

APPENDIX B

DETAILED DESCRIPTION OF THE CORPS' ALTERNATIVE TO THE 2000 BIOP GAVINS POINT RPA

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ADAPTIVE MANAGEMENT

The 2000 BiOp recommended that the Corps adopt an adaptive management approach to implementing the various BiOp measures. The USFWS stated that the “adaptive management framework is a particularly effective way to address multiple species, ecosystem variability, and biological unknowns about the lifecycles, behaviors, and habitat requirements of the listed species.” The National Research Council in its January 2002 report titled, “The Missouri River Ecosystem: Exploring the Prospects for Recovery”, also recommended that adaptive management be adopted as an “ecosystem management paradigm” for the Missouri River. Key components included broad stakeholder involvement, an independent scientific peer review process, and a collaborative process to “learn about successes, failures, and potential management actions that could be usefully implemented in the Missouri River ecosystem.”

The Corps, in this proposed action measure, embraces the concept of adaptive management. Adaptive management is not a new concept; but rather, a construct that is now commonly used throughout the world to help shape resource management decisions, policies, and approaches. There is an up-front recognition that all is not known about the complete life cycles and behaviors of the threatened and endangered species or the requisite habitat needs throughout the species’ life cycles. Adaptive management is an overall strategy for dealing with change and scientific uncertainty. It promotes an environment for testing hypotheses and pursuing promising changes, based on sound scientific data and analyses.

Generally speaking, adaptive management: 1) aggressively implements on-the-ground actions to attain those biological attributes that will result in beneficial effects for the listed species; 2) conducts a rigorous research effort to reduce the uncertainty surrounding essential attributes needed to insure the survival and recovery of listed species; and 3) adapts to the findings of an intensive and comprehensive monitoring and evaluation program. In carrying out an adaptive management approach to decision-making, some future actions may pose significant effects to the natural and/or human environment. In some cases, this may require that the Corps undertake an assessment of the effects in accordance with the NEPA, prior to making any decisions to implement an action. The ultimate success of the adaptive management framework for the Missouri River basin must also take into account that humans are integrated into the ecosystem and that natural ecosystems do not recognize property lines and administrative boundaries.

Understanding this, the Corps proposes the first part of the adaptive management framework, the development of the Missouri River Recovery Implementation Program

(MRRIP). MRRIP is a comprehensive and integrated set of measures to be undertaken by the Corps in collaboration with the USFWS, working with the States, Tribes, and other stakeholders in the basin. MRRIP will be undertaken to protect and recover threatened and endangered species listed under the ESA and the ecosystem upon which they depend.

MRRIP will include recovery actions on the mainstem of the Missouri River from Three Forks, Montana, to St. Louis, Missouri, and on select tributaries of the Missouri River, including the Kansas River, while taking into consideration other Congressionally authorized and traditional uses of the river. The actions undertaken for MRRIP will be relied on by the Corps, USFWS, and others to avoid the likelihood of 1) jeopardy to the three listed species (piping plover, least tern, and pallid sturgeon) in the Missouri River, 2) adverse modification to designated critical habitat, and 3) violation of the take prohibitions of Section 9 of the ESA.

The basic components of the initial ecosystem recovery program, either those actions being implemented in response to the 2000 BiOp or set forth in details in this proposed action include:

- **Habitat creation, enhancement, and maintenance for pallid sturgeon, piping plover, and least tern.** Under this category, the Corps' existing efforts to create shallow water habitat for the pallid sturgeon and emergent sandbar habitat for the least tern and piping plover will continue and be expanded. Additional habitat enhancement efforts will be undertaken to provide even more and potentially better habitat for all three species.
- **Hatchery support including facility improvements, accelerated brood stock collection, and accelerated stocking for the pallid sturgeon.** In 2003, the Corps is enhancing pallid sturgeon propagation activities at six rearing facilities to assist in achieving annual stocking goals. The facilities have been able to upgrade water systems, fish transport units, holding and rearing capabilities as well as a variety of miscellaneous items. The continuation and enhancement of these activities as part of the recovery program will enable propagation and augmentation efforts to be maintained and expanded. Successful collection, spawning, rearing, and stocking will partially offset the lack of natural reproduction.
- **Population assessments of the pallid sturgeon, piping plover, and least tern.** The Corps has implemented a comprehensive least tern and piping plover monitoring program, which has provided state-of-the-art information on habitat and birds that has become critical to river management decisions. With this recovery program action, the Corps will continue this successful assessment program and seek ways to improve and modernize the monitoring and evaluation techniques and data delivery and communication tools. Sampling efforts for the pallid sturgeon population assessment were initiated in 2001 and have gradually been expanded. The effort is to be fully implemented in the spring 2004 with

crews conducting standardized assessments in all of the high priority river segments.

- **Intense research, monitoring, and evaluation of all three species.** The Corps recognizes that a complete monitoring and evaluation program should be a central and operational component of all management activities. As a focal point of this action, the Corps will incorporate a monitoring and evaluation program that provides data to further our understanding and resolve the wide range of uncertainties.
- **Flow tests as part of an adaptive management strategy.** Flow tests to create and condition emergent sandbar habitat for the interior least tern and piping plover and potentially improve flow conditions for the pallid sturgeon are included in the recovery program. Due to their experimental nature, any future actions would be addressed in an adaptive management strategy. Flow tests would not be included in the revision of the Master Manual; however, consideration of System operations is included as part of MRRIP.

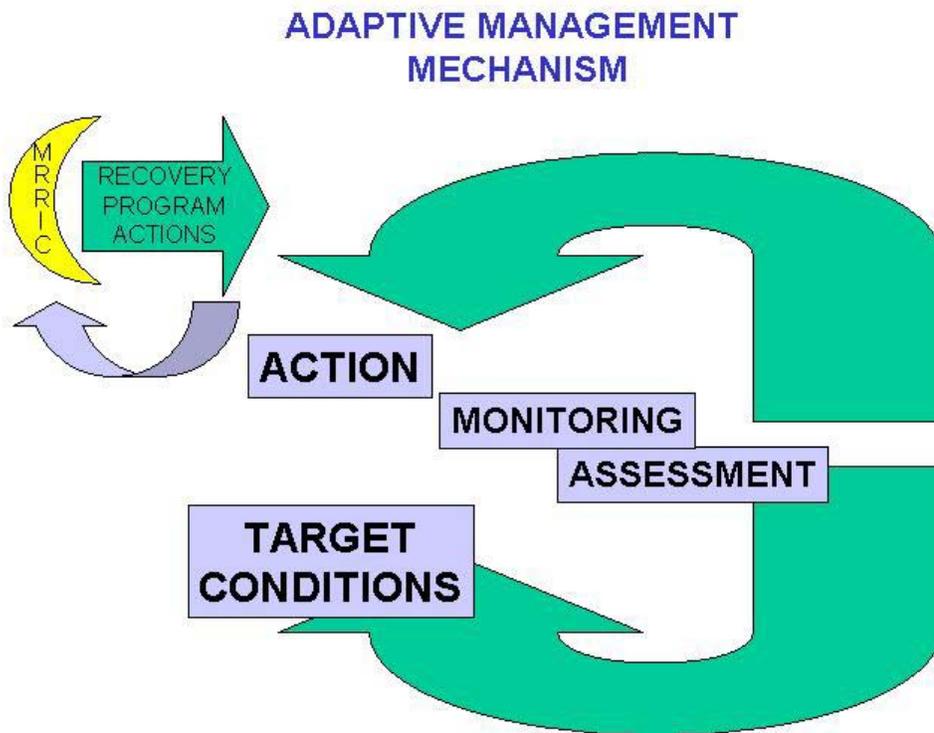
Part of the adaptive management approach is to conduct research to reduce the uncertainties surrounding the limiting factors to survival and recovery of the species. The critical uncertainties for the pallid sturgeon include identifying physical cues for initiating spawning and conditions necessary for the early stages of the young-of-year. If hydrologic conditions are critical to initiate spawning, then the magnitude, frequency, and duration of those events must be identified. Conditions that allow for the growth and survival of early life stages of pallid sturgeon are also uncertain. The Research Program outlined in the Description of the Action section describes how these uncertainties will be reduced.

