.
- Fish pathogen inspection, sampling and laboratory testing methods should be conducted according to current international, national and/or regional standards. Some suggested approaches include:
    - *OIE Manual of Diagnostic Tests for Aquatic Animals* (http://www.oie.int/eng/normes/fmanual/A_summry.htm)
    - *AFS-Fish Health Section "Bluebook" Inspection Section* (http://www.fisheries.org/units/fhs/members/docs/2007_BB_folder/2007%20BB%20folder/start.pdf)
- Eggs received from any spawning site and water in which they are transported should be disinfected upon arrival and prior to incubation.

- Interstate paddlefish transportation will be accompanied by a fish health inspection report prepared and signed by a qualified American Fisheries Society fish health inspector or qualified licensed veterinarian. Prior to shipment the inspector will furnish to the receiving member state a statement confirming that the source of gametes, fertilized eggs or fish has been inspected for the presence of each listed pathogen.
- A fish health inspection report, as directed by the agency with legal jurisdiction over the waters being stocked, should require testing of 60 paddlefish from each lot for the following pathogens:
    - Viruses
        - Infectious Pancreatic Necrosis Virus (IPNV)
        - Acipenserid Herpesvirus 1 and 2 (AciHV-1 and AciHV-2)
        - Infectious Hematopoietic Necrosis Virus (IHNV)
        - Viral Hemorrhagic Septicemia Virus (VHS)
        - Spring Viremia of Carp Virus (SVCV)
        - Cytopathic Effect on at least two cell lines
    - Bacterial Pathogens
        - *Aeromonas salmonicida* (AS), Furunculosis
        - *Yersinia ruckeri* (YR), Enteric Redmouth
        - *Edwardsiella ictaluri* (ESC), Enteric Septicemia
    - Parasites
        - Gross external parasites

Conclusion

Development and implementation of operational stocking plans consistent with these MICRA protocols will minimize negative effects that introductions of hatchery-reared paddlefish may have on wild paddlefish or on paddlefish management strategies elsewhere in the basin. This will allow all states to manage their paddlefish fisheries in a manner consistent with MICRA's mission: "to improve conservation, management, development and utilization of interjurisdictional fishery resources in the Mississippi River Basin through improved coordination and communication among the responsible management entities."

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