U.S. Fish and Wildlife Service 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System

December 16, 2003

INTRODUCTION

In 1989, the U.S. Army Corps of Engineers (Corps) initiated consultation with the U.S. Fish and Wildlife Service (Service) regarding operation of the Missouri River Main Stem Reservoir System (See Figure 1). This consultation was conducted under the provisions of section 7 of the Endangered Species Act (ESA), which requires Federal agencies to consult with the Service when the agency's proposed actions may affect the status of species listed as endangered or threatened. For the Missouri River operations by the Corps, the species covered in the 1989 consultation were the endangered Interior least tern (*Sterna antillarum*), threatened Northern Great Plains piping plover (*Charadrius melodus*) and the endangered bald eagle (*Haliaeetus leucocehpalus)*. Subsequently, the pallid sturgeon was listed as endangered in 1990.

Over the next eleven years the Service and the Corps conducted informal and formal section 7 consultations, resulting in a final Biological Opinion by the Service in 2000 covering operations of the Missouri and Kansas Rivers as well as the Missouri River Bank Stabilization and Navigation Project. The 2000 Biological Opinion found that the actions proposed by the Corps would result in jeopardy to the tern, pallid sturgeon and plover, but no jeopardy to the bald eagle. However, we recommend that the Corps not construct bank stabilization structures for the purpose of protecting cottonwood forests on private or public-owned lands. The Corps should continue to protect cottonwood forests along the Missouri River through the purchase, from willing sellers, of privately owned lands by fee title or conservation easement. The Service provided the Corps with a Reasonable and Prudent Alternative (RPA) to their action that, if implemented, would preclude jeopardizing these three species.

On November 3, 2003, the Corps requested reinitiation of formal consultation under section 7 of the ESA, and provided a Biological Assessment in support of the request. Reinitiation of formal consultation is appropriate where there is significant new information or circumstances change subsequent to the original Biological Opinion. In its reinitiation request, the Corps cited the designation of Critical Habitat (under the ESA) for the piping plover in 2002, and a new report on mortality of terns and plovers, as triggers to consultation. Earlier in 2003 the Service had advised the Corps that both of these were adequate triggers for reinitiation, and on November 10, 2003 the Service accepted the Biological Assessment and the start of formal consultation.

In addition to these two triggers for reinitiation, the Corps further stated its commitment to implement the RPA found in the 2000 Biological Opinion but proposed replacing certain elements of the RPA in its Missouri River management. The proposal includes a modified drought conservation plan, Gavins Point Dam summer releases, accelerated construction of shallow water habitat, hatchery facility improvements to increase pallid sturgeon production capabilities, accelerated brood stock collection, adaptive management (including research, monitoring and evaluation, and flow tests), but did not include the spring flow rise and low summer flow contained in the 2000 Biological Opinion RPA for Gavins Point Dam, nor did it include full implementation of flow enhancement out of Fort Peck Dam. The reinitiation of consultation included consideration of this proposal from the Corps.

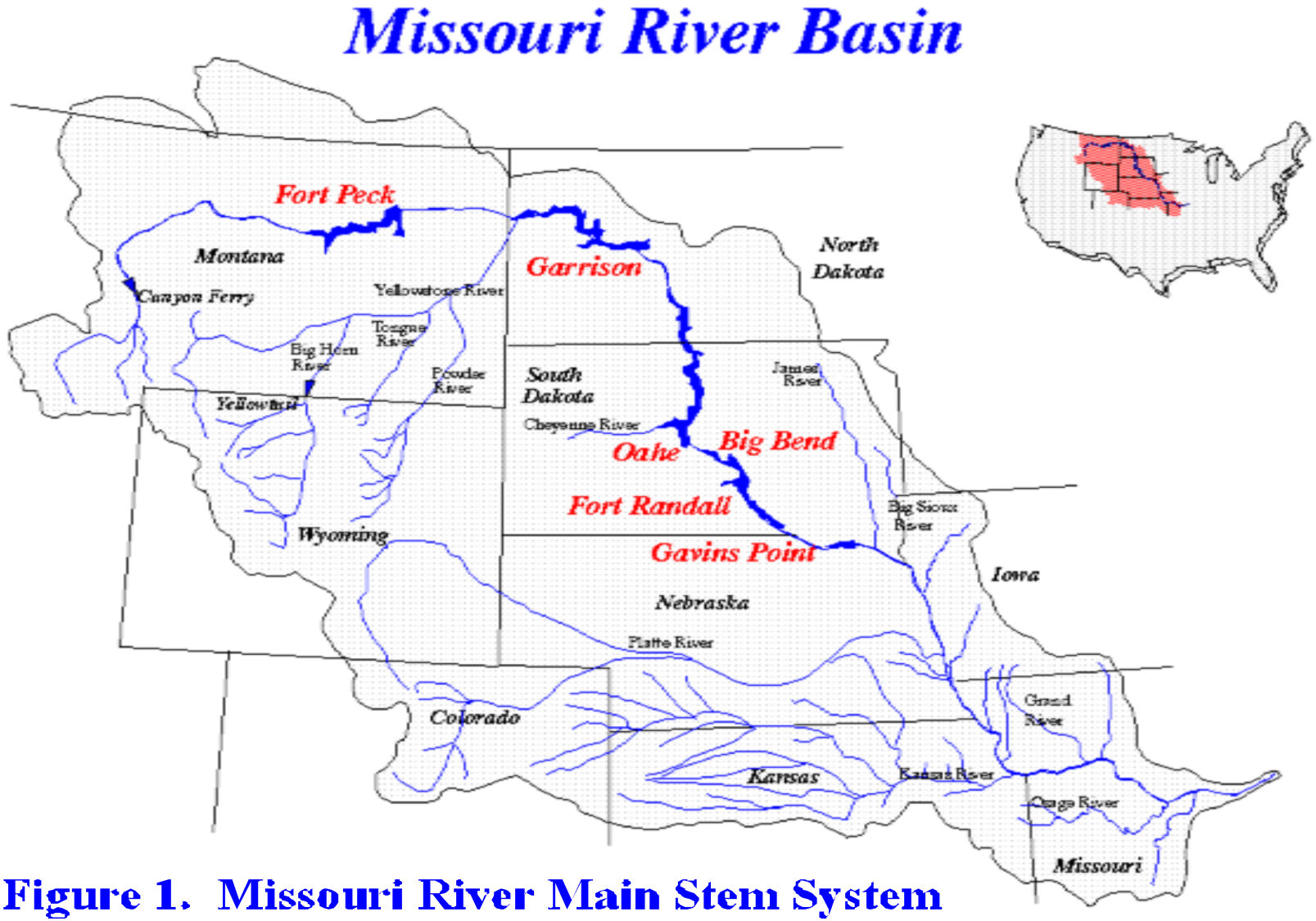


Figure 1. Missouri River Main Stem System

The Service's response to the Corps' November 2003 Biological Assessment is a 2003 Amended Biological Opinion, contained in this document. The scope of this consultation is limited to specific alternative elements offered by the Corps for specific elements in the 2000 RPA. Further information on the process of consultation is documented in the section titled "Consultation History" in this Amended Biological Opinion.

ESA SECTION 7 CONSULTATION GUIDELINES

This 2003 Amended Biological Opinion is issued pursuant to section 7 of the ESA that addresses consultation. The guidelines on section 7 are essential for understanding the foundation and processes involved in a Biological Opinion. Below is an explanation of the ESA consultation provisions that governed our decision-making in this 2003 amended Biological Opinion.

The ESA directs the Service to assist other Federal agencies in ensuring that their actions will not jeopardize the continued existence of threatened or endangered species. Section 7(a)(2) of the ESA states:

> Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency...is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical...

This process requires an analysis of the best available scientific information on species natural history, behavior, habitat requirements, and demographics. Service personnel responsible for implementing the ESA are required to consider scientific information available on the species addressed in a given consultation. The Service must overlay that information with the projected effects of the proposed Federal action.

To accomplish this provision, the Service provides a Biological Opinion to the action agency (in this case the Corps of Engineers) that evaluates the potential impacts of the proposed action on all listed species in the action area and any designated critical habitat that might be affected by the proposed action. Regulations published subsequent to passage of the ESA (50 CFR Part 402, published June 3, 1986) clarified the phrase "is not likely to jeopardize" such species or critical habitat. The regulations state:

> …jeopardize the continued existence of means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

To clarify the intent of this definition, the comments section of the regulations state:

> ...to find that an action is likely to jeopardize a listed species or result in the destruction or adverse modification of critical habitat, the Service must identify detrimental impacts to both the survival and recovery of the listed species... the word "both" was added by the proposed rule to emphasize that, except in exceptional circumstances, injury to recovery alone would not warrant the issuance of a jeopardy Biological Opinion. The Service adopts these definitions substantially without change from the proposed rule….

The Service's Final ESA section 7 Consultation Handbook (Handbook) of March 1998 represents Fish and Wildlife Service policy that steps down these legislative and regulatory mandates into pragmatic guidance for use by all Service personnel involved in section 7 consultations. In defining the entity that qualifies for protection under the ESA (referred to here as the listed or listable entity), the Handbook quotes section 3(15) of the ESA, which defines species to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." When consulting with other Federal agencies under section 7 to determine whether a proposed action will jeopardize a listed species, it is therefore necessary to focus on the listed entity. For the purposes of this review, listed entity will mean the entity listed in 50 CFR 17.11 or an entity that conforms to an exception as explained in the Service's Consultation Handbook.

The Handbook states on page 4-34 that:

> The determination of **jeopardy** or **adverse modification** is based on the effects of the action on the continued existence of the **entire** population of the listed species or on a listed population, and/or the effect on critical habitat as designated in a final rulemaking. When multiple units of critical habitat are designated for particular purposes, these units may serve as the basis of the analysis if protection of different facets of the species' life cycle or its distribution is essential to both its survival and recovery. Adverse effects on individuals of a species or constituent elements or segments of critical habitat generally do not result in **jeopardy** or **adverse modification** determinations unless that loss, when added to the environmental baseline, is likely to result in significant adverse effects throughout the species' range, or appreciably diminish the capability of the critical habitat to satisfy essential requirements of the species. (emphasis in original).

The Handbook (page 4-36) recognizes exceptions to the above rule. This includes the situation where it may be appropriate to make jeopardy determinations on a population that differs from the listed entity, if notice has been given through the *Federal Register* of the Service's intent to do so. In the case of the piping plover, although the species was listed as endangered in the Great Lakes and threatened everywhere else it occurs (50 CFR 17.11), the Service has indicated that it considers the listed entities to be comprised of three separate breeding populations. Since listing the piping plover, the Service has completed two recovery plans that identified recovery goals for three separate populations: Northern Great Plains, Great Lakes, and Atlantic Coast piping plovers. Further, in October 2002, critical habitat was designated separately for the Northern Great Plains and Great Lakes populations, but not for the Atlantic Coast population, satisfying the requirement (Handbook, page 4-36) that notice be given through the *Federal*

Register of the Service's intent to make jeopardy determinations on a population that differs from the entity listed in 50 CFR 17.11. Therefore, we have determined that the appropriate scale of the jeopardy analysis for piping plovers in this consultation is the Northern Great Plains population of piping plovers.

To determine whether a proposed project may jeopardize a listed species, the Service considers the specific portions of the definition of jeopardy that refer to "survival" and "recovery". The Handbook defines these terms in the following manner:

> **Survival:** "…the species' persistence, as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter (page xviii - xix)"
>
> **Recovery:** "… improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act. {50 CFR Sec 402.02}. (p. xvii)"

In formulating a Biological Opinion on a proposed action, the Service evaluates the potential effects of that action against an environmental baseline that describes the current status of the listable entity, the geographic distribution and number of known populations, as well as the affected area of the proposed action. If a conclusion of "no jeopardy" is reached, the requirements of the Federal action agency are to minimize, to the extent practical, the take of listed species that is anticipated to occur, given that the project has already been determined to not jeopardize the species. The Service is limited in its ability to modify the project by what has been termed the "minor change rule", defined in the interagency consultation regulations at 50 CFR 402.14(i)(2): "reasonable and prudent measures, along with the terms and conditions that implement them, cannot alter the basic design, location, scope, durations, or timing of the action and may involve only minor changes." (Reasonable and Prudent Measures are referred to as RPMs).

If, on the other hand, the determination is made that a "jeopardy" condition will exist for one or more listed entities, the Service must attempt to provide a reasonable and prudent alternative (RPA) to the proposed project that will avoid jeopardizing the listed species. The regulations define reasonable and prudent alternative (50 CFR 402.02):

> Alternative actions identified during formal consultation that can be implemented in a manner consistent with the intended purpose of the action, that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, that is economically and technologically feasible, and the Director believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

Each step of the process must be done in sequence. First, the action agency (in this case, the Corps) prepares a document that reviews the status of the species, the proposed actions, and the effects of those actions on listed species (Biological Assessment). The Biological Assessment is received by the Service and reviewed to determine if adequate information is provided to understand the proposed project and the agency's analyses of potential impacts. If all necessary information is provided, the Service then notifies the action agency in writing and formal consultation begins. The Service follows up to gain technical detail to fully understand the proposed action. All accessible information on the listed entities under consultation is gathered and organized and an understanding gained of the status of the entities is documented in an environmental baseline. This includes information on the geographic distribution; population estimates; reproduction, food, water and shelter requirements; and relationship of the action area to the entire range of the entities, incorporating their biological needs.

The Biological Opinion written by the Service is the result of superimposing the impacts of the project on what is known about the entities and their life histories. The analysis is focused on the impacts of the proposed project and how it affects the newly established environmental baseline. The Biological Opinion also takes into account other known impacts to important habitat or populations in the environmental baseline.

Definitive information about every aspect of a species life history and its probable response to impacts are not always available. The Service is charged with using the best available scientific information to analyze the effects of a given Federal action against the backdrop of the species current status and to provide our best professional opinion as to whether the project is likely to appreciably reduce the likelihood of both the survival and recovery of the species.

CURRENT CONSULTATION PROCESS

In the 2000 Biological Opinion, the Service determined that the Corps' action would jeopardize the continued existence of the least tern, piping plover, and pallid sturgeon. The Service provided the Corps an RPA that, if accomplished, would likely avoid jeopardizing these species. In November 2003, the Corps provided to the Service a Biological Assessment that indicated that the Corps wanted to reinitiate consultation because of new information about the effects of the action, because piping plover critical habitat had recently been designated, and because they had determined that portions of the original RPA were not reasonable or prudent.

One of the Corps' reasons for stating that the original RPA may not be reasonable and prudent was the likely lack of success in creating the desired amount of habitat using the flows required in the 2000 Biological Opinion RPA. The Corps presented an engineering analysis in their 2003

Biological Assessment that determined that the flows required in the 2000 RPA would not accomplish the intended habitat objectives specified, and that the RPA flows would likely accelerate erosion of sandbars beyond the effects of the current water control plan. The Corps stated that the results of their studies showed that the long term net result of the RPA would be less available habitat. Therefore, in their BA, the Corps proposed to meet the habitat goals specified in the 2000 Biological Opinion RPA through alternate means (e.g., mechanical creation of sandbars and restoration of existing sandbars through vegetation removal). The Service accepted the Corps' results regarding the efficacy of the required RPA flow modifications to create habitat.