MRRIP actions will be discussed and coordinated with a Missouri River Recovery Implementation Committee (MRRIC), which will include broad and diverse stakeholder representation to ensure that public values are incorporated into recovery implementation. It will provide recommendations to the Federal agencies regarding recovery implementation and will be developed cooperatively with entities having an interest in recovery of listed species and the ecosystem on which they depend. Representation on MRRIC will include the full spectrum of basin interests. Committee membership will be comprised of representatives of Tribal and State governments and of non-governmental organizations that have an interest in the management of the river and recovery of the species and ecosystem.

The proposed action measure for adaptive management is consistent with all applicable federal and state laws, Native American trust responsibilities, and interstate compacts and decrees. The Corps recognizes that the USFWS and the Corps each have statutory responsibilities that cannot be delegated, and the establishment of MRRIC is not intended to abrogate any of their statutory responsibilities. The Corps, however, advocates that MRRIC be a partner in recommending applicable future actions to be taken to benefit the listed species in the Missouri River. Consistent with the adaptive management

framework, the Corps will pursue alternative courses of actions based on the scientific findings of Corps efforts and, when applicable, recommendations of MRRIC.

It is anticipated that basin development of MRRIC will require a considerable amount of time. The structure of MRRIC itself will be the subject of adaptive management. A conceptual diagram of an adaptive management strategy to include MRRIC is provided below.



The above discussion is a broad overview of an encompassing adaptive management strategy. In reality, adaptive management would occur at several levels. For example, in the day-to-day operation of the System, the Corps communicates daily with the USFWS; other Federal, State, and local entities; basin Tribes; and numerous stakeholder organizations and individuals. Many of the issues raised and subsequent decisions by the Corps are minor and would not be the subject of review by MRRIC. These day-to-day interactions will continue and are essential to real time operation of the System.

All of the measures included in the Corps' proposed action will be subject to an overall adaptive management strategy. Further, the Corps currently implements adaptive management in its operation of the Missouri and Kansas River Projects and will continue that strategy while MRRIC is being developed. Initiation of the measures identified in this proposed action will proceed in the context of an overall adaptive management strategy, irrespective of the status of MRRIC.

Immediate implementation of measures that benefit the pallid sturgeon is particularly important in light of the potential imminent extirpation of that species from certain reaches of the Missouri River. The USFWS has indicated there is a high likelihood that the pallid sturgeon may become extirpated from the reach below Fort Peck Dam on Missouri River within the next decade. To ensure that certain populations are not extirpated, immediate action and continual re-evaluation of species response to actions is critical. The Corps proposes a re-evaluation of the status of the species and success of implemented measures to date be conducted within 3 years following the Final BiOp. This re-evaluation will ensure that there is adequate time for implementation of additional measures or modification of existing measures and strategies to ensure that the pallid sturgeon is not extirpated from the Missouri River, while development of MRRIC is potentially still occurring.

The National Research Council, in its 2002 report, identified the following four steps that should be taken to help lay the groundwork for adaptive management strategies and actions.

1. Congress must legitimize and empower Missouri River managers with the authority and responsibility to actively experiment with river operations that aim to enhance ecological resources.
2. A representative stakeholder committee should be empowered and convened by the appropriate agencies to develop a basin wide strategy, conduct assessments, review plans, and provide oversight over the implementation of adaptive management initiatives.
3. Congress must require the development of long-term goals and short-term measurable objectives for adaptive management action so that successes and failures can enhance public understanding.
4. Given our imperfect knowledge of ecological dynamics and social preferences, Federal agencies must be mandated by Congress to work with stakeholders to build commitment to and acceptance of changes to the current pattern of benefits delivered from the river and reservoir system.

The National Research Council also indicated the following principles are important to ensure the stakeholder group's effectiveness:

- Participation by a broad spectrum of interest groups
- Inclusion of Tribal interests
- Continuous two-way communication with the public
- Visible participation by federal, state, and tribal governments and non-government organizations
- Support from an independent, interdisciplinary scientific panel
- Provision by the federal government, with support from the states and tribes, of secure funding for stakeholder involvement effort over the lifetime of the activity

- Participation by representatives of Congress and of the state legislatures of Missouri River basin states
- Consensus decision making by the stakeholder group

As the Corps moves forward in its efforts to implement adaptive management through MRRIP, the Corps will formulate much of its efforts with the National Research Council's steps and principles in mind.

MAINSTEM SYSTEM OPERATION CHANGES

The operation of the System is designed to serve the Congressionally authorized project purposes including flood control, hydropower, water supply, water quality, irrigation, navigation, recreation, and fish and wildlife. During periods of drought, service to all authorized purposes is maintained, though at reduced levels.

This proposed action measure has two basic flow features that are changed from the CWCP. First, more stringent drought conservation, or retention of water, in the upper three reservoirs, is included. Second, a set pattern of intrasystem unbalancing is included. These two features were changed to address some of the major concerns expressed by upper basin interests as the 1987 to 1993 drought occurred. More detailed information on the changes follows. Flow changes at Fort Peck and Gavins Point Dams are also discussed in this section.

Drought Conservation Measures

a. **Drought Conservation Measures.** During extended drought periods, or those lasting more than 1 year, navigation service would be reduced earlier under the proposed action than it is under the CWCP. This would allow more water to be stored in the upper three reservoirs. During the more severe droughts, such as the 1930 to 1941 drought, releases for navigation would be curtailed at a higher total System storage level than under the CWCP. This proposed action measure was not specified in the USFWS 2000 BiOp RPA; however, all modeling conducted for the USFWS as it prepared the BiOp included more stringent drought conservation measures.

The drought conservation criteria included in the proposed action consists of "guide curves" for the determination of flow support for navigation and other downstream purposes and navigation season length. Under the proposed action, the navigation service level and season length would be reduced at higher system storage levels than they are currently under the CWCP. The March 15 System storage level at which navigation would not be served for that year was raised from 23.5 MAF under the CWCP to 31 million acre-feet (MAF) under the new drought conservation measures for this proposed action measure. Figures B-1 through B-3 compare the drought storage levels and the corresponding navigation service levels and season lengths of the CWCP and proposed action.

Comparison of Drought Conservation Measures
 15 March Storage Check (MAF) – Flow Support

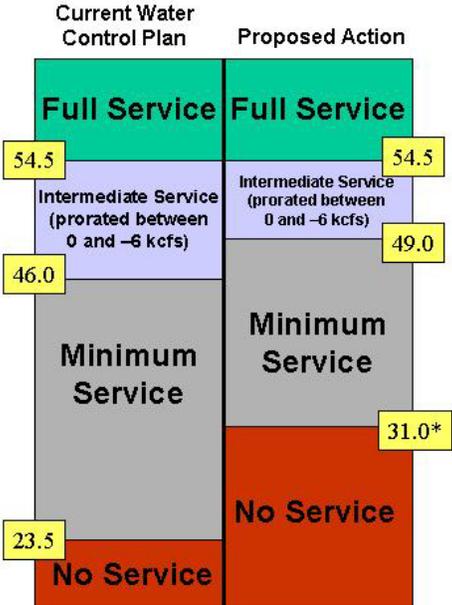


Figure B-1. Comparison of drought conservation measures between the CWCP and the System operations under the proposed action based on the March 15 System storage check for Service Level.

Comparison of Drought Conservation Measures
 1 July Storage Check (MAF) – Flow Support

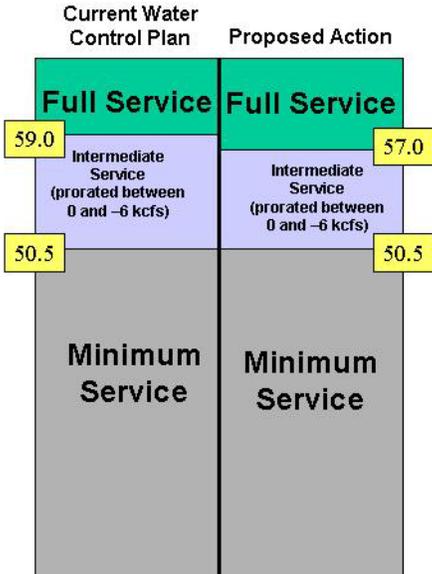


Figure B-2. Comparison of drought conservation measures between the CWCP and the System operations under the proposed action based on the July 1 System storage check for Service Level.

Comparison of Drought Conservation Measures 1 July Storage Check (MAF) – Season Length

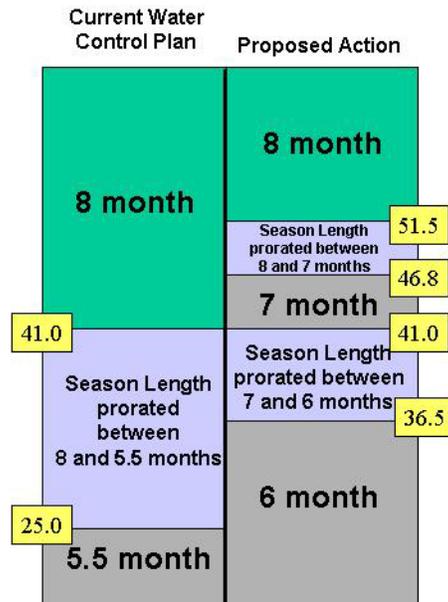


Figure 3. Comparison of drought conservation measures between the CWCP and the System operations under the proposed action based on the July 1 System storage check for Season Length.

The proposed water control plan presented in BA calls for suspension of navigation service if System water-in-storage (storage) is at or below 31 MAF on 15 March of any year. It should be noted that the occurrence of System storage at or below 31 MAF would most likely coincide with a national drought emergency. If any of the reservoir regulation studies performed for the development of the Annual Operating Plan (AOP) indicate that System storage will be at or below 31 MAF by the upcoming 15 March, the Corps will notify the Secretary of the Army. Approval from the Secretary of the Army will be required prior to implementation of back-to-back non-navigation years. The Corps will ensure that basin stakeholders are promptly informed of the notification to the Secretary of the Army and of the Secretary's decision regarding suspension of navigation.

Table B-1 compares the lowest elevations that would have occurred under the CWCP and this proposed action measure for each of the upper three lakes during the 1987 to 1993 drought. The figure also contains the minimum storage for the CWCP if the current drought conservation measures had been strictly followed. Inclusion of these measures would increase total system storage from 40.2 to 42.1 MAF for this proposed action measure during a similar drought.

Table B-1. Lowest lake levels for the 1987 to 1993 drought.

Lake	CWCP	Proposed Action
Fort Peck Lake	2,206	2,208
Lake Sakakawea	1,813	1,817
Lake Oahe	1,585	1,587

Gavins Point Dam Release Changes

The 2000 BiOp included release changes from Gavins Point Dam in the form of a spring rise and lower summer releases. Neither of these release changes is included as a feature of the proposed action, but they could be implemented at some future date if they are scientifically determined to be essential conditions that contribute to the survival of the pallid sturgeon. Included, as a feature of the proposed action, is a Comprehensive Pallid Sturgeon Research Project, which will determine the critical ecological factors that contribute to successful pallid and shovelnose sturgeon reproduction and survival in the Missouri River. If a spring rise or lower summer flows were found to be necessary for pallid sturgeon survival, the Corps would then pursue implementation of the release changes through the adaptive management process after performing another NEPA analysis, if needed.

Summer releases under the proposed action will be adjusted when the Missouri River Basin Water Management Division is notified by the Omaha District, Operations Division, Threatened and Endangered Species Section that birds have begun nesting. Flow support for navigation and other downstream purposes could be provided by adjusting releases as needed throughout the summer as tributary inflow varies to meet targets (flow-to-target), by providing a steady, flat release during the tern and plover nesting season at the flow level estimated to provide the desired service support in August when tributary inflows have declined (steady-release), or by some combination of the two methods, as was done during the 2003 nesting season (steady-release – flow-to-target). The modeling done for the RDEIS and FEIS used a flat 28.5 kcfs as an estimate of the release needed to provide minimum service support, and 34.5 kcfs for full service support; however, the actual release would vary based on the hydrologic conditions at the time.

The decision on which method to use during any given year would be made within the adaptive management framework and would be based on runoff, habitat availability, fledge ratios, and population conditions at that time. For example, if a moderately high runoff year is anticipated and sufficient habitat exists, a flat release may be used because, in general, it would evacuate more water during the summer months than would be released by following targets. If, on the other hand, the upper basin is experiencing a moderate to severe drought and the upper three large lakes are low, a flow-to-target or steady-release – flow-to-target operation may be followed through the summer season to conserve water in the System. These methods are dependent on the Corps retaining the flexibility to adjust releases during the summer months to provide the required

downstream flow support and comply with the ESA by ensuring that the operation of the System does not jeopardize the continued existence of the interior least tern and the piping plover.

In addition to the proposed action for Gavins Point Dam release during the nesting season, the following measures to minimize losses of the two listed bird species are also included as part of a more comprehensive proposed action.

1. The Corps will conduct an adult census and weekly productivity monitoring of all known and potential piping plover and least tern nesting sites within the Kansas and Missouri Rivers, beginning the last week of April through the end of the breeding season.
2. As recognized in the 2000 BiOp, the Corps will maintain its “state-of-the-art” least tern and piping plover recovery program. This will include a 16-hour Productivity Monitoring and Survey Techniques course (including nest-moving methods) for all seasonal staff and permanent staff, including contractors working with least tern and piping plover activities.
3. The Corps will maintain an aggressive coordination effort between the USFWS, Water Management Division, dam operators, and the Omaha District’s Endangered Species Section to evaluate and minimize losses due to water management.
4. Outreach efforts include the production of a new interagency brochure on the least tern, piping plover and pallid sturgeon; the placement of additional interpretive signs at area boat ramps; endangered species programs at public venues; and public service announcements.
5. Predator management efforts will continue with the placement of predator exclosures over piping plover nests, evaluation of open-topped cages for least terns, electrified predator barrier fences, and livestock exclosure fences on reservoir shorelines.
6. Garrison and Fort Randall Dam releases will be restricted, including limiting hourly peaking, during the least tern and piping plover nesting to minimize losses.
7. The Corps will move nests threatened by rising water on river and reservoir reaches to higher, more secure habitat when possible using recognized techniques.
8. The TESDMS will be used during the nesting season. The use of the TESDMS, when coupled with gage data, helps reduce the likelihood of inundation by providing near-real-time survey and monitoring data to water managers.
9. During periods when the downstream flow target is at Kansas City, the Corps will release water from the Kansas River projects, as Congressionally authorized and

described in the Kansas River Master Manual, to minimize least tern and piping plover losses.