In their November 2003 Biological Assessment, the Corps described for the Service some alternative elements for the RPA that they believed would likely avoid jeopardizing the three species if done in conjunction with the other requirements of the 2000 Biological Opinion. Note that the proposed alternative elements of the RPA did not contain the flow modifications from Gavins Point Dam or full implementation of the modifications out of Fort Peck Dam.

The Service's task in this 2003 reinitiation of consultation is to review the Corps' proposed new elements of the RPA and determine whether the new elements, viewed in light of a new baseline for each species, and all the other components required by the 2000 Biological Opinion, will continue to avoid the likelihood of jeopardizing the three species in question. For clarity, we address the analyses separately for each species along with a formal consultation for critical habitat.

Change in the status of the species or the baseline since the original opinion can effect the determination of whether the alternative elements of the RPA (together with the requirements from the 2000 Biological Opinion) will continue to avoid the likelihood of jeopardizing the species in question. For example, if the status of the species has significantly improved, an RPA may not need to be as extensive or stringent as the original. In contrast, if the status of the species has significantly declined, an RPA may need to be more extensive to ensure that the jeopardizing effects of the project are removed.

CONSULTATION HISTORY

- November 30, 2000 – The Service issued a final Biological Opinion to the Northwestern Division of the Corps on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System. The Opinion concluded that current operations would jeopardize the continued existence of the least tern, piping plover, and pallid sturgeon, but not jeopardize the bald eagle. The Opinion provided a RPA to avoid jeopardy, and also included an Incidental Take Statement identifying anticipated take that would occur after implementation of the RPA, RPMs to minimize the take, and terms and conditions to implement the RPMs.

- April 21, 2003 – The Service issued a Final Supplemental Biological Opinion to the

Northwestern Division of the Corps of Engineers on the revised 2003 Annual Operating Plan (AOP) for the Missouri River between May 1 and August 15 of 2003. The document represents a supplement to the November 2000 Biological Opinion and modifies the RPA II A regarding Gavins Point summer low flow element, plus the RPM 3 regarding the level of incidental take of terns and plovers for the specific period only. The Corps' revised AOP for 2003 included a combination of a flat release at 26 or 27 Kcfs early in the tern and plover nesting season and a flow-to-target release later in the summer when flows would have to be increased to meet downstream navigation targets. The supplement did not change the 2000 jeopardy opinion on the least tern, piping plover, and pallid sturgeon. (Included in Consultation History from November 2000 – April 2003, Appendix I and II).

- May 5 and 6, 2003 – The Service met with the Corps in Denver to continue discussions on the apparent stalemate regarding a commitment from the Corps for flow modifications at Gavins Point Dam.

- June 4, 2003 – The 8th U.S. Circuit Court of Appeals upheld a Federal judge's ruling in Nebraska that required the Corps to follow its Master Manual for operation of the Missouri River. The Appeals Court Ruling may have ramifications on several other pending Missouri River lawsuits in the basin, especially the American Rivers lawsuit which is based on the ESA.

- On July 12, a Federal court in Washington, D.C., ruled in favor of American Rivers and ordered the Corps to drop flows on the Missouri River to comply with the November 2000 Biological Opinion. Citing conflicts between this ruling and the 8th Circuit Court ruling in St. Louis requiring the Corps to follow the Master Manual, the Corps decided to abide by the 8th Circuit ruling and provide navigation flows. On July 22, the Judge ruled the Corps was in contempt of court for ignoring her order to lower Missouri River flows to protect endangered species and that they would be subject to a daily fine of $500,000 if they did not comply. Amidst discussion of Supreme Court involvement, a Federal Judicial Panel on Multidistrict Litigation met in Portland, Maine, and transferred the American Rivers lawsuit and five other Missouri River lawsuits to U.S. District Judge Paul Magnuson in Minnesota on July 24. On August 4, the Judge ruled that no conflict existed and ordered the Corps to follow the District court's order to reduce flows, but did provide a stay on the contempt order and fines.

- July 21, 2003 – The Northwestern Division of the Corps transmitted an email to the Service providing the Corps' Draft Supplemental Biological Assessment for ESA Compliance Actions on the Missouri River Mainstem Reservoir System, the Lower Missouri River, and the Kansas River.

- July 25, 2003 – The Service transmitted an email to the Northwestern Division of the Corps providing preliminary Service comments on the Corps Draft Supplemental Biological Assessment. General areas of concern were highlighted.

- July 30, 2003 – The Northwestern Division of the Corps sent a letter to the Service

transmitting a revised Biological Assessment entitled Biological Assessment on the Missouri River Mainstem Reservoir System, the Lower Missouri River, and the Kansas River and requesting reinitiation of formal section 7 consultation.

- August 18, 2003 – The Corps and Service held an upper level management meeting in Denver, CO to begin discussions on the Corps' Biological Assessment and request for formal consultation.

- August 29, 2003 – The Omaha District of the Corps transmitted a letter to the Service requesting scoping comments on an Implementation Plan for creation of emergent sandbar habitat per RPA element IV(B) of the 2000 Biological Opinion.

- September 5, 2003 – The Northwestern Division of the Corps transmitted an email to numerous Corps and Service staff providing revised draft Biological Assessment sections (i.e., emergent sandbar habitat, pallid sturgeon, shallow water habitat, and adaptive management).

- September 10 and 11, 2003 – Following acknowledgment by the Corps that their July 2003 biological assessment on Missouri River projects was inadequate for initiation/reinitiation of section 7 formal consultation, Service representatives from the Washington Office and Regions 6 and 3 met with Corps personnel from the Northwestern Division and Omaha and Kansas City Districts in Denver to further discuss a possible initiation or reinitiation of section 7 formal consultation on Missouri River projects. The purpose of the meeting was to help the Corps understand the regulatory criteria that must be met to warrant reinitiation of consultation. To this end, all of the Corps' proposed actions or issues were first listed, and then categorized as either a response to the 2000 Biological Opinion, new information, or a new action not considered in the 2000 opinion.

- September 23, 2003 – The Service transmitted an email to the Northwestern Division of the Corps providing Service comments on the Corps' revised outline for their revised Biological Assessment.

- September 24, 2003 – A Missouri River Basin Governor's Summit was held in South Dakota to discuss options to move away from the current stalemate on Missouri River management and settlement possibilities. South Dakota presented a "summit proposal" that included a minor spring rise component.

- September 29, 2003 – Assistant Secretary of the Interior Manson transmitted an email to the Service providing a new schedule for formal consultation with the Corps on Missouri River projects. The schedule called for a draft Biological Assessment from the Corps on October 15, a final Biological Assessment by November 3, a draft Biological Opinion by the Service on December 2, and a final Biological Opinion by December 15.

- October 3, 2003 – The Northwestern Division of the Corps transmitted an email to numerous Corps and Service staff providing a draft of the first section of the revised Biological Assessment (i.e., "Actions Implemented in Response to 2000 Biological

Opinion"). This section was information to help put the new proposed action into context.

- October 17, 2003 – The Northwestern Division of the Corps transmitted an email to the Service providing a draft of the Historical Mortality Report on the least tern and piping plover as required by the 2000 Biological Opinion.

- October 20, 2003 – The Northwestern Division of the Corps transmitted an email to the Service providing additional draft sections of the Biological Assessment.

- October 27, 2003 – A conference call was held between the Service and the Corps' Northwestern Division. The Corps informed the Service of a new direction that would significantly reduce the scope of the Missouri River Biological Assessment to focus on flows, piping plover critical habitat, and the historical take report on terns and plovers. The Corps submitted a draft outline for the revised Biological Assessment.

- October 29, 2003 – Assistant Secretary Manson transmitted a memorandum to Service Director Williams announcing the formation of a special national team of experts to conduct the section 7 consultation on the Missouri River Master Manual.

- November 3, 2003 – The Northwestern Division of the Corps transmitted to the Service a new Biological Assessment entitled Biological Assessment on the Operation of the Missouri River Mainstem Reservoir System, the Operation and Maintenance of the Bank Stabilization and Navigation Project, and the Operation of Kansas River Reservoir System and a request to reinitiate consultation.

- November 4, 2003 – The Northwestern Division of the Corps transmitted a letter to the Service providing the final Historical Mortality Report and associated database on the least tern and piping plover as required by the 2000 Biological Opinion.

- November 10, 2003 – The Service transmitted a letter to the Northwestern Division of the Corps acknowledging receipt of the Corps November 3 request for reinitiation of formal consultation on the Missouri River projects.

- November 12, 2003, letter from General Grisoli to Regional Director Thorson. This letter amended the Corps' Biological Assessment, Appendix B, to include the drought conservation measures.

- November 13, 2003, presentation to Service's consultation team in Minneapolis by Larry Cieslik, Corps of Engineers. Mr. Cieslik's presentation covered Missouri River Basin Water Management.

- November 14, 2003, presentation to Service's consultation team in Minneapolis by John Remus, Corps of Engineers. Mr. Remus' presentation covered the hydrology and hydraulics of the Service's 2000 Biological Opinion RPA and the Corps' proposed RPA

substitution.

- November 14, 2003, presentation to Service's consultation team in Minneapolis by Casey Kruse, Corps of Engineers. Mr. Kruse's presentation discussed the status of terns and plovers on the Missouri River and the Corps' current Missouri River program for terns and plovers.

- November 14, 2003, presentation to the Service's consultation team in Minneapolis by Mark Drobisch, Corps of Engineers. Mr. Drobisch's presentation discussed the status of the pallid sturgeon on the Missouri River and the Corps' current Missouri River program for pallids.

- November 25, 2003 – The Omaha District of the Corps transmitted to the Service the Corps' 2002 Annual Report for the Implementation of the Biological Opinion for the Missouri River Mainstem System, Missouri River Bank Stabilization and Navigation Project, and the Kansas River Reservoir System. This document represents a compilation of the Corps of Engineers' efforts to meet the RPA, RPMs, and Conservation Recommendations in the 2000 Biological Opinion.

BACKGROUND CONCERNING SCIENCE

Ecology of Rivers

Although this consultation concerns the effects of the Corps' proposed action on three listed species and designated critical habitat pursuant to the ESA, it is important to remember the ecological context in which the analyses are taking place. In the 2000 Biological Opinion, the Service placed significant value on the ecological processes of the river and how the natural processes are necessary to ensure the survival of rare and not-so-rare species in the wild.

For a more thorough description of the Missouri River and its ecological processes see USFWS (2000) or National Research Council (NRC) (2002). The Missouri River was historically a highly dynamic, highly variable river system. There were, and still are, significant physical and chemical properties that are essential for the flora and fauna that live in or depend upon the Missouri River. Species, such as the pallid sturgeon, have evolved in the unique environment provided by this large alluvial river system. The Missouri River was historically very wide and meandered across a wide floodplain. There was a tremendous amount of sediment present in the river and the hydraulic processes of the river mobilized and redistributed this sediment both bedload and suspended sediment on a frequent basis.

The hydrology of the system was highly reflective of Great Plains snow accumulation and melt, mountain snow accumulation and melt, and precipitation on the Great Plains and in the Rocky Mountains. When early snow melt began in the lower elevations of the plains, as early as March continuing through April, it contributed to an early pulse of water into and down the river. This early pulse of water, depending on magnitude and duration, would mobilize and redistribute sediment. Initial sand bar and shallow water habitat forming events likely began during this

time. These processes were both hydraulic and physical through the contribution of ice scour that would have stripped vegetation from the banks and sand bars of the river. This initial early pulse would also stimulate the large river fish community to begin migrating, redistributing themselves throughout the river in preparation for spawning, reproduction, and utilization of food base. This early pulse contributed to early forage base production and habitat building events while also simultaneously providing nesting habitat for bird species such as the least tern and piping plover.

As the initial early snow melt receded, the mountain snow melt began, possibly as early as April, and may have continued through the middle of July. These high, late spring/early summer, pulses inundated floodplains and fostered a significant bloom of forage fish and other prey sources. These forage fish, invertebrates, and planktonic species, in turn, provided food for the juvenile river fish that congregated in close proximity to the river's edge where the floodplains would be draining and supplying this rich source of protein to the river. In extremely high years where productivity was significant, this productivity likely carried over to subsequent years and continued to provide for the health of the natural community dependant on the river. These high, late spring, pulses also provided for major habitat formation and redistribution of both shallow water habitat and sand bars that would be exposed as the water receded. The late pulses also provided significant behavioral cues to fish depending upon the magnitude of the pulse, the rate of the increase of flow that comprised the pulse, temperature, and chemical stimuli associated with either the water or the sediment load in the river.

As these later pulses receded, the river would revert to a wide, shallow alluvial river with a mosaic of complex and diverse habitat elements that provided for nesting and rearing of birds. The forage fish and invertebrates that were produced during the late pulse would congregate in shallow water areas as the water receded and this, in turn, provided a rich food source for native birds using the river throughout the summer. These shallow water areas also provided slow water refugia for native river fish, simultaneously congregating the prey and forage base for these large river fish. The lower summer and fall flow could start as early as late June and likely continued through the early winter when flows receded even further and run off was diminished while ice formed on the rivers. Ice and low flows characterized the winter months until spring, when the cycle began again.

The sediment and turbidity of the water through these cycles contributed significantly to the evolution of the large river fish such as the paddlefish and the pallid sturgeon. These fish have adapted to highly turbid and low visibility environments, providing these fish with physiological adaptations to enhance their ability to capture prey and avoid capture as juveniles and larvae in this turbid setting.

Unlike the historical river system, the current system is highly altered, both hydrologically and physically. The development of dams, water diversion structures, and structures to provide flood control and provide for navigation have all significantly altered the natural processes that structured the evolution of species in the Missouri River. The dams have altered and shifted the timing of flows, primarily from the spring and early summer, to the early fall and winter. The low flows that ordinarily occurred throughout the summer, fall, and winter are largely non-existent under many water-year types. Additionally, the dams, bank stabilization and navigation

structures have reduced the sediment availability to the lower river by almost six fold (229 million metric tons to 40 million metric tons, NRC (2002)). These changes have, in turn, had significant cascading ecological effects on the health of the river and its biota.

The timing, magnitude, and frequency of flow changes have impeded the capability of large river fish to detect the behavioral cues for successful reproduction. The Corps' dams in the river have precluded the ability of fish to migrate up and down the river. The dams have also severely eliminated slow, shallow water areas where fish can escape predators and forage. The suppression of flooding events on the floodplain has suppressed the ability of the river to produce forage and prey items and deliver those ecological benefits to young, large river fish species at a time when it is most needed, as larvae and juveniles. These hydrologic alterations and lack of sediment have suppressed the ability of the river to create the high sandbars and shallow water areas that provide essential nursery and foraging areas for birds and fish. Indeed, these hydrological alterations have likely had the reverse effect, increasing the rate that habitat for birds and rearing fish is made unsuitable for essential life cycle stages.