10. Before increasing releases from Gavins Point Dam, an evaluation of the location of tows will be made to determine if release increases can be delayed without negatively impacting navigation.
11. In any year that the July 1 storage check shows an increase in service level for the remainder of the navigation season, the increase will be delayed until the end of the nesting season.
12. Law enforcement activities will include the posting of nesting sites with restriction signs and fencing to reduce human disturbance. Also, the Corps will increase coordination of law enforcement patrols of nesting areas and integrate law enforcement activity logs into the TESDMS.

For the benefit of pallid sturgeon and other native river fish, the evacuation of floodwaters would be delayed until mid-September when possible. Delayed evacuation in the late summer and early fall would benefit the young-of-year native river fish: the bigger that young-of-year native river fish are at the time of evacuation, the greater their chance of survival. This delay may be done independently in any year flood water evacuation is needed after the nesting season or in conjunction with one of the flow tests proposed as part of the proposed action.

Unbalancing of the Upper Three Lakes

The Corps has the authority under the existing Master Manual and does implement intrasystem unbalancing. Unbalancing of the lakes was also included as a feature of the RPA identified in the November 2000 BiOp.

Unbalancing consists of purposefully lowering one of the upper three lakes approximately 3 feet to allow vegetation to grow around the rim, and then refilling the lake to inundate the vegetation. The unbalancing would rotate among the three lakes on a 3-year cycle. Movement of water among the lakes as they are lowered and refilled provides benefits to fish and birds in both the intervening river reaches and the lakes. Higher spring releases will fill the downstream reservoir and provide a rising lake level for game and forage fish spawning. The subsequent 2 years of lower flows would expose sandbar habitat for use by the protected birds. Unbalancing would also provide more bare sandbar habitat around the perimeter of the lakes for the birds. In subsequent years, the inundated vegetation around the perimeter would be used by adult fish for spawning and by young lake fish hiding from predators.

Under this proposed action measure, intrasystem unbalancing would be implemented in those years when there is not an excessive amount of flood control storage utilized or significant drawdown of the lakes due to severe drought conditions. Both the MRNRC and MRBA have provided recommended reservoir elevation guidelines that could be

used to initiate unbalancing. The MRNRC guidelines have been presented in Annual Operating Plans (AOPs) since 2001. Unbalancing would be accomplished within an adaptive management framework and would be opportunistic in regards to each year's plains and mountain snowpack. To the extent possible, based on hydrologic conditions, a 3-year cycle would be followed for lowering the water level about 3 feet below normal the first year, followed by a refill of the lake to about 3 feet above normal the second year and declining lake levels (a "float" year) the third year. This 3-year cycle would be rotated among the upper three lakes on an annual basis so that each year one lake is high, one is low and the third is floating. Table B-2 describes the 3-year cycle of lake unbalancing.

Table B-2. Unbalancing schedule for upper three lakes

	Fort Peck		Garrison		Oahe	
	March 1	Rest of Year	March 1	Rest of Year	March 1	Rest of Year
Year 1	High	Float	Low	Hold Peak	Raise and hold during spawn	Float
Year 2	Raise and hold during spawn	Float	High	Float	Low	Hold Peak
Year 3	Low	Hold Peak	Raise and hold during spawn	Float	High	Float

During the low year at a lake, the goal of the Corps would be to begin the runoff season on March 1 with the lake low with respect to the other two upper lakes. Ideally, the lake would rise during the lake fish spawn and then hold the peak lake level for the remainder of the year. The following year, the high year, the lake would begin the runoff season high with respect to the other lakes, rise during the fish spawn and then float downward during the remainder of the year. The float year, or third year, the lake would rise during the fish spawn and then drift downward for the remainder of the year so that it is in position to begin the following year low as the cycle repeats.

The results of unbalancing will be carefully monitored and evaluated under an adaptive management framework.

Fort Peck Dam Release Changes

The 2000 BiOp included release changes from Fort Peck Dam as a component of the RPA. Prior to full implementation of this release modification, the RPA included two tests, the "mini test" and the "full test". These two tests are included as "Actions Implemented in Response to the 2000 Biological Opinion". Depending on the results of the tests, the Corps may implement a Fort Peck Dam release modification; however, full implementation is not included as part of the proposed action.

FLOW TESTS

Due to the extent of required habitat, considerable new habitat will need to be created. Three tests would be conducted to determine the extent that additional habitat can be

constructed with flows into Lewis and Clark Lake and in the river reach downstream from Gavins Point Dam and to determine if constructed sandbars can be conditioned to provide better habitat for the least terns and piping plovers.

Gavins Point Reach Fall Test

One flow test will be run in the river reach downstream from Gavins Point Dam in the fall after the System has been refilled following the current drought. The test would be conducted opportunistically when evacuation of the System is necessary. The test will consist of a release of approximately 60 kcfs for a period of approximately 60 days. The exact magnitude and duration of the test will be determined through pre-test investigations and public input. The test would be monitored for physical changes in sandbar distribution and characteristics in the reach of the river from Gavins Point Dam to Ponca State Park. Representative island/bars will be monitored to determine the factors that limit the initiation of scour, and tests would be performed on techniques that may aid the scouring process, e.g., vegetation removal prior to the test discharges, physical conditioning (i.e., disking) prior to the test, etc. This would increase the total amount of bare sandbar habitat in this reach and would allow for a redistribution of the habitat. Further, any “spring rise – summer low flow” release scenario from Gavins Point Dam may result in an increase in the occurrence of high flows in the fall months. This test would, therefore, also provide a greater understanding of the benefits/impacts associated with any potential alternative release scenario from Gavins Point Dam with a spring rise or lower summer flow.

Besides the condition that System storage be adequate to provide the water for this test, several other conditions would have to be met prior to implementation. These include:

- The hydrologic conditions in the lower basin would have to be normal or drier.
- NEPA compliance would have to be completed. It is anticipated that only an environmental assessment would be required for a single test.
- Pretest data would have to be collected. This would consist of surveys of the reach of the river between Gavins Point Dam and Ponca State Park, aerial photography, and detailed mapping of selected sandbars.
- Extensive stakeholder buy-in is required. Storage and evacuation needs will play a large role in stakeholder buy-in.
- Appropriate economic mitigation measures and stop protocols will need to be in place to minimize adverse impacts on the Lower River. Economic mitigation measure could include portable pumps to aid in interior drainage, temporary protection of non-federal flood control projects, etc. Stop protocols may include discharge trigger on tributary streams, stage maximums on the Missouri River, threats to vital infrastructure, etc.

The primary reason for conducting the test in the fall rather than in the spring is to minimize the impacts to authorized project purposes, primarily flood control. This test, however, would minimize the impacts to other project purposes, as the test would use water that is in excess of that required for full service System operations.

Fort Randall Reach Fall Rise

A second flow test that includes a fall rise out of Fort Randall Dam will also be conducted. This action would consist of producing a controlled rise in releases from Fort Randall Dam preceded by a lowering of the pool in Lewis and Clark Lake to be conducted after Labor Day. The purpose of the rise is to further define sediment-flushing parameters and to modify the sediment deposits in the delta area. This would increase the amount of least tern and piping plover habitat in the reach below Fort Randall Dam and will further the basin's understanding of the sediment flushing requirements. The releases from Fort Randall Dam could be as high as 60 kcfs, and the pool at Lewis and Clark Lake could be as low as 1180 feet mean sea level (ft-msl). The length of the test would depend on the rate that the Lewis and Clark Lake pool is refilled, which depends on the release rate from Gavins Point Dam. It could be conducted at the same time as the fall rise test downstream from Gavins Point Dam or it could be conducted independently. If it were run with the Gavins Point Dam fall rise, the duration could be up to 60 days. If it were run by itself, the estimated test length is 5 days. The exact magnitude and duration of the test will be determined through pre-test investigations and public input.

This test has many of the same conditions as the fall rise from Gavins Point Dam. These include:

- Storage in the system would have to be adequate to support the test. Also, the Lewis and Clark Lake elevation would have to be no greater than 1185 ft-msl.
- NEPA compliance would be completed.
- Pretest data would be collected. This would consist of surveys of the reach of the river between Fort Randall Dam and fore set of the delta and aerial photography.
- The test would be suspended or canceled if higher than normal discharges were to come from the Niobrara River. High flows from the Niobrara River will cause excessive flooding in the confluence area and will alter the nature of the sediment-flushing test.

The primary reason for conducting the test after Labor Day is to minimize the recreational impact on Lewis and Clark Lake and to minimize the impacts to other authorized project purposes. This test is likely to cause some high ground water problems and possibly some overbank flooding in the Niobrara Area; however, flowage easements have been obtained on much of the impacted area, and a fall test would have fewer residual impacts.

Sandbar Habitat Conditioning

A third flow test, conditioning of constructed sandbar habitat, will be conducted downstream from Gavins Point Dam. Before running this test, new sandbar habitat would be constructed following the fledging of the least terns and piping plovers. As releases from Gavins Point Dam are increased the following spring to meet the

navigation service requirements, arrangements will be made to make releases in excess of that planned to serve navigation such that the new sandbar habitat would be inundated for a day or two. This is intended to consolidate the substrate and potentially mix organic material in the surface layer. The objective of this test is to determine if there is a difference in least tern and piping plover productivity between the conditioned habitat and the habitat that is constructed and not inundated.

This test would also have some conditions that would have to be met prior to the test. These include:

- NEPA compliance would be completed.
- Pretest baseline conditions data would be collected.

Emergent sandbar habitat is also susceptible to change as the river flows vary from year to year. To be responsive to the changes, the Corps will monitor the habitat annually as plans for construction and maintenance of this habitat progress from year to year.

HATCHERY FACILITY IMPROVEMENTS

The 2000 BiOp RPA element VI A outlines the Corps' responsibility for pallid sturgeon propagation and population augmentation. This RPA is specifically related to all aspects of propagation (i.e., broodstock collection, spawning, rearing, tagging, stocking and subsequent monitoring). To address this RPA element, an existing program is now in place providing annual support for the population augmentation efforts. This program will continue on an annual basis in addition to the action described below.

At the time the 2000 BiOp was written, pallid sturgeon propagation had been met with limited success. Knowledge of rearing densities specific to pallid sturgeon were not developed and existing facilities were designed in similar fashion to West Coast hatcheries propagating white sturgeon for commercial markets. Through experience, fish culturists now know the pallid sturgeon must be reared at very low densities to achieve normal growth and minimize the potential for disease outbreaks. The 2000 BiOp did not address specific needs related to infrastructure and facility improvements that may be limiting to the population augmentation component of recovery. Additionally, since the completion of the 2000 BiOp, stocking plans have been revised utilizing more liberal stocking rates to supplement the year classes that are absent as a result of a lack of natural reproduction/recruitment and severely depressed wild populations.

A series of limitations have been identified by the Propagation Workgroup to enhance the capabilities of the propagation program. These limitations are compiled in Table B-3 and are outside any guidance of the 2000 BiOp. The USFWS and the Corps have prioritized this list jointly with an emphasis on increasing production capabilities while improving water quality and water reliability to propagate pallid sturgeon of the highest quality possible. To achieve the increased production levels and improve the overall health of the progeny produced for the population augmentation program, a series of expansions and/or modifications are necessary. The Corps is seeking funding for the following hatchery facility improvements.

Table B-3. Prioritized List of Hatchery Facility Improvements to Alleviate or Mitigate the Limiting Factors Associated with Pallid Sturgeon Propagation

Facility	Description	Priority	Comments	Benefits/Rationale
GPNFH	Broodstock Building	1	All components included (i.e. filtration &UV)	Double production capabilities from 2,500-5,000 (minimum) and enable the facility to hold representative fish to serve as future captive broodstock Fish Health Experts Feel UV Treatment Systems are essential
NNFH	Building Expansion	2	Essential Components included (i.e. filtration &UV)	Increase capacity to 4,000 5,000 from current level of 3,000 fish yielding 9-inch fish
NNFH	New Building	3	Essential Components included (i.e. filtration &UV)	With above building expansion, would increase facility capacity from 4,000-5000 to 10,000 fish (9-inch fish) Fish health experts feel UV treatment systems are essential
BZFTC	Feed Development Equipment	4	Vacuum coater, oven, furnace, deionizer & still	Liver analysis of pallids propagated on commercial feeds has been shown to have a fatty liver condition. Improved diets are essential to ensure quality specimen to recover the species
BPSFH	Lake Dredging	5	Improve water storage capabilities	Enhanced water reliability for future pallid culture activities
BPSFH	Water Chiller	6	Provide ability to moderate temps during hot conditions. Ability to chill up to 200 GPM	Maintain water temperatures at suitable levels for pallid sturgeon culture
BPSFH	Renovation/Building	7	Remove raceways, Replace w/ circulars	Double Production Capabilities from 6,000 to 14,000 (9-inch fish)
BPSFH	Water Supply Line	8	Must be done in conjunction with lake dredging	Upgrading water supply line essential for increasing capabilities
GDNFH	Increase Power Capabilities	9	Can Corps provide power?	
GDNFH	Boiler 2.295 BTU; 675 KW	10	Ideal way to heat water if power is available	Boiler is not an option without an increase in power
GDNFH	Heat Pumps (6)	11	Not necessary if increase Power Capabilities	Boiler is better option, simpler, fish health. Heat pumps have seasonal feasibility
GDNFH	Reuse System	12	Not necessary if increase Power Capabilities	Boiler is better option, simpler, fish health
GPNFH	New Well/Water Tower	13	Increased well water for brood building	Enhancing well water capabilities would provide additional cool water for pallid sturgeon production and broodstock holding
MCSFH	Building Expansion	14	Move adult brood (spawning) holding tanks out of main building.	Production fish would remain in the main bldg. This expansion would isolate production fish from the spawning activities reducing the potential for disease transmission. Broodstock would not displace production space during spawning efforts in the spring
MCSFH	Water Supply Improvement	15	Fish Health Issue; altering the water supply would allow for increased natural settling of solids that would otherwise need to be filtered.	By decreasing the solids and clarity in the water, an increase in effectiveness of the UV system would reduce the likelihood of disease transmission and parasite infestations.

MCSFH	Modify Drain System	16	Increasing production in accordance with item 14 will require modification of the existing drain line	Water drain system will no longer be a limiting factor to increasing production
BZFTC	Distribution Truck w/ Tank	17	Fish transport truck and tank for stocking production fish	Well designed, reliable fish transport systems are essential to ensure that the final product of the propagation efforts are successfully stocked in the Missouri River

The actions highlighted in Table B-3 are further described in order of priority below:

These improvements include additional broodstock holding capabilities (Broodstock Building and Well Water/Tower) at the Gavins Point NFH, which is the only facility currently holding future broodstock. Future broodstock are held captive as a safety net in the event that wild fish are unavailable for continuation of the program. Currently, the Gavins Point NFH is at its maximum capacity. Facility expansion to accommodate the holding of the future broodstock will provide a reduced stress environment by reducing holding densities. This expansion also enables the facility to participate as the lead facility in spawning efforts, as the expansion would provide space for holding wild broodstock. This action increases options for holding/spawning lower basin pallid sturgeons (wild) captured in conjunction with accelerated broodstock collection efforts. Additionally, this expansion would enable the facility to use the existing infrastructure for production and stocking of pallid sturgeon, essentially doubling the capabilities of the hatcheries current production.