While a section 7 consultation does not consult on ecosystems or ecological processes, the contribution of these aspects to life history needs of listed species is important. Further, while section 7 consultations concentrate on the effects to individual species, where multiple species have evolved and currently co-occur, emphasis on restoring ecological processes for the multiple benefits of many species is an important consideration. The ecological processes that are essential for the listed species in the Missouri River have been significantly altered. Until a semblance of the normalized hydrograph is restored and habitat is generated and maintained through re-establishment of these processes, listed species will continue to decline and their capability to achieve recovery will continue to diminish. For the pallid sturgeon, the opportunity and capability to achieve recovery may be lost in the very near future if these underlying issues are not addressed. The realization of the need to protect other species in the Missouri River is increasing. To the extent those species depend on the Missouri River and the ecological processes that support this system, addressing these underlying processes will reduce the need to protect additional species under the ESA.

Adaptive Management

The concept of Adaptive Management is one employed when adequate information may be lacking to make definitive decisions. This management concept is based on taking reasonable steps when the outcome of those steps is not clearly known, but there is a reasonable expectation that the action will reap desired results. Critical to use of Adaptive Management is proper monitoring to document actual outcomes as compared to expected results.

In the Corps' Biological Assessment (Appendix A, page 2), they quote the report of the National Research Council on the subject of Adaptive Management. They state:

"The NRC proposed that future actions leading to recovery of the ecosystem be framed within an adaptive management approach, which includes broad stakeholder participation. The report states:

> 'Restoring some portion of the Missouri River's pre-regulation physical processes is the key to ecological improvements. Movement toward river recovery will necessarily be incremental, and should be framed within an adaptive management approach. Details of the timing and the extent of specific management actions should be established through collaboration among scientists, managers, and the public. Restoration efforts should be implemented within a basinwide framework that recognizes the relationship of tributaries to the mainstem, of upstream areas to downstream areas, and of the river system's main channel and floodplain. The recommendation to cast management actions within a basinwide framework is not meant to imply that all actions should be conducted simultaneously across the basin. On the contrary, a more reasoned approach, consistent with an adaptive management paradigm, would be to first identify and implement management actions that appear to offer substantial ecological improvements with minimal disruptions to people and floodplain infrastructure (the "low hanging fruit"). Management actions that are taken should be conducted in a spatially-coordinated manner that considers mainstem-tributary, upstream-downstream, and main channel floodplain relations through the entire river system'."

The most basic premise of Adaptive Management is that adjustments or changes in operations will be made as a result of the experimental actions and the monitoring results. In other words, as we learn what works best, changes will be made to ensure those successful actions are implemented on a longer term basis to sustain the positive results. The Corps proposes to accept the findings of the NRC and form an advisory group called the Missouri River Recovery Implementation Committee (MRRIC). This Committee, made up of a broad group of stakeholders from all states along the River, would make recommendations on potential actions that could be undertaken to improve the functioning of the River while minimizing impacts to human uses. However, we can find no definitive statement in the Biological Assessment that commits the Corps to implement experimental actions recommended by MRRIC, monitor those actions, and make adjustments to River operations or habitat creation/management.

On page 6 of Appendix C, the Corps states:

> "The 2000 Biological Opinion 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**." (Emphasis added).

This statement is troubling from two perspectives. First, Adaptive Management has as its main premise that experimentation will occur first in order to monitor results and gain essential knowledge regarding the success of those experiments. If it must first be proven that the action

is "scientifically determined to be essential conditions that contribute to the survival of the pallid sturgeon", then the commitment to Adaptive Management is brought into question in favor of long term research in order to gain proof of the efficacy of the action, rather than using the experiment to gain the necessary knowledge to focus on the most successful actions. This approach would serve to postpone any flow experiments well into the future, a possibility that creates significant concern by many scientists that consider the age structure of wild pallid sturgeon in the Upper Missouri River to be nearing reproductive senility within the next ten years. Pallid sturgeon are declining in the Lower Missouri River and hybridization appears to be increasing.

Second, if a new NEPA document (and potential amendments to the Master Manual) would be necessary to implement any action recommended by MRRIC, then the definition of the project under present consultation must be interpreted to exclude any of those potential actions. Proper use of Adaptive Management would be to ensure that the current NEPA document on the Master Manual changes incorporates the latitude to accept and implement experimental actions in the course of long term Adaptive Management, and to make substantiated long term changes to project operations that are supported by monitoring results. If it does not, then a new Biological Opinion would be required to replace this opinion in order to perform experimental flows. This assumption contradicts the discussion provided in the Biological Assessment that suggests a three year review of the project operations with the assistance of the newly formed MRRIC in order to discuss potential changes or experimentation. Review and potential changes must either be consistent with the current project, or determined to be a future new action that would require its own Biological Opinion.

Adaptive Management is founded on simplicity: identify desired outcomes; take reasonable management actions that are **believed** to yield positive results; monitor those actions to determine if the expected results were achieved; and make management changes based on the new information. The Service fully supports the formation of the MRRIC. However, the long term success of the Committee depends on the real impact it can have on the management of the Missouri River. Proper latitude in the Master Manual is essential in order to preclude continual revisiting of both the Master Manual and the ESA.

As discussions proceed in the MRRIC regarding Adaptive Management, we suggest several broad areas for consideration. There will almost certainly be an expanded list, but perhaps these categories will serve to initiate discussions.

Rivers throughout the world have been formed by drainage and precipitation patterns in the specific areas in which they are found. However, significant similarities exist between rivers and the physical and biological communities that have evolved. In river systems that evolved to make best use of snow melt and tributary flows that have been stored over winter in higher altitudes, the common occurrence is to have the significant annual input of water in the spring months as snow melts and spring storms occur. The biological communities also evolved and adapted to this cycle of spring high flows, diminishment of flows over the summer and constant lower discharges through the late fall and winter. Their biological needs have, therefore, evolved to make best use of habitat conditions created by this cycle for reproduction, rearing of young, and recruitment into the adult population.

Through management for the multiple human needs identified on the Missouri River, several aspects of this natural cycle have been modified. Biologists would argue that the cycle of the River has actually been reversed; moderated flows in the spring to ensure adequate water is stored for later human use, low flows in the summer to conserve water and high flows in the fall to evacuate water from the reservoirs in preparation for the spring inflows. As the process of Adaptive Management moves into the future, every effort should be made to bring more stabilization to the natural cycle with consideration of impacts to reservoir management, as well as human needs and flood damage abatement.

A significant problem that dams and reservoirs commonly share is their retention of natural sediment and bedload. The sands, soils and gravel components make up the geomorphology of the river and manifest in gravel bars, islands, shallow water habitat and many other habitat components, to include turbidity. However, reservoirs create a man made barrier to the free movement of these components, which results in a problem for both lake management and the natural functions of the river. According to the NRC report on the Missouri River (2002), "Sediment transport, which was the hallmark of the pre-regulation Missouri River (and was thus nicknamed 'The Big Muddy'), has been maintaining the river system's form and dynamics. For example, before the 1950s', the Missouri River carried an average of roughly 229 million tons of sediment per year; after closure of the dams, an average of roughly 40 million tons per year moved past the same location." This common problem shared by the Corps in the management of the dams and reservoirs, and the importance of sediment to the natural processes of the river should be pursued through Adaptive Management experimentation in pursuit of a management solution.

A potential learning ground for Adaptive Management is the Yellowstone River. The Yellowstone River offers a significant opportunity to take minimal action and gain significant beneficial information on pallid sturgeon in the upper Missouri River system. The Department of the Interior's Bureau of Reclamation has studied the feasibility of an inflatable barrier at Intake, Montana. In recent times there has been a rock weir to hold water at sufficient depths for irrigation withdrawals. Maintenance of this weir has proven to be costly and repetitive. The inflatable barrier would be deflated during the spring months to allow ingress/egress of spawning adults to the Upper River and movement of larval fish down to the mouth of the Yellowstone. During summer months, the barrier would be inflated to ensure adequate water levels for irrigation withdrawals. The Corps has identified this in their long term planning, but the Bureau is the management agency responsible for this irrigation function.

The value of restoring the Yellowstone River as a natural migratory route for sturgeon, and making the upper Yellowstone function as the spawning and nursery grounds for pallids cannot be overstated. Having a healthy population of pallid sturgeon at any point on the Missouri River brings significant flexibility in management prerogatives and reduces the risk associated with Adaptive Management experiments. The functionality of the inflatable barrier is now beyond major doubt. All involved partners, especially the Federal agencies, should find means to fund this important measure.

STATUS OF LISTED SPECIES RANGEWIDE

LEAST TERN

Species Description

The species description of the least tern from the 2000 Biological Opinion (USFWS 2000) was reviewed and no additional information since that time was found to be added. Therefore, this section is incorporated by reference from the 2000 Biological Opinion.

Historic and Current Rangewide Distribution

The historic and current rangewide distribution of the least tern from the 2000 Biological Opinion (USFWS 2000) was reviewed and no additional information since that time was found to be added. Therefore, this section is incorporated by reference from the 2000 Biological Opinion.

Life History

The reproductive biology section from the 2000 Biological Opinion was reviewed and no additional information since that time was found to be added. Therefore, that subsection is incorporated by reference from the 2000 Biological Opinion. Because of the importance of life history in addressing the tern, the 2000 Biological Opinion section is provided below:

Reproductive Biology

Least terns spend 4 to 5 months at their breeding sites. They arrive at breeding areas from late April to early June (Youngworth 1930, Hardy 1957, Wycoff 1960, Faanes 1983, Wilson 1984, USFWS 1987). Courtship occurs at the nesting site or at some distance from the nest site (Tomkins 1959). It includes the fish flight, an aerial display involving pursuit and maneuvers culminating in a fish transfer on the ground between two displaying birds. Other courtship behaviors include nest scraping, copulation and a variety of postures and vocalizations (Hardy 1957, Wolk 1974, Ducey 1981).

> "The nest is a shallow and inconspicuous depression in an open, sandy area, gravelly patch, or exposed flat. Small stones, twigs, pieces of wood and debris usually lie near the nest. Least terns nest in colonies as small as a single pair to 100+ pairs and nests can be as close as just a few feet apart or widely scattered up to hundreds of feet (Ducey 1988, Anderson 1983, Hardy 1957, Kirsch 1990, Smith and Renken 1990, Stiles 1939). The birds usually lay two to three eggs (Anderson 1983, Faanes 1983, Hardy 1957, Kirsch 1987, 1988, 1989, Sweet 1985, Smith 1985). Both sexes share incubation which generally lasts 20 to 25 days but has ranged from 17 to 28 days (Moser 1940, Hardy 1957, Faanes 1983, Schwalbach 1988). Least tern chicks hatch within one day of one another and stay near the nest bowl for several days. Departure from colonies by both adults and fledglings varies, but is usually complete by early September (Bent 1921, Stiles 1939, Hardy 1957)."

Growth and Longevity

This section is incorporated by reference from the 2000 Biological Opinion. In addition, Dugger et al. (2000) estimated chick survival from hatching to fledging for least terns nesting at two sites on the Lower Mississippi River in Missouri using mark-recapture methodology. The mean daily

survival rate for least tern chicks at river kilometer (Rkm) 1431 was 0.951 and 0.972 at Rkm 1481. Estimated survival of least tern chicks throughout the entire 17-day fledging interval was 0.43 at Rkm 1431 and 0.62 at Rkm 1481.

Movements/Dispersal Patterns

This section is incorporated by reference from the 2000 Biological Opinion. In addition, least terns are thought to be highly philopatric, but limited data indicate that the degree and spatial scale of breeding site fidelity vary among breeding populations in different geographic areas (Thompson 1997). Massey (1992) found that 95 percent of banded least tern chicks returned to nest within 75 km of their Pacific Coastal natal colony at Huntington Beach, California. Renken and Smith (1995) reported that 97 percent of 78 banded terns returned to within 1.5 to 80 km of the colony where they were banded. On the central Platte River in Nebraska, 28 percent of 109 adults returned to their natal colony (Lingle 1993). Band returns on interior least terns, although limited, show movement within the Interior least tern subspecies. Chicks banded in Nebraska nested in Kansas (Boyd 1993, Lingle 1993), and a chick banded on the Missouri River in South Dakota nested on the Lower Platte River in Nebraska (Thompson 1997).

New genetic information suggests dispersal among Interior, Eastern, and California least tern populations. Whittier (2001) proposed that the three subspecies of least terns do not differ genetically, although the rate of genetic exchange appears to be lower between Interior and California least terns than between Eastern and Interior, and Eastern and California subspecies:

Eastern and CA: >3 migrants/generation
Eastern and Interior: >3 migrants/generation
Interior and CA: 1.9 migrants/generation

Results of mtDNA and nuclear DNA were somewhat contradictory because nuclear DNA tests revealed less gene flow than mtDNA; Whittier (2001) suggests this may be an artifact of small sample size rather than a reflection of actual gene flow.

Recovery Objectives

In 1990, the Service published the *Interior Population of the Least Tern Recovery Plan* (USFWS 1990a; Tern Recovery Plan). That plan includes recovery goals for the least tern along major river systems throughout their range. Major recovery steps outlined in the plan include: (1) determine population trend and habitat requirements; (2) protect, enhance, and increase populations during breeding; (3) manage reservoir and river water levels to the benefit of the species, and; (4) develop public awareness and implement educational programs about the least tern; (5) implement law enforcement actions at nesting areas where there are conflicts with high public use.

The Tern Recovery Plan recommends the removal of the tern from the list of threatened and endangered species if essential habitat throughout its range is properly protected and managed, and species distribution and populations goals are reached and maintained for 10 years. Specifically, the recovery plan recommended that the following distribution and numbers of adult birds be maintained for 10 years:

Missouri River system - 2100
Lower Mississippi system - 2200-2500
Arkansas River system – 1600
Red River system – 300
Rio Grande River system – 500

The Tern Recovery Plan further specifies a geographic distribution of these totals within each river system identified above. For example, within the Missouri River system, the plan calls for the total of 2100 adults to be distributed as follows:

Montana- 50 adults
North Dakota- 250 adults
South Dakota- 680 adults (includes 400 adults shared with Nebraska on the Missouri River) distributed as follows:

Missouri River below Gavins Point Dam-400 adults
Other Missouri River sites- 200 adults
Cheyenne River- 80 adults

Nebraska- 1,120 adults distributed as follows:

Missouri River- 400 adults (shared with South Dakota on Missouri River)
Niobrara- 200 adults
Loup River- 170 adults
Platte River- 750 adults.

Kirsch and Sidle (1999) noted that low individual site fidelity and substantial fluctuations in local tern numbers suggest considerable movement among breeding areas. Those factors can further confound the understanding of the species status based on short-term trends. Therefore, long-term information on tern numbers, distribution, and reproductive success is an important factor in determining when the least tern has successfully achieved its recovery goals.