Additional facility improvements include building expansion and construction of a pallid sturgeon culture building at the Neosho NFH. Currently, the facility has the ability to rear approximately 3,000 pallid sturgeon (9-inch fish). These facility expansions would triple the production capabilities and enable the facility to spawn wild pallid sturgeon collected from the Lower River and the Middle Mississippi River.

A fatty liver condition has been identified in most all of the pallid sturgeon reared in the hatcheries that are on commercial feeds. Commercial feeds utilized for salmonids and other species are not adequate diets for sturgeon; however, limited suites of feeds are available for sturgeon culture. The Bozeman FTC has the expertise to develop and manufacture specialty feeds for a variety of species. This facility has conducted research regarding feed development and conducted feed trials evaluating performance, growth and overall health on multiple species over the past decade. Special formulations and development of compatible and suitable feeds requires a variety of unique equipment. Pallid sturgeon propagation and augmentation have been identified as an essential component to the recovery of pallid sturgeon (at least initially); therefore, it is critical to produce and stock fish of the highest quality possible. Proper nutrition is a necessity to achieve this goal.

The Blind Pony SFH has a single water source (Blind Pony Lake) that is currently affected by the drought conditions. Four interrelated modifications have been identified for the Blind Pony facility.

- Lake Dredging

- Water Supply Line
- Water Chiller
- Building Renovation/Expansion

Because the facility relies on a single water source, the storage capacity of the water supply would be improved by dredging. The increased water storage would maintain a more constant temperature less susceptible to rapid temperature spikes and dips that are common with small impoundments.

Simultaneously with the dredging operation, the original water supply line leading from the lake to the endangered species portion of the facility needs to be replaced. The existing pipeline (transit pipe) is original and water reliability is questionable. Water supply upgrade will provide a reliable water delivery system to the modified and expanded facility for pallid sturgeon spawning and propagation.

During extreme heat conditions, the facility does not have the capability of moderating water temperatures that may impose lethal levels of stress on the fish. A water chiller would provide the relief during the extreme heat conditions by enabling the crew to blend cooler water with the ambient lake water.

Currently, concrete raceways are being used for sturgeon production. These structures are covered by a metal roof, but lack both security and protection from predation. An enclosed pole shed would provide security and protection from vandalism, predation and weather conditions. A portion of the raceways would be removed in conjunction with this renovation and upgraded to circular tanks. The upgraded water supply line would be installed to accommodate these renovations.

The combination of facility improvements at the Blind Pony SFH would increase production capabilities from 6,000 to 14,000 fish annually (9-inch fish).

Lake Sakakawea is the water source for the Garrison Dam NFH. Although the lake provides an abundance of water, the temperature range is below the requirements needed to obtain growth in an intensive culture environment for the pallid sturgeon. As a result, water must be heated to provide suitable temperatures necessary for spawning and rearing activities. Several potential options have been explored. The best option is to increase the power capabilities to the hatchery and install boilers to heat the water. Other options include installing heat pumps in conjunction with a water reuse system. This option is less ideal because of water quality issues associated with reuse systems and the increased potential for disease and parasite outbreaks. Additionally, heat pumps would be ineffective during the winter months at maintaining temperatures suitable to achieve growth in pallid sturgeon.

Increasing the power capabilities and installing boilers at the Garrison Dam NFH would provide the ability to mimic ambient river temperatures that correspond with photoperiod. Currently, the existing heat exchangers are run at the most efficient times to offset ambient river temperatures. As a result, the “normal” ambient water temperatures that

these fish would experience in the river are delayed by approximately 4-6 weeks from spring to fall. The additional boiler system provides the culturist with the ability to mimic water temperatures of the Missouri River, which are naturally synchronized with photoperiod.

The Miles City SFH has undergone minor modifications in the past couple of years to accommodate pallid sturgeon propagation activities. An addition to the existing building would enable the facility to hold broodstock in the spring separate from production fish. Currently, the broodstock holding tanks displace production tanks (rearing space) during spawning activities. The building expansion would double production capabilities for the facility and reduce the risk of disease transmission because the wild broodstock would be held separately (isolated) from production fish.

The existing water supply system at the Miles City SFH contains a high sediment load. Renovation of the existing supply system would increase natural settling of particles that otherwise would require multiple filtering prior to passing through the ultraviolet disinfection system. Renovation of the existing water supply system improves water quality and reduces the potential for disease and parasite outbreaks.

The geographic range that these pallid sturgeon need to be distributed across (from Montana to Missouri) to meet the needs of the propagation and augmentation program requires that well designed fish transport units are available. Fish distribution is the final step of the propagation effort and reliable transport systems are essential to ensure that the progeny are transported safely to the stocking location. Dependable fish transport units will help ensure that fish are transported to stocking locations safely with minimal stress and loss associated with the stocking event.

The above-described components of the proposed action for hatchery facility improvements are based on several assumptions:

- Reducing densities and improving the environment in which these fish are propagated will increase survival and enhance overall fish health
- Efforts to spawn “wild” broodstock are based on the ability to continue to be successful in the collection of broodstock in the future
- Population augmentation plans will not be halted as a result of non-physical factors (i.e., fish health issues)
- The captive broodstock program will be successful in that these fish will mature and produce viable progeny for continuation of population/augmentation efforts in the event that broodstock cannot be collected from the river
- Genetic studies and their results will continue to support population/augmentation efforts

ACCELERATED BROODSTOCK COLLECTION

To date, broodstock collection efforts in the lower basin have relied upon acquiring adult fish from commercial fishermen on the Middle Mississippi River. No successful spawning of fish in the Lower River (downstream of Gavins Point Dam) has taken place since 2001, when the Blind Pony SFH last spawned pallid sturgeon captured by a commercial fishermen in the Middle Mississippi River. The Missouri Department of Conservation is considering closing commercial fishing for sturgeon (shovelnose). In response to this action, the commercial fishermen have announced that they will no longer provide support for the broodstock collection efforts on which that program has grown to rely.

In 2002 and 2003, pallid sturgeon progeny resulting from adults captured in the Missouri and Yellowstone Rivers in North Dakota and Montana, were stocked in the Lower River; however, genetics are limiting in the upper basin with aging fish and a dwindling population. It is now necessary to capture and propagate the remaining gene pool in the Lower River. Current broodstock collection efforts targeting Lower River pallid sturgeon to fulfill propagation and stocking goals for the Missouri River are inadequate.

Accelerated broodstock collection would facilitate direct, intensive collection efforts by state and federal agencies to capture the genetic stocks that inhabit the Lower River. Specific efforts directed toward broodstock collection are essential to capture and represent the genetic variability and diversity of pallid sturgeon in the Lower River. Successful collection, spawning, rearing, and stocking will partially offset the lack of natural reproduction and would help ensure these genetic stocks are perpetuated in the wild while solutions to habitat loss are addressed through the various means of habitat restoration (i.e., SWH projects).

Expansion of the hatchery facilities to accommodate the holding of these fish is essential to the success of this effort. The Gavins Point NFH and the Neosho NFH are currently used to capacity and would be unable to accommodate these additional fish for spawning. The Blind Pony SFH has limited space available; however, water reliability is questionable, especially during drought times. Improvements to each of these facilities would provide multiple options for holding and spawning these Lower River broodfish.

ACCELERATED SHALLOW WATER HABITAT CONSTRUCTION

The following proposed action to accelerate the construction of shallow water habitat to exceed the short-term goals outlined in the 2000 BiOp. This action will be taken in the Lower River from Ponca State Park to the mouth.