Population Status and Trends

The least tern is a difficult species to census accurately. The least tern frequently shifts nesting sites and timing of nesting varies locally because of weather, habitat availability (e.g., seasonal duration and timing of flooding of sandbar habitats), and latitude (Thompson, et al. 1997). Consistent timing and coverage of surveys is logistically difficult. The nesting colonies of Interior least terns are ephemeral and occur over a large geographic area that contains remote riverine habitats.

No comprehensive, annual, or regularly scheduled rangewide census for the Interior least tern exists. However, several river segments are being surveyed on an annual basis. Many of these surveys are being conducted by the Corps or its contractors. Rivers regularly surveyed by the Corps are the Missouri River, the Arkansas River in Oklahoma, the Red River from Denison Dam to Index, Arkansas, and the Lower Mississippi River. The annual census of the Missouri River is the most comprehensive survey conducted by the Corps. Least Tern surveys are also

conducted regularly on the Kansas River, Platte River, North Platte River and Canadian River below Eufaula Dam, and on three National Wildlife Refuges (Salt Plains, Quivera, and Bitter Lake). Efforts are underway by the Service and the Corps to develop standard, comprehensive census procedures for least terns. This is the basic objective of the population assessment measure addressed in the 2000 Biological Opinion and the November 2003 Biological Assessment.

Table 1 provides a summary of the approximate rangewide number of adult interior least terns. This information represents all available information provided to the Service as of December 2003 and updates the rangewide information provided in the 2000 Biological Opinion. It is important to mention that this table does not represent a complete census; some segments of some rivers are surveyed in one year but not another. Furthermore, no recent surveys have been conducted on the Canadian River above Norman, Oklahoma and the Cimarron River in Oklahoma and Kansas, whereas previous surveys on these two rivers documented important least tern nesting colonies. The Rio Grande River in Texas, another important river segment for least terns, has been sporadically surveyed in recent years. Because it is clear that not all areas have been surveyed recently, we believe that the total abundance estimate in Table 1 is likely a minimum estimate.

The number of adult least terns has increased since rangewide summaries by Kirsch and Sidle (1999) and the 2000 Biological Opinion. Rangewide numbers have increased in the three years since the 2000 Biological Opinion and numbers counted have increased every year since 1997 (except for a slight decline in 2002). The number of adult least terns recorded for the Lower Mississippi River in 2003 continues to represent the highest proportion of terns rangewide (8,082; 67 percent of the total number surveyed).

Table 1. Approximate Numbers of Adult Interior Least Terns Throughout the Range

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Yellowstone River, MT to L. Sakakawea	16	14	19	40	21	19	21						
Missouri River, MT Ft. Peck Reservoir	10	0	7	9	2	0	2	4	0	4[1]	0[1]	0[1]	2[1]
Missouri River, MT Ft. Peck Dam to L. Sakakawea	66	110	31	58	95	128	162	25	40	33[1]	39[1]	34[1]	38[1]
Missouri River, ND L. Sakakawea	8	29	14	35	7	27	2	23	9	10[1]	34[1]	21[1]	25[1]
Missouri River, ND/SD Garrison to Oahe Dams	338	322	258	377	368	179	142	231	162	190[1]	219[1]	232[1]	214[1]
Missouri River, SD Ft. Randall to Gavins Pt.*	87	42	114	87	26	30	60	154	200	116[1]	117[1]	126[1]	96[1]
Missouri River, SD/NE Gavins Pt. to Ponca	193	186	272	211	93	82	115	144	161	206[1]	232[1]	314[1]	366[1]
Missouri River, IA Sioux City	0	12			12	13	16						
Missouri River, IA Council Bluffs	20	9	0	0	4	8	5			6[3]			
Kansas River, KS					12[2]	14[2]	10[2]	36[2]	14[2]	22[2]	12[2]	34[2]	38[2]
Subtotal	738	724	715	817	640	500	535	617	586	587	653	761	779
Cheyenne River, SD					32	32	30						
Niobrara River, NE	291					321	103				150[3]		
Niobrara River, NE (Natl. Scenic R. Norden - HWY 137)												15[3]	12[3]
Loup River, NE	117	188	46		150	139					81[3]		
North Loup River, NE						17					16[3]		
South Platte River, NE	0	0	5	0	0	2				8[3]	4[3]		2[3]
North Platte River and Lake McConaughty, NE	16	24	10	12	8	10	10	14[3]	6[3]	4[3]	24[3]	24[3]	28[3]
Platte River, NE North Platte - Lexington (upper)	197[3]	32[3]	32[3]	62[3]	30[3]	24[3]	44[3]	34[3]	18[3]	18[3]	15[3]	12[3]	8[3]
Platte River, NE Lexington - Chapman (central)	19[3]	191[3]	178[3]	169[3]	119[3]	157[3]	120[3]	76[3]	34[3]	42[3]	101[3]	110[3]	94[3]
Platte River, NE Chapman - Missouri Riv. (lower)	487[3]	427[3]	451[3]	426[3]	180[3]	290[3]	377[3]	208[3]	134[3]	460[3]	310[3]		394[3]
Elkhorn River, NE	30	35	38	24	35	86	62				64[3]		
Lower Arkansas River Valley Lakes, CO	46	42	30	22		64							
Arkansas River (J.M. Res.) and adjacent col, CO													
Quivira NWR, KS	54		48	46	50	66	56					31[3]	28[3]
Jeffery Energy Center, Pottawatomie Co, KS	0	0	0	16	20	20	15				28[4]		10[4]
Cimarron River, KS/OK	67	452	16	22	16	14	14						
Optima Reservoir, OK	15	16											
Salt Plains NWR, OK	82	136	168	90	200	200	200						130[5]
Prairie Dog Town Fork of Red River, TX													597[8]
Red River, OK/TX Denison Dam - Index AR	333								700	631[6]	893[6]	782[6]	993[6]
Red River, AR													250[7]
Arkansas River, OK Kaw Dam to Muskogee	304	315	447	471	339	381	277	312[9]		384[9]	628[9]	614[9]	569[9]
Arkansas River, AR		68									198	264	
Canadian River, OK Newcastle to Purcell	38		80	78	122	86	110						
Canadian River, Norman to Eufaula Lake, OK												286	
Canadian River, OK Eufaula Dam - Sequoyah NWR					54	77	41		106[11]	107[11]	65[11]	71[11]	59[11]
Mississippi River, Cape Girardeau to Vicksburg	4297	3653	4589	6776	6971	3067	3428	5538	6159	5920[12]	6361[12]	5802[12]	8082[12]
Ohio River, KY/TN	0			44		138	91						
Gibson Lake, IN	12	9	34	30	24	68				70[3]	80[3]		
Bitter Lake NWR, NM	10	12	14	11	14	14	12			20[3]	22[3]		
Rio Grande River, Falcon Reservoir, TX			655							214[3]			
Rio Grande River, Lake Casa Blanca, TX													
Rio Grande, Armistad Reservoir, TX													
Dallas County, TX, Waste Water Treatment Plant		15	24	20	20	27	25			21[3]			
Annual Total	7153	6339	7580	9136	9024	5800	5550	6799	7743	8486	9693	8772	12035

Update Sources:

1. Missouri River - U.S. Army Corps of Engineers, Omaha District. 2003. Mainstream Missouri River Least Tern Productivity Monitoring 1986-2003. Unpublished report submitted USFWS
2. Kansas River - Boyd and Sexson, 2003
3. Niobrara, Loup, South Platte, North Platte, Platte Rivers, Elkhorn River, Quivera NWR, Rio Grande River, Dallas County, TX, Gibson Lake, and Bitter Lake - Erika Wilson, pers. comm.
4. Jeffrey Energy Center, KS - Boyd and Sexson, 2003 and Boyd 2001
5. Salt Plains NWR - Kevin Stubbs, pers. comm.
6. Red River, OK/TX - Gulf South Research Corportation. 2000, 2001, 2002, and 2003; Kevin Stubbs, pers. comm.

7. Red River, AR - Meduna and Nupp, 2003
8. Prairie Dog Town Fork of Red River - Aqua-Terr, LLC., 2003
9. Arkansas River, OK - U.S. Army Corps of Engineers, Tulsa District, 2001 and 2002; Kevin Stubbs, pers. comm.
10. Arkansas River, AR - Urbanic, 2003
11. Canadian River, OK - Kevin Stubbs, pers. comm.
12. Mississippi River - URS Corporation, 2003

The number of adult terns surveyed on the Arkansas River in Oklahoma, Red River from Denison Dam to Index, Arkansas, and Missouri River has increased during the past three years. In 1988, 119 least terns were counted on the Arkansas River in Arkansas (Kirsch and Sidle 1999). Urbanic (2003) recently surveyed a segment of the Arkansas River in Arkansas and estimated the number of adult terns to be 198 in 2001 and 264 in 2002. At the time Kirsch and Sidle (1999) published their summary, the Prairie Dog Town Fork, Red River, Texas had last been surveyed in 1990, with 18 terns counted. However, in 2003, the Corps' survey of this river segment documented 597 adult least terns (Aqua-Terr 2003). Since 2000, least tern surveys have been conducted on two new river segments, the Canadian River between Norman, Oklahoma and Eufaula Lake and the Red River in Arkansas. During a 2002 survey of the Canadian River, 286 adult terns were counted (Kevin Stubbs, USFWS Oklahoma Field Office, pers. comm.). The 2003 survey on the Red River in Southwest Arkansas documented 250 adult terns (Meduna and Nupp 2003) although some terns in the upper most portion of their survey segment may have also been counted in the Corps' survey between Denison Dam and Index, Arkansas (Kevin Stubbs, USFWS, Oklahoma Field Office, pers. comm.)

In evaluating status and trend of Interior least terns, several authors have evaluated what level of reproduction (as measured by number of fledglings produced per breeding pair) is necessary to result in a stable or increasing population, given estimates of juvenile and adult survival. Thompson (1982) hypothesized that 0.5 fledglings per adult or 1.0 fledglings per pair would result in a stable population. Dugger (1997, page 12) used a deterministic population model, assumed a survival rate of 0.85 for adults and a survival rate of 0.30 for juveniles (fledglings to age 2; generated by Thompson 1982), and concluded that 1.0 fledglings per pair were necessary to support a stable population (see Table 1 for a review).

Kirsch (1996) also used a deterministic population model with a range of adult and juvenile survival rates, together with the average 0.5 fledglings per pair she had observed on the Platte River in Nebraska, and found that a stable or increasing population was achieved only when survival rates were fairly high. For example, at 0.5 fledglings per pair an adult survival rate of 0.85 only achieved a stable population when the juvenile survival rate was at 0.80, and an adult survival rate of 0.90 achieved a stable or increasing population when juvenile survival was at 0.65. From this she concluded that 0.5 fledglings per pair was a conservative estimate of the minimum level needed to achieve population stability or growth, because most estimates of adult tern survival do not exceed 0.85 and while few estimates of juvenile survival are available, it is unlikely that juvenile survival is as high as adult survival. On the Platte River, postfledging survival must be very high for the observed level of productivity (0.5) to sustain the population (Kirsch 1996); alternately, the population may be supported by immigration from other areas.

Kirsch and Sidle (1999) summarized the status of the Interior least tern. They found that of six geographic areas with significant population trends, four of these areas had observed fledge ratios that would not support the observed population trend. In addition, observed fledge ratios in many local areas were below the 0.5 fledglings per pair

conservatively thought necessary to achieve population stability. The observed fledge ratios on the Lower Mississippi River were not sufficient to support the observed population trend in that drainage basin. The overall population trend for the entire Interior least tern was positive, but this was primarily due to the increases observed on the Lower Mississippi River. Kirsch and Sidle (1999) stated that the most plausible explanation for the increase in the population of Interior least terns was surges of immigration from the least tern population along the Gulf coast which they characterized as a large and stable or increasing population. However, only one published record of a least tern moving between the Gulf coast and interior breeding areas has been reported (Boyd and Thompson 1985 as cited in the 2000 Biological Opinion), so this hypothesis is difficult to test. Recent data on rate of genetic exchange between Eastern least terns and Interior least terns indicates that greater than 3 migrants per generation are being exchanged (Whittier 2001.)

An alternate hypothesis that adult longevity, coupled with occasionally high recruitment, may offset generally low levels of production was assessed using data from least terns at Salt Plains National Wildlife Refuge in Oklahoma, Quivira National Wildlife Refuge in Kansas, and along the Missouri River in South Dakota (Whittier 2001). Longevity and periodic high recruitment counteracted lower productivity estimates in the model for terns at Salt Plains and Quivira National Wildlife Refuges, and indicated that the breeding population would persist despite low productivity, but the same was not true for the Missouri River. Whittier (2002) hypothesized that longevity could not counteract low productivity in the Missouri River due to lower overall productivity and no peaks in productivity compared to the other sites. Kruse's (1993) Missouri River data analyzed by Whittier (2001) covers 1986-1992. His estimates of fledglings/pair ranged from 0.20 to 0.64. Since that time observed data indicate a greater range of productivity estimates for this and other reaches of the Missouri River, particularly in the years since the 1997 flood. An analysis of a longer time series of data might yield a different result for this population.

Kirsch and Sidle (1999; table 4; p. 480) compiled estimated fledglings per pair for selected local areas from 1980-1996. Fledge ratios observed across the range of the least tern in more recent years are shown in Table 2. A review of these estimates shows that few areas have exceeded an average fledge ratio of 1.0, with the exception of post 1997 data from the Missouri River system (data provided by C. Kruse, USACE). The highly productive years following 1997 are believed to be a result of record basin runoff and subsequent high discharges from 1995-1997. Those flows created extensive least tern nesting habitat below Garrison, Fort Randall, and Gavins Point Dams (segments 4, 8, and 10). Subsequent to these flows, estimates of tern production increased to levels greater than 1.0 fledglings per pair, until 2003 when the estimate decreased to 0.87 fledglings per pair (Figure 2).

Table 2. Observed Ratios of Fledglings per Breeding Pair for Interior Least Terns on Selected Rivers 1995-2003.

	Fledge Ratio								
River	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Missouri River1	0.67	0.21	0.52	1.74	1.42	1.24	1.06	1.28	0.87
Kansas River2	0	0.57	0	0.67	0	1.36	0.0.5	0.41	0.26
Arkansas River, OK3							0.8	0.65	0.64
Red River, OK/TX (Denison Dam – Index, AR)4						0.09	0.53	0.33	0.33
Red River, AR5								0.7	
Lower Mississippi6	1.27	0.28	0.5						
Lower Mississippi7	0.85								

1 USACE.2003d. Mainstem Missouri River Least Tern Productivity Monitoring 1986-2003. Unpublished data

2 Boyd R.L. and M. Sexson. 2003. Least Tern and Piping Plover Surveys on the Kansas River 2003 Breeding Season. Rpt. To Kansas City District, US Army Corps of Engineers. 31p

3 U.S. Army Corps of Engineers, Tulsa District. 2002. Table 2 in Annual Report to U.S. Fish and Wildlife Service. Unpublished Report. 2 p.

4 Gulf South Research Corp. 2000. Red River Interior Least Tern Surveys Denison Dam, Oklahoma to Index, Arkansas. Annual Report for Fish and Wildlife Permit submitted to U.S. Fish and Wildlife Service. 6p (excerpts)

Gulf South Research Corp. 2001. Final Report - Survey Report Lower Red River Population of the Interior Least Tern from Denison Dam to Index, Arkansas. US Army Corps of Engineers, Tulsa District. 5 p. (excerpts)

Gulf South Research Corp. 2002. Final Report - Survey Report Lower Red River Population of the Interior Least Tern from Denison Dam to Index, Arkansas. US Army Corps of Engineers, Tulsa District. 5 p. (excerpts)

Gulf South Research Corp. 2003. Draft Report - 2003 Survey Report Lower Red River Population of the Interior Least Tern from Denison Dam to Index, Arkansas. US Army Corps of Engineers, Tulsa District. 4 p. (excerpts)

5 Meduna, L. and T. Nupp. 2003. Annual Report - Status of Reproductive Ecology of the Interior Least Tern (Sterna antillarum) on the Red River in Southwest Arkansas. Unpublished Report.

6 Szell, C.C. and M.S. Woodrey. 2003. Reproductive Ecology of the Least Tern along the Lower Mississippi River. Waterbirds 26(1): 35-43.

7 Dugger, K.M., M.R. Ryan, and R.B. Renken. 2000. Least Tern Chick Survival on the Lower Mississippi River. J. Field Ornithol., 71(2): 330-338.

In summary, available literature addressing tern population trends rangewide conclude that most observed fledge ratios on average would not support a stable or increasing population trend, unless postfledging survival estimates are quite high or unless the population is being supported by immigration from elsewhere (e.g., the Gulf coast). An alternate hypothesis is that longevity and intermittent periods of peak productivity can produce a stable populations even when average productivity is fairly low. The lack of age-specific survival rate estimates for terns and a lack of band return data that would indicate that Gulf coast birds are dispersing and joining the Interior population. Management actions to increase least tern fledging rates in interior areas are recommended to ensure that the interior population stabilizes or increases.

Habitat and Food Requirements

The least tern habitat and food requirements section from the 2000 Biological Opinion (USFWS 2000) was reviewed and no additional information since that time was found to be added. Therefore, this section is incorporated by reference from the 2000 Biological Opinion. Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for clarity.

> **"Habitat Characteristics -** Interior least terns physical habitat requirements are difficult to describe and are often confused by regional variation. Lack of vegetative cover (Dirks 1990, Ziewitz et al. 1992), substrate composition and homogeneity (Adolf 1998), and proximity to stable food sources (Faanes 1983, Dugger 1997, Adolf 1998), have been identified as important physical components of least tern habitat. Sandbar geophysiology and associated hydrology are integral components of suitable habitat. Bacon (1996) found channel bars chosen for nesting sites by least terns on the Yellowstone River were exposed above river level longer throughout the breeding season than non-nesting habitats. Similarly, Smith and Renken (1991) found that least tern colonies along the lower Mississippi River were located on sand islands and sandbars that differed from unused sand islands by the length of time sites were continuously exposed above the river. Most nest colonies on the Yellowstone occurred in a section of the river where channel sinuosity began to increase and there was a higher incidence of channel bars and overlapping islands surrounded by irregular channel activity. Recent habitat investigations by the Corps (C. Kruse, pers. comm. 2000) support Ziewitz et al. (1992) that large habitat blocks occurring in complexes or "hemi" bars are selected for at rates exceeding their random availability.
>
> Least tern colony sites are usually located in open expanses of sand or pebble beach within the river channel or reservoir shoreline. They prefer sites that are well-drained and well back from the water line. Least terns usually nest on sites totally devoid of vegetation, but have been found on sites with up to 30 percent vegetative cover (Schulenberg and Placek 1984, Dryer and Dryer 1985, Landin et al. 1985, Rumancik 1985). Vegetation, if present, is usually located well away from the colony (Hardy 1957, Anderson 1983, Rumancik 1985, Smith and Shepard 1985). However, widely dispersed annual vegetation or young saplings may commonly be found within or near some interior least tern colonies (Wycoff 1950, Faanes 1983, Evans 1984, Dryer and Dryer 1985).

The interior least tern also nests in dike fields along the Mississippi River (Smith and Stuckey 1988, Smith and Renken 1990); at sand and gravel pits (Kirsch 1987-89); ash disposal areas of power plants (Wilson 1984, Johnson 1987, Dinsmore and Dinsmore 1988); along the shores of reservoirs (Chase and Loeffler 1978, Neck and Riskind 1981, Boyd 1987, Schwalbach 1988); and at other manmade sites (Shomo 1988). It is unknown to what extent those alternative habitats have replaced productive natural habitat.

Foraging habitat for least terns includes side channels, sloughs, tributaries, shallow-water habitats adjacent to sand islands and the main channel (Dugger 1997). To successfully reproduce, productive foraging habitat must be located within a short distance of a colony (Dugger 1997). In a study of eastern least terns in North Carolina, all 61 of the colonies observed were within 820 ft (250 m) of a large expanse of shallow water (Jernigan et al. 1978). In Georgia, eastern least terns foraged a maximum distance of 1,345 ft (410 m) from the colony (Tomkins 1959). Least terns in Nebraska generally were observed foraging within 328 ft (100 m) of the colony (Faanes 1983). Armbruster (1986) recommends that feeding areas for terns be present within 1,312 ft (400 m) of the nesting colony.

Food and Feeding Habits

The interior least tern is piscivorous, feeding on small fish in shallow waters of rivers, streams, and lakes (USFWS 1990a). Moseley (1976) believed least terns to be opportunistic feeders, exploiting any fish within a certain size range. Important prey genera include *Fundulus*, *Notropis*, *Campostoma*, *Pimephales*, *Gambusia*, *Blonesox*, *Morone*, *Dorosoma*, *Lepomis*, and *Carpiodes* (Hardy 1957, Grover 1979, Schulenberg et al. 1980, Rumancik 1988, 1989, Wilson et al. 1989, Smith and Renken 1990). Fishing behavior involves hovering and shallow dives over standing or flowing water."

Rangewide Distribution and Abundance of Habitat

The least tern Rangewide Distribution and Abundance of Habitat section from the 2000 Biological Opinion (USFWS 2000) was reviewed and is incorporated by reference here. In addition, the following updates reflect information subsequent to the 2000 Biological Opinion:

Although a portion of the increase in terns since listing can be attributed to increased survey efforts, in 2003 sufficient habitat apparently existed to support 12,035 terns (428 percent increase compared to 1985). The point at which habitat availability will become limiting, slowing future increases, is unknown.

Some information is available on the current quality of habitat for select river segments (e.g., Missouri River; see Current Distribution and Abundance of Habitat within the Action Area), however sufficient information is not available to assess the habitat quality rangewide.

Nesting Habitat

Interior least terns nest on sandbars with little vegetation within the main channel of large alluvial rivers. This is dynamic, continually changing habitat that is formed and maintained by the hydrology of the river and the movement of its alluvial bedload. Climatic conditions that influence river hydrology are a major factor influencing the distribution, abundance, and quality of least tern nesting habitat. During periods of high rainfall events, such as occurred over much of the Great Plains in the mid-1990s, sand is moved to create new sandbars and existing sandbars are scoured (which replenishes sand and removes vegetation). During a drought period (currently happening in the upper Great Plains), spring flows that form and maintain sandbars are reduced or absent. During these low flow periods vegetation increases on sandbars, reducing their quality for nesting least terns. Climatic cycles and the seasonal ebb and flow of these alluvial rivers are the driving forces for least tern nesting habitat.

Least tern nesting habitat can be impacted by any action that changes river hydrology and morphology. The construction and operation of large Federal reservoirs is a major action impacting least tern nesting habitat on several rivers within the species' range. A major hydrologic effect of these reservoirs on nesting habitat is the reduction in the magnitude, frequency, and duration of peak flows that are necessary to move sediments for new sandbars and scour existing sandbars. These reservoirs also retain large volumes of sediment (sand) that normally would be distributed throughout an unregulated river. This sediment is the basic building block of least tern nesting habitat. The substantial reduction of sediment input by these reservoirs impacts the distribution, abundance, and quality of least tern nesting habitat.

Within the range of the least tern, large Federal reservoirs occur on the Missouri River, Arkansas River, Red River, Platte River, Kansas River, and Canadian River. Although terns nest on river segments downstream of these reservoirs, the amount and quality of their nesting habitats may have declined since these rivers were regulated. Nesting habitat that is in close proximity to the dams is most impacted because the effects of the reservoirs attenuate further downstream with increased tributary influence. Except on the Missouri River, the shorelines of these Federal reservoirs are not frequently used by nesting least terns. During periods of low Missouri River reservoir levels there is a considerable amount of exposed, unvegetated shoreline used as nesting habitat by least terns. Such conditions currently exist on these reservoirs due to the drought in the upper Missouri River Basin.

River segments that do not have altered hydrology and sediment transport by reservoirs retain many of the dynamic processes that form and maintain least tern nesting habitat. Such river segments include Canadian River in Oklahoma and Texas, the Cimarron River in Oklahoma and Kansas and the Red River/Prairie Dog Town Fork of the Red River above Lake Texoma in Oklahoma and Texas. Although the Lower Mississippi River is not affected by a mainstem reservoir, its morphology has been impacted by the construction of extensive river training structures (e.g., dikes, bendway weirs, bank stabilization).

Thompson (1997) surmised that habitats used by least terns for nesting have changed through time as human development has encroached on breeding areas and natural ecological changes have occurred. Least terns have nested in a variety of man-made environments, including dredge piles, scarified land adjacent development, and graveled rooftops (Thompson 1997, Jackson and Jackson 1985); however, nesting success at these locations is not well documented. Lingle (1993 (reported in Sidle and Kirsch (1993)) speculated that nest success might be higher on abandon sand and gravel pits, than it would be on the nearby Platte river where nest on riverine sandbars were sure to be flooded by water management operations. Productivity of Least Terns on artificial habitat is likely related to the proximity of the habitat to forage-fish sources (Thompson 1997), accessibility by predators, and the likelihood that the site will be damaged or disturbed by natural or anthropogenic causes (e.g., flooding). The effectiveness of habitat intentionally constructed for least tern nesting on the Missouri River has not been tested, but is likely to depend upon design features to provide nearby forage fish habitat, safety from predators, and avoidance of flooding.

Foraging Habitat

Availability of suitable foraging habitat is likely important to tern population growth. Dugger (1997) identified direct links between estimates of relative food availability and aspects of least tern reproduction on the Lower Mississippi River. Decreased food availability tended to be related to reduced egg weights, clutch sizes, and chick weights, which likely influence chick survival and fledging rates.

Changes in the basin and floodplain physiography and channel morphology due to regulation of the river have greatly changed the native fish community composition and ecology (Welker 2000); commercial fish harvests decreased by over 80 percent and many other native fish have declined (Hesse et al. 1989). A review of the composition, distribution, and relative abundance of fish in the mainstem Missouri River yielded 136 species, of which 79 percent are native (Galat et al. in press). Significant use of floodplain habitat occurs for 60 species. Of the fishes that they were able to classify, 33 percent were either stable to increasing or increasing, whereas 45 percent were either stable to decreasing or decreasing.

Impoundments have created barriers on the mainstem Missouri and reduction in channel complexity and changes to the flow regime have been particularly damaging to the big river fauna. Several small-bodied chubs are now extirpated from more than one-half of the river's length (Galat et al. in press). Consistent population declines have occurred in the main channel Missouri River for sicklefin chub (*Macrhybopsis meeki*), sturgeon chub (*Macrhybopsis gelida*), plains minnow (*Hybognathus placitus*), western silvery minnow (*Hybognathus argyritis*), highfin (*Carpoides velifer*) , carpsucker (*Carpoides carpio*) and sauger (*Stizostedion canadense*). Benthic, or bottom-dwelling, fish is one group in the Missouri River system that has exhibited major population declines (Galat et al. 2001).

Inundation of the flood plain prior to the 1993-1996 flooding events occurred when timing and duration was not optimal for floodplain spawning fish. However, after the recurrent floods of the 1990s, researchers were able to compare the effects on community

structure in connected scours with effects in isolated scours that were not connected. Adult fish assemblages were similar between connected and unconnected scours, yet composition of larval and juvenile fish were markedly different. Sunfishes (*Centrarchidae*) dominated in isolated basins, while connected basins had a more diverse riverine assemblage dominated by goldeyes (*Hiodontidae*), minnows (*Cyprinidae*), suckers (*Catostomidae*), and drums (*Sciaenidae*) (Galat et al. 1998). Little evidence of reproduction by riverine species trapped in isolated scours was found, and these researchers predicted that those isolated scours would succeed toward a pondlike fish community dominated by bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*) and crappies (*Pomoxis spp.)*.

Hesse (2002) described relative abundance of small fish in the Nebraska reach of the Missouri River between 1970 and 1993 (upstream of Lewis and Clark Lake, downstream of Gavins Point Dam, and in the channelized section). When these areas were again seined in 1998, subsequent to the wet period that began in 1993, relative abundance of small fish in each of these reaches exhibited a substantial increase.

Plains minnows represented 28 percent of the total seine catch in the channelized reach from 1970-1975. They decreased to 2 percent of the total during the period of 1986-1993 but responded to the wet period beginning in 1993 by increasing to 10 percent of the total catch in 1997 (Hesse 2002). Hesse (2002) referenced Fisher's (1962) studies of the mid-1940s as the earliest scientific seine sampling representing the pre-dam and pre-channelization period of the Missouri River; his results indicated that plains minnows comprised 68 percent of the catch at that time.

In comparing moderately altered stretches of the Missouri and lower Yellowstone Rivers to highly altered reaches, Welker (2000) found that small native minnows (*Cyprinidae*) were common in the least altered area (characterized by a high sediment load and a more natural hydrograph), comprising 55 percent of the fish, whereas in more highly altered segments, minnows constituted only between 3 and 27 percent of the fish present. Many native species of *Cyprinidae* and *Catostomidae* found in the least altered segment were not present in the more highly altered reach.

Least terns are thought to select small-sized fishes with narrow body types (Thompson 1997), including shiners (*Notropis* spp.), flathead minnow (*Pimphales promelas*), and gizzard shad (*Dorosoma cepedianum*). Pegg (2000) collected samples from 15 segments of the Lower Yellowstone River and Missouri River during late summer and early fall of 1998 and 1999 to analyze fish community structure as it relates to flow regimes and natural history characteristics. He found a significant difference in fish community composition and abundance between river reaches below Ft. Peck Dam and reaches above Ft. Peck Dam, demonstrated by marked reductions in species richness in all the reaches above the dam. Species found in greater abundance below Gavins Point Dam, tended to exhibit morphologic characteristics, such as elongated body types and narrow caudal fins, which imply better ability to swim for prolonged periods in moderate to fast currents.