Ponca State Park

Design has been completed on a backwater complex at Ponca State Park, the extreme downstream end of Segment 10. The overall goal of the project is to restore aquatic habitat areas that have degraded as a result of hydrology and sediment transport changes in the adjacent reach of the Missouri River. Included in this restoration is 29 acres of low velocity backwaters, 15 acres of connected wetlands, and 41 acres of tallgrass prairie (Corps 2003). Construction is scheduled to begin during late FY 2004, pending completion of necessary real estate easements and available funding.

Ponca State Park to Rulo, Nebraska

A goal has been set to construct an additional 1,000 acres of habitat in the reach between Sioux City, Iowa and the Platte River and an additional 960 acres in the Kenslers Bend reach upstream from Sioux City by 2010. These two reaches are important because the current level of habitat is relatively scarce, averaging about 2 acres per mile in the reach downstream from Sioux City (Table 7.7-7 of the Revised Draft EIS for the Master Manual Study). The USFWS has indicated that habitat work in the reaches where the greatest deficits exist should proceed as quickly as possible. The Corps is in the final design stages of chute/backwater projects at Glovers Point Bend (RM 712), Hole-in-the-Rock (RM 706), Lower Hamburg Bend (RM 553), and Kansas Bend (RM 546). Construction of major dike modifications is underway in the Nebraska City area, and additional site plans are being prepared for implementation in FY 2004 and 2005. These sites include Tobacco Island, Langdon Bend, and Boyer Bend. The Corps is also working with the Omaha and Winnebago Tribes to develop projects on reservation lands, and will pursue structure modification on lands owned by the state of Iowa. The Corps' Omaha District and the Papio-Missouri River Natural Resources District are currently constructing a Section 1135 Project for SWH at Blair, Nebraska.

Rulo, Nebraska to the Mouth

The current notching program to enhance and diversify existing SWH areas will be continued and accelerated where possible, as long as private property interests are not impacted. This program consists of strategically placed 50' to 100' notches constructed in some of the existing 3,500 rock structures below Rulo. The notches are placed to increase flow between structures during normal to high river stages. The effect is to diversify and enhance the habitat currently present within existing high banks. This program will ensure no net loss of existing SWH. Currently, structure modifications are being constructed at Overton Bottoms, and a side channel is in the design phase for Worthwine Island. Initial planning efforts are underway to design and construct extensive structure modifications and/or side channels at Marion Bottoms, Eagles Bluff, Franklin Island, Jameson Island, and Baltimore Bend. The goal is to complete this work by the end of 2005.

RESEARCH, MONITORING, AND EVALUATION

Comprehensive Pallid Sturgeon Research Project

Research to determine the critical ecological factors that contribute to successful pallid and shovelnose sturgeon reproduction and survival in the Missouri River will include laboratory and field research. This research will provide new information on the physiology of reproduction and growth, survival across the life stages, status of populations, and taxonomy for sturgeon in the Missouri River, including quantitative assessment of how biology, hydrology, and water quality combine to provide suitable habitat and resources over a considerable spatial and temporal scale.

While a variety of factors has been proposed as contributing to the viability of pallid and shovelnose sturgeon, the significance and interaction of flow-related factors (such as hydrologic cues, temperature, turbidity, depth, and velocity) with in-channel habitat features and other factors (such as nutrition, competition, predation, productivity, water quality and contamination) has not been clarified. The research tasks will provide definitive information on the effects of flow-related factors on sturgeon but will not be restricted to these factors. An objective assessment of how multiple life stages and essential activities of the two sturgeon species respond to a range of potential stressors will provide rigorous and credible information for use in resolving the many issues surrounding pallid sturgeon recovery actions. This research is intended to provide the best understanding of sturgeon responses as functions of management variables, thereby providing stakeholders with an improved understanding of tradeoffs among management alternatives.

Research tasks include:

- Understanding the reproductive physiology of Missouri River sturgeon – Objective is to further the understanding of the reproductive physiology of Missouri River sturgeon to assess if environmental conditions are adequate for gamete maturation and release.
- Spawning of Missouri River sturgeon – Evaluate sturgeon stocks in several representative reaches of the Missouri River to examine the chronology of spawning activity.
- Characterization of optimal conditions for normal development and hatch of Missouri River sturgeon embryos – Characterize the exposure response relationships for several important water quality parameters during embryo development through hatch, evaluate egg quality, and determine contaminant doses for commonly detected contaminants of concern in water and sturgeon tissues. Apply this information to an assessment of embryo survival at likely or know spawning sites.
- Determinants of post-hatch survival of larval Missouri River sturgeon – Examine the influence of water temperature and sediment levels on initiation of feeding, growth, and morphological development of post-hatch sturgeon. Identify food habits, food availability, and habitat used by post-hatch sturgeon. Examine river hydraulic processes as mechanisms of larval sturgeon transport.

- Environmental factors affecting Missouri River sturgeon from the larval feeding to juvenile life stage – Continuation of previous research as larval sturgeon shift from internal to external feeding. Tasks include the determination and examination of ecomorphology, environmental factors, diet, predation, habitat use, and drift.
- Determination of the critical ecological factors that contribute to successful survival of Missouri River sturgeon from juvenile to 1 year of age – Examination and determination of preferred habitat, food habits, growth rates, and over wintering of juvenile to 1-year-old sturgeon.
- Survival and growth of Missouri River sturgeon from year-one to reproduction – Determine habitat use as compared to availability, nutrition and feeding, and growth and maturation rates.
- Develop population-forecasting models that can be used to predict future population size and distribution of sturgeon in the Missouri River.
- Examination of morphological and molecular characteristics to determine the identification of pallid and shovelnose sturgeon and hybrids.
- Develop a database of sturgeon information, including Web-based format for access by the public.

Pallid Sturgeon Genetic Analysis

Pallid and shovelnose sturgeon are closely related and, therefore, resemble one another when evaluated based on phenotypic characteristics. Morphological measurements have facilitated the development of a variety of indices to distinguish between the two species. Current indices are valuable in differentiating between the two species; however, these techniques have limitations and are subjective due to the precise requirements in collecting morphological measurements. Shovelnose sturgeon is a common species native to the Mississippi, Missouri, and Ohio Rivers. Pallid sturgeon is a rare and endangered species with a distribution from the Missouri headwaters to the mouth of the Mississippi but not the upper Mississippi or Ohio Rivers. Adults of either species are distinguishable by subtle differences in the placement of barbels and by the larger size and more flattened head profile of pallid sturgeons. Distinguishing young fish is far more difficult. Young-of-year (YOY) shovelnose and pallid sturgeon are virtually indistinguishable at sizes less than 22-23 mm using various morphological indices. As a result, morphological based indices have been criticized on the basis that they do not work for smaller specimens.

Previous studies to distinguish between the Missouri River sturgeons have failed. Morphological measurements have been combined with the use of allozymes and mitochondrial DNA to differentiate between pallid, shovelnose, and hybrid sturgeon. The lack of success of these previous efforts may be due to recent common ancestry and/or a slow rate of genetic evolution of the markers employed. However, the use of microsatellite loci, which are the most rapidly evolving class of molecular markers yet discovered, indicate that pallid and shovelnose sturgeons from the same geographic areas had significantly different allele frequencies. A series of primer sequences for 70 polymorphic microsatellite loci have been published for *Scaphirhynchus*. The use of

multiple loci may produce a high degree of certainty in identifying individual fish to species and may be useful in determining parentage of progeny.