Changes in physical structure of many interior rivers, particularly the Missouri and Mississippi Rivers, have resulted in changes to habitat used by least terns and changes to the fish community that they forage upon. The degree to which these changes in forage fish abundance and distribution may have affected tern population trends has not been quantified.

Factors Affecting the Species Rangewide

Habitat Loss and Degradation

The factors discussed in the 2000 Biological Opinion that affect the quantity and quality of least tern nesting habitat continue and are incorporated by reference. In addition, we provide the following updated information. Since 2000, the continued drought over a large portion of the Great Plains has reduced the quality and suitability of nesting habitat in several rivers. The habitat that was created with the high flow period between 1995 and 1997 is now being degraded by the lack of replenishing flow due to the drought.

Nesting Habitat

Least terns on the Arkansas River in Oklahoma also appear to be affected by nesting habitat availability and changes in habitat due to regulated river flows out of Keystone Dam. After scouring flows in 1993 that elevated existing sandbars and created new sandbars, breeding colonies, number of adults observed, number of nests, chicks, and eggs observed, and number of terns fledged all increased the following year. In addition, loss of nests due to flooding declined the following year (Leslie et al. 2000). Leslie et al. (2000) reiterated the call for periodic ($\geq$ 7 years) scouring flows to maintain the quality of nesting habitat available to terns.

Foraging Habitat

The 2000 Biological Opinion discussed the loss of shallow water areas that provide habitat for many fish, including those used as forage by least terns, and a portion of that discussion (at page 196) is included here for clarity:

> "Several studies from the Missouri and other Midwestern rivers have shown the value of shallow water habitat to all life stages of native big river fishes and other river organisms. In general, the literature reports depths of 0-7 ft (0-2.1 m), and velocities less than 2.5 fps (76 cm/s) over sandbars as being preferred main channel and main channel border habitat of big river species such as sauger, channel catfish, shovelnose sturgeon, and blue sucker during all or some of their life history (Nelson 1984, Stauffer 1991). Pallid sturgeon use similar depths and velocities (Liebelt 1998). Those habitats are especially important in the late summer and fall to larval, young-of-the-year, and juvenile life stages of many species.
>
> Construction, operation, and maintenance of the main stem dams and the BSNP have largely eliminated the 0-7 ft (0-2.1 m) depths and velocities less than 2.5 fps from the channelized river by constriction of the channel and imposition of artificially high flows during the normal late summer/fall low-flow period. Table

18, 2000 Biological Opinion illustrates little shallow water (0-5 ft [0-1.5 m] depths), slow velocity (0-2.5 fps) habitat remains in the channelized river relative to historic conditions" (2000 Biological Opinion page 196).

Table 18 of the 2000 Biological Opinion points out:

> "(t)he amount of shallow-water habitat in the pre-development river appears to have been equally distributed throughout the lower river reaches. Historically, an average of over 105 acres/mile of shallow water habitat (0-5 ft [0-1.5 m]) consistently occurred over about 500 mi (805 km) of the lower river. A similar amount of habitat probably occurred in the 199-mi (481-km) reach below Waverly based on a comparison of the percent reduction in channel width from 1890 conditions (Missouri River Commission, 1898) at St. Joseph (RM 463), Waverly (RM 299), and Hermann, MO (RM 90). At all these sites, the former high bank to high bank width has been reduced by 72 to 78 percent.
>
> Continuation of current operations provides only about 24 percent of the shallow water habitat that existed historically below Sioux City. Within the existing channel configuration, operations under the FWOP would provide 5-8 percent of historical habitat acreage. Although these conditions would not be close to historic conditions, they would represent a 100 percent increase over current acreage, which may be significant to the survival of listed species. Furthermore, the data suggest that over 90 percent of the loss of historical shallow water, slow velocity habitat in the lower river is due to the construction, operation, and maintenance of the BSNP."

Further examination of Table 18 of the 2000 Biological Opinion shows that in the Gavins Point reach, a reach used heavily by terns in many years, average daily acres of shallow slow moving habitat per river mile has been reduced to about 60 percent of historical conditions.

The spatial and temporal availability of small fishes, a component of tern foraging habitat, may affect the species rangewide. Changes in the basin and floodplain physiography and channel morphology due to regulation of the river have greatly changed the native fish community composition and ecology (Welker 2000); commercial fish harvests decreased by over 80 percent and many other native fish have declined (Hesse et al. 1989). The annual flow regime determines timing of forage fish availability because many newly spawned fish migrate from the floodplain to the river when the river stage drops, if connectivity exists between the river and the floodplain. Recruitment of small fishes due to this process arising from the spring flood pulse provides forage for predators, including least terns (Tibbs and Galat 1998).

On the Lower Mississippi River, 80 percent of small fishes sampled in aquatic habitats adjacent to least tern nesting colonies consisted of taxa known to spawn in floodplain habitats (Tibbs and Galat 1998). Both the timing of the forage fish production and the initiation of least tern nesting are related to the spring rise in river stage; alteration of the

historic flow regime may impact tern reproductive success by decoupling the timing of peak forage availability from timing of peak reproductive efforts. Particularly where the connections between the river and the floodplain have been reduced or eliminated completely by construction of levees, forage fish production may have been significantly altered. Such a linkage between forage availability and reproductive success has been demonstrated for some gull and tern species (Safina and Burger 1985, Safina et al. 1988, Sydeman et al. 1991, as reported by Tibbs and Galat 1998). In addition, Dugger (1997) demonstrated a link between aspects of least tern reproduction and variation in food availability.

Human Disturbance

Human disturbance factors affecting the least tern from the 2000 Biological Opinion (USFWS 2000) were reviewed and no additional information since that time was found to be added. Therefore, this section is incorporated by reference from the 2000 Biological Opinion.

Pollution and Contaminants

Pollution and contaminants factors affecting the least tern from the 2000 Biological Opinion (USFWS 2000) were reviewed and no additional information since that time was found to be added. Therefore, this section is incorporated by reference from the 2000 Biological Opinion.

Disease

Disease factors for least terns were not specifically addressed in the 2000 Biological Opinon (USFWS 2000). We note here that eleven dead piping plovers were found on the Missouri River in 2003. One of these was suitable for analysis by the U.S. Geological Survey National Wildlife Health Center in Madison, Wisconsin. Preliminary results were positive for West Nile Virus from multiple tissues, although the final report has not been released. Although no dead least terns were found, the potential for least tern deaths as a result of West Nile Virus exists.

Summary

Although not every location is surveyed every year, total numbers of adults rangewide have ranged from a low of 5550 counted in 1997 to 12,305 in 2003 (Table 1). Note that a large portion of this positive rangewide trend is due to increases in numbers of least terns on the lower Mississippi River which have increased from an estimated 3653 in 1992 to a high of to 8082 in 2003 (Table 1).

Although recent counts of least terns (approximately 12,305 terns in 2003) exceed the overall recovery objective of 7,000 birds, the mean number of least terns in all drainage basins identified in the recovery plan (Tern Recovery Plan) do not reach corresponding objectives related to geographic distribution of those birds, nor has each area remained stable for 10 years, as called for in the recovery plan.

Current suitable least tern nesting habitat is anticipated to decline in quantity and suitability as sandbar habitat converts to woody vegetation until or unless scouring flows enhance existing sandbars and creates new sandbars. Foraging habitat has declined from historical levels, and in the Missouri River, changes in fish community composition has occurred.

Although we are unable to conclude precisely what level of production (measured by fledglings/breeding pair) is necessary to ensure population stability or growth, we estimate that the level is between 0.5 and 1.0 fledglings/breeding pair, and we encourage management actions that will increase fledge ratios through benefits to nesting and foraging habitat.

PIPING PLOVER

Species Description

The species description of the piping plover from the 2000 Biological Opinion was reviewed. No further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000).

Historic and Current Rangewide Distribution

The historic and current rangewide distribution of the piping plover from the 2000 Biological Opinion was reviewed. No further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000).

Life History

Reproductive Biology

The basic reproductive biology of the piping plover from the 2000 Biological Opinion was reviewed. No further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000).

Growth and Longevity

The growth and longevity of the piping plover are incorporated by reference from the 2000 Biological Opinion (USFWS 2000) and updated herein with information that has become available since 2000. Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for reader clarity.

> "Current estimates of piping plover survival rates are limited. Root et al. (1992) estimated a mean annual survival rate of 0.664 for adults in the Great Plains population from 1984-1990 using recapture and re-sighting data from plovers in North Dakota."

Larson et al. (2000, 2002) re-examined banding data for the Great Plains piping plovers because of discrepancies between previous adult survival estimates for the Great Plains populations (0.664 from Ryan et al. 1993) and estimates from other regions and closely related species. Larson et al. (2000, 2002) reported mean adult survival was 0.737. Immature survival was 0.318; however, the study indicated true immature survival is probably higher, primarily due to unknown but likely high dispersal rates.

Movements/Dispersal Patterns

Movements/dispersal patterns of the piping plover from the 2000 Biological Opinion was reviewed. No further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000).

Population Status and Trends

Population status and trends of the piping plover are incorporated by reference from the 2000 Biological Opinion (USFWS 2000) and updated herein with information that has become available since 2000. Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for reader clarity.

> "The Service identified the piping plover as a candidate species for addition to the list of threatened and endangered wildlife in December 1982 (47 FR 58454). On January 10, 1986, the Service listed piping plovers on the Great Lakes as endangered, while the remaining Atlantic and Northern Great Plains birds were listed as threatened (50 FR 50726-34). Plovers on migration and in wintering areas were classified as threatened."

Although the piping plover was listed (50 CFR 17.11) as endangered in the Great Lakes and threatened everywhere else it occurs, the Service has indicated that it considers the listed entities to be comprised of three separate breeding populations. Since listing the piping plover, the Service completed two recovery plans that identified recovery goals for three populations: Northern Great Plains, Great Lakes, and Atlantic Coast piping plovers. Further, in September 2002, critical habitat was designated separately for the Northern Great Plains and Great Lakes populations, but not for the Atlantic Coast population, satisfying the requirement (U.S. Fish and Wildlife Service's Consultation Handbook, page 4-36) that notice be given through the *Federal Register* of the Service's intent to make jeopardy determinations on a population that differs from the entity listed in 50 CFR 17.11. Therefore, we have determined that the appropriate entity for the jeopardy analysis for piping plovers in this consultation is the Northern Great Plains population of piping plovers.

> "There are no estimates of historic piping plover population sizes (i.e., populations prior to the initiation of surveys in the early 1980s (USFWS 1988)). Breeding surveys in the early 1980s reported 2,137 to 2,684 adult plovers in the Northern Great Plains/Prairie region, 28 adults in the Great Lakes region, and 1,370 to 1,435 adults along the Atlantic Coast (Haig and Oring 1985)."

> "In 1991, the first International Piping Plover Census was conducted by the Great Lakes & Northern Great Plains and the Atlantic Coast Piping Plover Recovery Teams (U.S.) and the Prairie and Atlantic Canada Piping Plover Recovery Teams (Canada) (Haig and Plissner 1993). That was an important step for surveying piping plovers on breeding and wintering grounds because census methods and timing were similar in all areas. Results of the 1991 breeding ground surveys were: 1,975 adults in the Atlantic Coast region, 40 adults in the Great Lakes region, and 3,467 adults in the northern Great Plains/Prairie region (Haig and Plissner 1993). On the wintering grounds 3,451 plovers were recorded, with the majority in Texas (Haig and Plissner 1993). A second International Census took place in 1996. Results of the 1996 breeding ground surveys were: 2,581 adults in the Atlantic Coast region, 48 adults in the Great Lakes region, and 3,284 adults in the Northern Great Plains region (Plissner and Haig 1997). On the wintering grounds, 2,515 plovers were counted (Plissner and Haig 1997)."

The third International Census was done in 2001 (Ferland and Haig 2002). The census enumerated 5,945 adult piping plovers. From the U.S. Northern Great Plains/Prairie Canada, 2,953 individuals were counted. The Atlantic Coast (including Canada) accounted for 2,920 individuals. The Great Lakes reported 72 individuals. On the wintering grounds, 2,389 piping plovers were located. Table 3 compares breeding survey results among 1991, 1996, and 2001 for the U.S. Northern Great Plains/Prairie Canada piping plovers.

Table 3. International Piping Plover Census Results 1991-2001

Location	Adults 1991	Adults 1996	Adults 2001	Trends 1991-1996	Trends 1996-2001	Trends 1991-2001
U.S. Northern Great Plains/ Prairie Canada	3469	3286	2953	-5.3 %	-10.1 %	-14.9 %

Between 1991 and 2001, the International Census showed that 14.9 percent fewer birds were found in the U.S. Northern Great Plains/Prairie Canada

In 2001, of the 2,953 individuals (Table 3) counted in the U.S. Northern Great Plains/ Prairie Canada, 972 birds (32.9 percent) were found in Prairie Canada and 1981 (67.1 percent) (Table 4) were found 4in the U.S. Of the U.S. birds, 1,048 (52.9 percent) were counted on the Missouri River and 933 (47.1 percent) were found elsewhere in the Northern Great Plains. When considering the entire U.S. Northern Great Plains/Prairie Canada population, 35.4 percent of the birds were found along the Missouri River.

In 1996, of the 3,286 individuals counted in the U.S. Northern Great Plains/Prairie Canada, 1,687 (51.3 percent) birds were found in Prairie Canada and 1,599 (48.7 percent) piping plovers were found in the U.S. Of the U.S. birds, 187 (11.7 percent) were

censused on the Missouri River and 1,412 (88.3 percent) were found elsewhere. When considering the entire U.S. Northern Great Plains/Prairie Canada population, 5.3 percent of the birds were found along the Missouri River.

In 1991, of the 3,469 individuals (Table 3) counted in 1991 in the U.S. Northern Great Plains/Prairie Canada, 1437 birds (41.4 percent) were found in Prairie Canada and 2032 (58.6 percent) were found in the U.S. Of the U.S. birds, 625 (30.7 percent) were counted on the Missouri River and 1,407 (69.3 percent) were found elsewhere in the Northern Great Plains. When considering the entire U.S. Northern Great Plains/Prairie Canada population, 18.3 percent of the birds were found along the Missouri River.

In the years of census, the use of the Missouri River by piping plovers both in the U.S. and the U.S. and Canada varies from year to year. Use rangewide varies between 5 and 35 percent, while use by birds in the U.S. ranges between 12 and 53 percent. These variations reflect the variation in habitat conditions in the Missouri River and Prairie regions.

Table 4 compares breeding ground survey results among 1991, 1996, and 2001 for the U.S. Northern Great Plains (NGP US), U.S. Northern Great Plains-Missouri River (NGP US MO. R.), U.S. Northern Great Plains-Non-Missouri River (NGP US Non-MO R.), and U.S. Northern Great Plains/Prairie Canada Non-Missouri River (NGP/PC Non-MO R.).

Table 4. Geographic Comparison of International Piping Plover Census Data 1991-2001

Location	Adults 1991	Adults 1996	Adults 2001	Trends 1991-1996	Trends 1996-2001	Trends 1991-2001
NGP US	2032	1599	1981	-21.3%	+23.9%	-2.5%
NGP US MO. R.	625	187	1048	-70.1%	+460.4%	+67.7%
NGP US Non-MO. R.	1407	1412	933	+0.03%	-33.9%	-33.6%
NGP/PC Non-MO. R.	2844	3099	1905	+9.0%	-38.5%	-33.0%

Survey results show that between 1991 and 2001, piping plover populations in the Northern Great Plains have declined by 2.5 percent; populations in Prairie Canada had 32.4 percent fewer birds during that same time period (Ferland and Haig 2002). However, about 67.7 percent more plovers have been found along the Missouri River in that time period; non-Missouri River populations both in the U.S. and overall in the U.S. and Canada report 33 percent fewer birds. Additional survey data from the Missouri River in 2002 and 2003 (USACE unpubl. data) counted 1132 piping plovers in 2002 and 1338 in 2003.

Piping plover populations are influenced by factors such as changing habitat conditions (e.g., drought, flooding), the species' mobility, and inconsistent census efforts. Population fluctuations are prominent in prairie habitat because precipitation and drought can significantly influence annual habitat availability (Goossen 2002). On an alkali lake in North Dakota, for example, the number of nesting pairs increased three-to-four fold in three years when precipitation filled the lake basin (Murphy et al. 2001). Populations on the lake were highest in 1996-1997 when numbers of piping plovers on the Missouri River were at extreme lows.

Larson et al. (2000) conducted an updated analysis of piping plover populations in the Great Plains. They concluded that previous analyses (Ryan et al. 1993, Plissner and Haig 2000) of population persistence for Great Plains piping plovers may have been overly pessimistic based on their (Larson et al. 2000) revised survival estimate for adult piping plovers (0.737 versus 0.66). These authors (Larson et al. 2000) concluded that the likelihood of recovering the Great Plains population of piping plovers is greater than previously thought. A renewal of current downward trends, however may depend on increased efforts to improve reproduction success (Larson et al. 2000). Due to the evident sensitivity of population growth levels to adult mortality, however, these efforts must be adjusted locally to minimize predation of incubating adults (Murphy et al. 2003).

Recovery Goals

The Service approved a recovery plan for the Great Lakes and Northern Great Plains Piping Plover in 1988 (USFWS 1988). A revised recovery plan was drafted in 1994; however, that document was never completed, so cannot be considered an official Service document for the purpose of recovery goals. Recovery goals were established for Northern Great Plains Piping Plover populations in the 1988 plan. The overall goal was to increase the number of birds in the U.S. Northern Great Plains to 1300 pairs.

The 1300 U.S. pairs are to be maintained in the distribution below for at least 15 years:

Montana – 60 pairs
North Dakota – 650 pairs
    Missouri River – 100 pairs
    Missouri Coteau – 550 pairs
South Dakota – 350 pairs (including 250 pairs shared with Nebraska on the Missouri River)
    Missouri River below Gavin's Point – 250 pairs (shared with Nebraska)
    Other Missouri River sites – 75 pairs
    Other sites – 25 pairs
Nebraska – 465 pairs (including 250 pairs on the Missouri River shared with South Dakota)
    Platte River – 140 pairs
    Niobrara River – 50 pairs
    Missouri River – 250 pairs
    Loup River system – 25 pairs

Minnesota – 25 pairs at Lake of the Woods

The above recovery goal includes 425 pairs of adult piping plovers to be maintained on the Missouri River over a period of 15 years. In 2001, the Missouri River exceeded this recovery goal for the first time. The recovery goal on the Missouri River was also exceeded in 2002 and 2003.

The Canadian Recovery Objective for their prairie population is 1626 adults (813 pairs) maintained over two additional international censuses with no net loss of habitat due to human action and to increase and maintain a median chick fledging rate of greater than 1.25 chicks/pair/year (Goossen 2002).

Habitat and Food Requirements

Habitat Characteristics

Habitat characteristics of the piping plover are incorporated by reference from the 2000 Biological Opinion (USFWS 2000) and updated herein with information that has become available since 2000. Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for reader clarity.

> "Piping plovers nesting on the Missouri, Platte, Niobrara, Yellowstone and other rivers use reservoir beaches and large dry, barren sandbars in wide, open channel beds. Vegetative cover on nesting islands is usually less than 25 percent (Ziewitz et al. 1992). Twenty-eight Platte River sandbars, occupied by nesting piping plovers, averaged 938 ft (286 m) in length and 189 ft (55 m) in width (Faanes 1983). Vegetative cover on those sandbars averaged 25.4 percent. The optimum range for vegetative cover on nesting habitat has been estimated at 0 to 10 percent (Armbruster 1986). Schwalbach (1988) found 89 percent of the plovers nesting in areas of less than 5 percent vegetative cover. On the Missouri River, average vegetation height ranged from 2-11 in (6 cm to 29 cm) (Schwalbach 1988; P. Mayer, pers. comm.). Schwalbach (1988) found that the majority of the plovers (63 percent) nested in areas where vegetation height was less than 4 in (10 cm). Average elevation of nests (terns and plovers) above river level range from 7.4 in (19 cm) below Gavins Point Dam to 12 in (30 cm) below Garrison Dam (Schwalbach 1988, Dirks 1990, P. Mayer, pers. comm.. 1994). Schwalbach (1988) and Ziewitz et al. (1992) suggest that birds select a higher nest site when available and sites away from the water's edge. Those conditions provide the essential requirements of wide horizontal visibility, protection from terrestrial predators, isolation from human disturbance, and sufficient protection from rises in river levels."

> "Open, wet, sandy areas provide feeding habitat for plovers on river systems and throughout most of the birds' nesting range. Piping plovers feed primarily on exposed substrates by pecking for invertebrates at or just below the surface (Cairns 1977, Whyte 1985)."

Critical habitat for the piping plover was designated in September 2002 (67 FR 57638). That designation identified physical and biological features (primary constituent elements) that are essential to the conservation of the species. According to the final rule for critical habitat:

> "The one overriding primary constituent element (biological) that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat. Without this biological process the physical components of the primary constituent elements would not be able to develop. These processes develop a mosaic of habitats on the landscape that provide the essential combination of prey, forage, nesting, brooding and chick-rearing areas. The annual, seasonal, daily, and even hourly availability of the habitat patches is dependent on local weather, hydrological conditions and cycles, and geological processes.
>
> "The biological primary constituent element, i.e., dynamic ecological processes, creates different physical primary constituent elements on the landscape. These physical primary constituent elements exist on different habitat types found in the northern Great Plains, including mixosaline to hypersaline wetlands (Cowardin et al. 1979), rivers, reservoirs, and inland lakes. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:
>
> "On prairie alkali lakes and wetlands, the physical primary constituent elements include – (1) Shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats: (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 299 ft (61m) above the high water mark of the alkali lake or wetland.
>
> "On rivers the physical primary constituent elements include – sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.
>
> "On reservoirs the physical primary constituent elements include – sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies."
>
> "It is the interactive nature of the biological primary constituent element or the dynamic ecological processes that create the physical primary constituent elements. On the northern Great Plains, the suitability of beaches, sandbars, shoreline, and flats as piping plover habitat types also is dependent on a dynamic hydrological system of wet-to-dry cycles. Habitat area, abundance and availability of insect foods, brood and nesting cover, and lack of vegetation are all linked to these water cycles. On rivers, one site becomes flooded and erodes away as another is created. More importantly the high flows on rivers create a

complex of habitats for feeding, nesting, and brooding (Pavelka 2002 and Vander Lee et al. 2002). This dynamic nature of rivers is important to long-term habitat creation and maintenance for piping plovers. On alkali lakes, the complex of different wetland types is especially important for providing areas for plovers feeding, nesting, and brooding in all years, as site availability cannot be predicted or selected at a given time, due to varying water cycles."

Food and Feeding Habits

Food and feeding habits of the piping plover from the 2000 Biological Opinion were reviewed. No further information since that time was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000). Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for reader clarity.

> "Little is known about the diet of piping plovers or their foraging behavior during any phase of the annual cycle (breeding, migration, wintering), largely because the species' status and sensitivity to disturbance have precluded the collection of birds for stomach contents analysis."
>
> "Along the Platte River in central Nebraska, piping plovers prey primarily on beetles and small soft-bodied invertebrates from dry substrates and from along the waterline (Lingle 1988). Piping plovers forage by picking food items off of the surface or by probing in soft substrates."

Rangewide Distribution and Abundance of Habitat

The rangewide distribution and abundance of habitat of the piping plover from the 2000 Biological Opinion were reviewed. No further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000). Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for reader clarity.

> "Piping plover habitat remains distributed across much of the species' historic range, although in a much reduced and fragmented condition."
>
> "Northern Great Plains piping plover habitat along the Missouri River has been reduced by over 80 percent by the construction of dams and the creation and maintenance of a commercial shipping channel. At a minimum, over 9,500 ac (3,847 ha) of sandbar (excluding vegetated areas) existed prior to impoundment of main stem dams above Gavins Point Dam (USFWS 1984). While the reach of river below Gavins Point Dam still exhibits its somewhat free-flowing state, approximately 7,800 ac (3,159 ha) of sandbar habitat has been lost between 1956 and 1975 (Schumulbach et al.1981). Gavins Point Dam closed in 1955. In 1981, Schmulbach et al. (1981) reported 2,200 ac (891 ha) of sandbar remaining along the 50-mile (80 km) stretch of river below Gavins Point Dam that is designated as the Missouri National Recreation Area."

Factors Affecting the Species Rangewide

Habitat Loss and Degradation

Habitat loss and degradation as factors affecting the piping plover rangewide from the 2000 Biological Opinion were reviewed. No further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000). Pertinent sections from the 2000 Biological Opinion are directly quoted in this amendment for reader clarity.

> "Reservoirs, river channelization, and modified river flows have eliminated sandbar nesting habitat along hundreds of kilometers of the Missouri and Platte rivers in the Dakotas, Iowa, and Nebraska. Diversion of peak flows that scour river sandbars has resulted in vegetation encroachment."
>
> "In addition, river main stem reservoirs now trap much of the sediment load resulting in less aggradation and more degradation of the river bed and subsequently less sandbar nesting habitat."

The 2001 International Piping Plover Survey (Ferland and Haig 2002) reflected that in many places across Prairie Canada, extensive and ongoing drought has resulted in complete drying of piping plover habitat and encroachment of vegetation. In addition, at other sites in Prairie Canada, severe flooding has taken a toll on previously good habitat.

Goossen et al. (2002) indentified several factors influencing the status of the piping plover in Canada, including water management activities. Stabilizing water levels on Lake Manitoba, Canada, has threatened piping plover nesting habitat by allowing vegetation encroachment onto beaches. Moreover, water management at Lake Diefenbaker, Canada, threatens one of the larger concentrations of piping plovers in North America. In Canada, a widespread problem is the disturbance of beaches by cattle. The disturbed beach substrate becomes more prone to vegetation growth, thus reducing or eliminating its value for piping plover nesting habitat. However, cattle grazing after the breeding season may actually reduce vegetation growth if beach substrates are firm (Goossen et al. 2002).

Human Disturbance

Human disturbance factors affecting the piping plover from the 2000 Biological Opinion were reviewed. In addition, no further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000).

Pollution/Contaminants

Pollution/contaminants affecting the piping plover from the 2000 Biological Opinion were reviewed. In addition, no further information was found that needed to be added to this amendment. This section is, therefore, incorporated by reference from the 2000 Biological Opinion (USFWS 2000).

Predation

An important limiting factor in the piping plover's breeding range is predation. Known or suspected predators of piping plover eggs and/or chicks include coyotes, raccoons, dogs, red fox, mink, ground squirrels, peregrine falcon, short-eared owls, merlins, crows, magpies, American kestrels, great horned owls, and gulls. (Goossen et al. 2002).

Summary

Northern Great Plains Piping Plovers are found in prairie habitats in the U.S. and Canada, as well as along the Missouri and other rivers in the United States. International census data in 1991, 1996 and 2001 revealed an estimated overall decline of 14.9 percent in the U.S. Northern Great Plains/Prairie Canada piping plover population. For only the U.S. Northern Great Plains piping plovers, for the same time period, the decline was 2.5 percent. However, on the Missouri River, numbers of piping plovers increased by 67.7 percent between 1991 and 2001 and by 460 percent from 1996 though 2001. In this dynamic ecosystem, breeding piping plovers move around to different habitat types from year-to-year depending on habitat conditions.

PALLID STURGEON

Introduction

The pallid sturgeon is native to the Missouri and Mississippi Rivers and is adapted to the pre-development habitat conditions that existed in these large rivers. These conditions can generally be described as large, free-flowing, warmwater, turbid habitats with a diverse assemblage of physical attributes that were in a constant state of change (USFWS 1993). Floodplains, backwaters, chutes, sloughs, islands, sandbars and main channel waters formed the large-river ecosystem that provided the macrohabitat requirements for all life stages of pallid sturgeon and other native large-river fish. Today, these habitats and much of the once functioning ecosystem has been changed by human developments.

Little is known of the reproductive biology of this species. Sexual maturity for males is estimated to be 7 to 9 years, with 2 to 3 year intervals lapsing between spawning events. Females are estimated to reach sexual maturity in 15 to 20 years, with 3 to 10 year intervals between spawning events (Keenlyne and Jenkins 1993). The length of time between spawning events depends partially on the quality and quantity of food available in their natural habitat (Keenlyne and Jenkins 1993). The fecundity of a given female may vary greatly by individual, with most spawning only a few times during a normal life span (Duffy et al. 1996). Spawning appears to be a function of floodflows (increased discharge and velocity) that generate spawning migrations, temperature and interaction with other pallid sturgeon (Steve Krentz, USFWS, pers. comm.). The influence of turbidity and conductivity is unknown (Steve Krentz, USFWS, pers. comm.). Pallid sturgeon have adhesive eggs, therefore, spawning is thought to occur over hard substrates of gravel or cobble accompanied by moderate flow. At hatching, young pallid sturgeon begin a migration period that may continue for up to 13 days (Kynard et al. 1998).

Suitable habitat and forage food must be available after yolk-sac absorption during the initial stages of larvae development.

Pallid sturgeon feed on benthic macroinvertebrates and drifting invertebrates during early life stages (juveniles) (Modde and Schmulbach 1977, Carlson et al. 1985). However, older juvenile and adult pallid sturgeon are more piscivorous than the shovelnose sturgeon and switch to a diet composed of a greater proportion of fish as they mature.

Species Description

The species description of the pallid sturgeon from the 2000 Biological Opinion (USFWS 2000) was reviewed and no additional information since that time was found to be added. Therefore, this section is incorporated by reference from the 2000 Biological Opinion.