With this proposed action measure, the Corps will develop a genetic analysis that would distinguish between the species. This technique would have several benefits. This type of analysis eliminates the limitations of differentiating sturgeons of smaller size. It is critical to obtain the ability to accurately identify smaller sturgeon to the species level to determine whether natural reproduction is occurring in pallid sturgeon. Additionally, the chemical analysis would be applicable to all life stages ranging from newly hatched sturgeon fry to adult. This analysis may be useful in locating spawning areas through larval sampling efforts downstream of spawning locations and could be used to refine the morphological indices to improve field identification. Presently, there are no tools available to differentiate between pallid and shovelnose sturgeon eggs. The genetic analysis would also be valuable in monitoring the exploitation of caviar through commercial avenues.

Depending upon the precision of the genetic analysis, parentage of stocked pallid sturgeon may be identified through this type of chemical analysis. Genetic samples of all adult pallid sturgeon contributing to the propagation program are currently collected and archived. Chemical (genetic) analysis may serve as a tool, aiding in the identification of hatchery produced versus naturally produced pallid sturgeon; thus providing diversification in the population augmentation program and enabling larval and smaller juvenile fish to be stocked (unmarked fish). The ability to identify genetic stocks would help to facilitate the evaluation of additional stocking strategies and likely improve the species chances of recovery. Southern Illinois University has been conducting the latest research in this arena and currently has a proposal to conduct this type of detailed analysis.

Survival and Habitat Use of Stocked Pallid Sturgeon

The pallid sturgeon population assessment program has been designed to incorporate the evaluation of stocked pallid sturgeon regarding survival, growth, and habitat use in the Missouri River. Additional strategies proposed by the Corps in this proposed action measure may provide enhanced results in a reduced time frame.

Likewise, the propagation augmentation program has been based on a series of assumptions. For example, survival rates have been projected based on similar programs working with white sturgeon. Concern has arisen regarding over winter survival due to the lack of capture during population assessment surveys in 2003. Over 7,400 juvenile pallid sturgeon were stocked at three primary stocking locations (Mulberry Bend, NE; Bellevue, NE; Booneville, MO) in the Lower River in April 2002. A small portion of these juveniles was recaptured during the summer and fall sampling efforts in 2002. However, continued sampling efforts throughout the winter and into the summer of 2003 have proven to be less successful. As a result of this, a telemetry project using juvenile pallid sturgeon may help to address this issue. Additional stocking efforts are underway in 2003. Stocking numbers will be similar to those efforts accomplished in 2002.

In addition to monitoring efforts included within pallid sturgeon population assessment activities, the Corps proposes a telemetry project using juvenile pallid sturgeon in the unchannelized (Gavins Point Dam to Ponca, NE) and the channelized (near Booneville, MO) portions of the Missouri River to provide a better understanding of these fish following stocking. The telemetry project would incorporate Geographic Positioning System (GPS) coordinates for all relocations. Physical habitat data would be collected at each relocation (i.e., turbidity, temperature, depth, velocity, and substrate). Fish relocation sites would be classified into macrohabitats and mesohabitats consistent with the standardized habitat classification system that has been developed for the pallid sturgeon population assessment program. These telemetry efforts will provide specific information related to the movements of pallid sturgeon, habitat use and preference, overwinter survival, and better survival rate data. These data would provide important feedback for the propagation augmentation program when determining suitable stocking rates for fish inhabiting these vastly different portions of the Missouri River.

***Scaphirhynchus sp.* Spawning Behavior and Habitat Selection Analysis**

Pallid and shovelnose sturgeon are believed to exhibit similar characteristics regarding spawning and habitat selection in the Lower River. This is not the case, however, for upper basin pallid sturgeon and shovelnose sturgeon, where shovelnose sturgeon spawn in the tributaries to the Missouri and Yellowstone Rivers. In all river reaches, the pallid sturgeon is in very low relative abundance when compared to shovelnose sturgeon. Both species have been artificially spawned in captive environments in equal temperatures and photoperiods with the use of synthetic hormones. Hybrid sturgeons have also been produced in these controlled environments. An increase in hybridization has, however, been documented in the Lower River.

With this proposed action measure, the Corps will develop a study focusing on spawning, spawning behavior, and habitat preferences that would provide information regarding the causes for increased hybridization. If the cause of the increase in hybridization can be attributed to a limiting factor, actions can then be taken to address this limiting factor.

Interior Least Tern, Piping Plover, and Pallid Sturgeon Regional Population Assessment

In addition to the population assessment and monitoring efforts on the Missouri River proper being conducted in response to the 2000 BiOp, the Corps will develop and support a regional coordination process for the subpopulations of which Missouri River piping plovers and least terns are part. It has become apparent that, if successful management actions are to occur for these species on the Missouri River, the dynamics of their larger population structure must be understood. Greater understanding of regional population interactions such as immigration/emigration, source/sink populations, and seasonal

presence/absence would provide greater sensitivity in assessing the long-term prospects for species persistence and allow more informed management decisions.

The Missouri River piping plover population is an important component of the Northern Great Plains piping plover population. The Northern Great Plains population extends across the northern Great Plains of the United States into Prairie Canada. Piping plovers are found in the alkali wetlands of North Dakota and Saskatchewan, wetland areas of Alberta and Montana, along the Missouri River from eastern Montana to northeastern Nebraska, and along Nebraska rivers. Remnant populations are found in Manitoba, Colorado, Kansas, Minnesota, and Iowa. These populations do not exist in isolation from one another and annual coordination of population assessment information from the Northern Great Plains piping plovers should be done to facilitate recovery of the birds on the Missouri River. This proposed action measure includes establishment of a central data collection center for piping plover productivity surveys and adult censuses that are annually conducted during the nesting season. Partners in data collection would include the Canadian Wildlife Service, USFWS, Corps, The Nature Conservancy, various states, provincial and Tribal natural resource agencies, and private entities. The Corps would establish the database for its own use. In coordination with the other interests, the database may serve as a repository for all data being collected by the other agencies. In conjunction with this effort, the partners would continue to support the International Piping Plover Adult Census, next scheduled to be conducted in 2006.

The interior least tern nests on the major interior rivers of the United States. This includes the Missouri, Mississippi, Rio Grande, Canadian and Arkansas Rivers and their tributaries. Missouri River tributaries with nesting least terns include the Kansas, Platte, Elkhorn, Loup, Niobrara, Cheyenne and Yellowstone Rivers. To determine actual population and recovery trends on the Missouri River, the least terns need to be assessed on other rivers. This proposed action measure includes establishment of a central data collection center for least tern productivity surveys and adult censuses that are annually conducted during the nesting season. Partners in data collection would include the USFWS, Corps, various states and Tribal natural resource agencies, and private entities. The Corps would set up the database for its own use. In coordination with the other interests, the database may serve as the repository for all data being collected by the other agencies. In conjunction with this effort the Corps will set up a task force to coordinate recovery efforts between Corps Districts. This team may be of assistance to the USFWS as it coordinates a new recovery plan using all data and information accumulated since the 1990 plan.

Additionally, of critical importance to the recovery of least terns and piping plovers are adequate and sustainable areas of wintering habitat. The Corps proposes with this proposed action measure to seek partnerships with various foreign and state natural resources agencies and private organizations to learn of opportunities for perpetuating sustainable wintering habitat.

Pallid Sturgeon Regional Population Assessment

The pallid sturgeon in the Missouri River is part of a larger population that may extend to the middle and lower Mississippi River. If successful management actions are to be successful on the Missouri River, the dynamics of the larger population structure must be understood. Population parameters such as recruitment, survival and mortality must be understood and the role each rivers system and segment plays in the overall success of the species must be determined. The corps is currently involved in determining these parameters for Mississippi River pallid sturgeon populations and will coordinate population assessment studies done on the Missouri River to insure a broader regional assessment can be conducted.