Genetics

A number of genetic studies of the genus *Scaphirhynchus* have been completed since 2000. These studies have been necessary due to questions concerning whether pallid, Alabama and shovelnose sturgeon represent separate species. The following briefly summarizes the results of each of these studies completed since 2000.

Campton et al. (2000) concluded that mitochondrial DNA (mtDNA) analyses provide the first molecular genetic evidence for distinguishing *Scaphirhynchus* species. The results of this study found genetic differences between shovelnose sturgeon and pallid sturgeon in the northern part of their range of natural sympatry (Upper Missouri River), as the two species did not share any haplotypes in this geographic area. Only frequency differences among shared haplotypes distinguished the two species in the southern range of natural sympatry (Atchafalaya River) (Campton et al. 2000). The genetic distances between northern and southern locations for each species were nearly as large as the distances between species (Campton et al. 2000) (e.g., the genetic distance between pallid sturgeon at the northern part of its range and at the southern part of its range is nearly as large as the genetic distance between pallid sturgeon and shovelnose sturgeon where they occur together). This is consistent with several hypotheses concerning hybridization between shovelnose sturgeon and pallid sturgeon in the more southern portions of their range but not in the Upper Missouri River (Campton et al. 2000). The mtDNA results indicate significant reproductive isolation between pallid and shovelnose sturgeon in areas of natural sympatry (Campton et al. 2000).

McQuown et al. (2000) developed a microsatellite database for sturgeon species to be used in genetic studies of various sturgeon species, including *Scaphirhynchus*. With the use of microsatellites, they found a high degree of polymorphism within each species.

Tranah et al. (2001) conducted a study utilizing five nuclear DNA microsatellite loci to measure genetic variability within and among populations of pallid and shovelnose sturgeon at the northern and southern extremes of their sympatric ranges to determine if genetic variation within the two species exhibits patterns of reproductive isolation. Their

results indicate that pallid sturgeon and shovelnose sturgeon are genetically distinct at three sympatric locations. Pallid sturgeon in the Upper Missouri River (2 populations) were genetically distinct from pallid sturgeon in the Atchafalaya River, suggesting that northern and southern populations are reproductively isolated (Tranah et al. 2001). Furthermore, shovelnose sturgeon from three populations were genetically indistinguishable and showed no population structure (Tranah et al. 2001). Tranah (2001) noted that, based on microsatellite and mtDNA data, pallid and shovelnose sturgeon from two Upper Missouri River sites and the Atchafalaya River are reproductively isolated. Tranah et al. (2001) also noted that sturgeon from the Atchafalaya River that were morphologically determined to be hybrids were genetically distinct from pallid sturgeon but were not distinguishable from shovelnose sturgeon (Tranah et al. 2001). However, Tranah (2001) states that morphologically intermediate Atchafalaya River sturgeon appeared to be genetically intermediate to pallid and shovelnose sturgeon, suggesting these individuals were possibly hybrids.

Researchers are currently working with the microsatellite database to further determine the genetic structure of both shovelnose and pallid sturgeon throughout their range and to determine the degree of hybridization between shovelnose and pallid sturgeon in the southern portion of their range (Kuhajda 2002, Heist and Heidinger 2002). The results of these studies will also be utilized to determine the degree of agreement between various morphological and meristic indices in identifying pallid and shovelnose sturgeon. To date, microsatellite genetic analysis of pallid and shovelnose sturgeon in the Middle Mississippi River support separate gene pools for the two species (Heist and Schrey 2003).

Simons et al. (2001) conducted a phylogenetics study of the genus *Scaphirhynchus* based on mtDNA sequencing. They could not establish hierarchical relationships based on mtDNA that are consistent with morphological data (Simons et al. 2001). However, these results are consistent with the hypothesis of a low rate of evolution between *Scaphirhynchus* species and also reflects recent hybridization between shovelnose and pallid sturgeon (Simons et al. 2001). They state that this hybridization is probably due to habitat degradation but provide no supporting information as to the specific mechanism or causes of hybridization between the two species.

Historic and Current Rangewide Distribution

The historic distribution of pallid sturgeon as described by Bailey and Cross (1954) primarily included the Missouri River, the Mississippi River from the mouth of the Missouri River to the Gulf of Mexico and the lower reaches of the Platte, Kansas and Yellowstone Rivers. Records also indicated pallid sturgeon were present in the Mississippi River at Grafton, Illinois, (Forbes and Richardson 1905) and as far north as Keokuk, Iowa (Bailey and Cross 1954, Coker 1930). Today, the distribution includes the Missouri River, Middle and Lower Mississippi River, the Atchafalaya River and the lower reaches of the Yellowstone, Platte, Kansas, St Francis and Big Sunflower Rivers (Constant et al. 1997). Of the total range of approximately 3,515 river miles, 28 percent

is impounded, 21 percent has been affected by upstream impoundments (altered hydrograph, temperature and sediment budget) and 51 percent is channelized (Keenlyne1989). The amount of impounded river miles fluctuates from year to year depending on the amount of inflow into the reservoirs (i.e., drought or flood conditions) and the Corps' operations. The affected channelized river miles of the Lower Missouri River and Middle Mississippi River are also affected by operation and maintenance of upstream impoundments, especially affecting sediment transport. The altered hydrograph and temperature effects are attenuated as the river progresses downstream (Robb Jacobson, USGS, pers. comm.). The result is a highly fragmented range of habitats with varying suitability for pallid sturgeon. Due to intensive study effort in recent years, catch records have increased indicating pallid sturgeon remain scarce but are widely distributed throughout their range.

Life History

Reproductive Biology

Information regarding pallid sturgeon reproduction and spawning remain scarce. Much of what has been learned is based on sampling of larval sturgeon, most of which are shovelnose sturgeon. Based on repeated collections of larval sturgeon in the Middle Mississippi River, Hrabik (2002) surmised that sturgeon (shovelnose and pallid) are spawning at the head of islands or other locations upstream and being transported as larvae to eddy pools along island shores and to the downstream tips of islands which may provide refugia for the developing fish. Large amounts of detritus have been collected along with the larval sturgeon (Hrabik 2002). Hrabik (2002) collected larval sturgeon in the Missouri River in September 2001. The collection of larval sturgeon late in the spawning season suggests that it is possible that spawning occurred twice in the Missouri River because sturgeon are pluriparous (multiple spawnings or ovulations) (Hrabik 2002).

Age and Growth

Gardner (2001) attempted to capture hatchery reared pallid sturgeon by drifting small mesh, gill nets and trammel nets and trawling. A total of four hatchery reared pallid sturgeon were captured, all in trammel nets. He notes that no pallid sturgeon were captured using the trawl probably because, at age 3, they were strong enough swimmers to avoid being captured. Gardner (2001) also compared the growth rates of recaptured hatchery reared sturgeon collected in the Missouri River with the growth rates of captive 1997 year-class pallid sturgeon held at Gavins Point National Fish Hatchery. He noted that released pallid sturgeon are growing at ½ the maximum rate observed in the hatchery after 2 years in the wild.

Yerk and Baxter (2001) were unable to quantify growth rates of the three hatchery reared fish they captured in 2000 because the length and weight data were not recorded on these fish when released. The three recaptured pallids averaged 357-mm fork length (FL). However, they compared the size of these fish with age-1 pallid sturgeon stocked in 2000 that averaged 353-mm fork length (FL) at the time of release. They state that the small size of the age-3 hatchery reared pallid sturgeon may possibly indicate minimal growth

since release in 1998, assuming they were stocked at a similar size as fish in 2000. They note that this compares favorably with the findings of Liebelt (2000) in which three 1997 year class hatchery reared pallid sturgeon captured in 1999 averaged 362-mm FL.

Kapuscinski and Baxter (2003) summarize the second year results of a 5 year study to investigate pallid sturgeon recovery efforts in Recovery Priority Management Area #2 (RPMA#2) (USFWS 1993) in the Upper Missouri River. One of the objectives of their study is to evaluate the progress of hatchery-reared pallid sturgeon released in RPMA#2. They currently do not have enough recaptures of hatchery reared pallid sturgeon to quantify their survival, growth, condition, movements or habitat use and selection (Kapuscinski and Baxter 2003). However, in 2002, Kapuscinski and Baxter (2003) recaptured a total of six hatchery reared pallid sturgeon. They note that 2 of these age-3 fish grew 34- and 65-mm, respectively, since being released.

Movements

Kynard et al. (2002) conducted laboratory studies on the ontogenetic behavior of free embryos and larvae of pallid and shovelnose sturgeon. They noted the two species used different methods to travel the same distance. The peak movement rate of pallid sturgeon yolk-sac embryos was only one-half the peak rate of shovelnose sturgeon, but pallid sturgeon continued at the lower rate for twice as long. In addition, free-swimming pallid sturgeon larvae were diurnal while shovelnose sturgeon larvae were nocturnal (Kynard et al. 2002).

Upper Missouri River (river segment 2, as identified in the 2000 Biological Opinion) - King and Wilson (2002, 2002) summarized the results of a Post Spawn Pallid Sturgeon Telemetry Study. The purposes of this study were to monitor post spawn migrational movements of pallid sturgeon to help identify spawning areas, to determine pallid sturgeon response to "Spring Test Flows" out of Fort Peck Dam and to evaluate reproductive stages of known post spawn females. The 2001 field season was considered a "pilot phase" of the project. Fourteen of 15 study fish were relocated in 2001 with the majority of these fish staying within the lower nine miles of the Yellowstone River (King and Wilson 2002). Three female pallid sturgeon accounted for 9 of 10 observations of study fish in the Missouri River above the confluence with the Yellowstone River (King and Wilson 2002).

Middle Missouri River (river segments 8 & 9) - Stancill (2001) reported the results of a telemetry study to track movement patterns and habitat use of pallid sturgeon in the Missouri River below Fort Randall Dam utilizing 1997 year class juvenile sturgeon from Gavins Point National Fish Hatchery. The sturgeon exhibited a pattern of moving upstream in the spring and dispersing throughout the system in the fall, which suggested migratory behavior. However, since the sturgeon were immature, it is assumed the fish are not moving for spawning purposes, but may be associated with flows from dam operations (Stancill 2001).

Lower Missouri River (river segments 10 to 15) - DeLonay and Little (2002) found that pallid sturgeon exhibited the ability to travel long distances in relatively short periods of

time. They recorded distances greater than 40 km/day downstream and greater than 25 km/day upstream noting that extreme movements occurred during flow events in spring and late fall. The sturgeon captured and released in the spring showed a strong tendency towards upstream movement while sturgeon released in the fall or winter moved downstream (DeLonay and Little 2002). DeLonay and Little (2002) noted that data from their study should be interpreted with caution as nearly all the fish used in the study were translocated fish and may have been initially disoriented by capture, transport, extended holding periods and release into unfamiliar surroundings.

DeLonay and Little (2002) wrote the following:

> "Some data suggests the possibility of lengthy and seasonal movements indicating that sturgeon respond to environmental variables associated with seasonal changes in physical habitat. Significant movement by these fish also indicates that the species is mobile and able to take advantage of discrete habitat rehabilitation and mitigation projects located at intermediate intervals along the length of the river. Data indicate that sturgeon may respond favorably to modifications to channel morphology that emphasizes diversity and spatial heterogeneity of habitat patches and complexity of bottom contour (DeLonay and Little 2002)."

Middle Mississippi River (Upper Mississippi River Miles 196.0 to 0.0) - The mean home range of study sturgeon in the ongoing telemetry study by Southern Illinois University at Carbondale (SIUC) (Sheehan et al. 2002) was 18.0 miles ranging from 0.1 to 72.2 miles. These observed home ranges represent the minimum range occupied since the fish may have moved in and out of the observed ranges between consecutive tracking trips (Sheehan et al. 2002). Six study fish were never relocated and seven study fish were relocated fewer than two times. These fish may have moved outside the study area, remaining in inaccessible areas or having died, therefore, observed home range data should be interpreted with care (Sheehan et al. 2002).

Sheehan et al. (2002) did observe some seasonal trends in movements of pallid sturgeon. Movements of study fish during the spring and summer months (March through July) were variable, with a few large movements observed in both the downstream and upstream direction (Sheehan et al. 2002). During July through October (late summer and fall months), pallid sturgeon generally moved upstream, while during December through March (winter months) pallid sturgeon appeared to slowly move downstream. Sheehan et al. (2002) noted that seasonal movement patterns observed in pallid sturgeon appear to be affected by discharge, temperature or both. They found that during periods of low discharge and low temperature (winter) the study sturgeon appeared to move downstream. During periods of high discharge (spring and summer) study sturgeon movements were highly variable with large movements taking place. During periods of mid-level, decreasing discharges (late summer and fall) study sturgeon tended to move upstream (Sheehan et al. 2002).

Population Status and Trends

Upper Missouri River (river segments 1 to 3) - Duffy et al. (1996) reported that mark and recapture data estimated 50 to 100 adult pallid sturgeon remain in the Missouri River above Fort Peck Dam in Montana RPMA #1 and between 200 and 300 adult pallid sturgeon remain between Garrison Dam in North Dakota and Fort Peck Dam, which also includes the Yellowstone River (RPMA#2). More recently, the Upper Basin Recovery Work Group estimate that fewer than the original estimate of pallid sturgeon still remain, leaving approximately 30 – 50 adult pallid sturgeon in RPMA#1 and between 89 and 236 adult pallid sturgeon in RPMA#2 (Kapuscinski 2003).

The pallid sturgeon sub-population in this river reach is aging and declining in status. This population is estimated at 151 individuals with 95 percent confidence intervals of 89 to 236 individuals (Kapuscinski 2003). This is down from an estimated 166 individuals in 2002 and 178 individuals in 2001. Kapuscinski (2003) estimates that this population of wild pallid sturgeon will be extinct by 2018 based on trend data collected for the period 1991-2003. The Service has interpreted Kapuscinski's conclusion of extinction to mean that this sub-population would be extirpated by 2018.

It should be noted that Kapusinski (2003) compensated for certain assumptions that are necessary for a valid outcome from the original method used to estimate population size (Schnable mark-recapture). Certain assumptions for a valid outcome in the original analysis, which were found to be incorrect, leave insufficient data to inform the present analysis. These include the rate at which tags are shed and the uniformity of effort expended to collect fish. These assumptions result in an overestimation and underestimation, respectively. An additional assumption concerning the rate of mortality during the study period was also found to be incorrect. The original analysis assumed no mortality during the study period. Kapusinski (2003) provided an estimate of natural mortality (10 percent) and subtracted known marked individuals that died during the study. Incorporating these into the analysis to address the mortality assumption resulted in a slightly lower abundance estimate than the estimate obtained from the original analysis.

The Montana Endangered Fishes Program has been evaluating the pallid sturgeon reintroduction program in the 168-mile reach of the Missouri River above Ft. Peck Reservoir (RPMA#1) since 1998 when 758 hatchery reared pallid sturgeon were released in this area (Gardner 2001). Three hatchery reared pallid sturgeon were recaptured in 1998, 3 in 1999 and 5 in 2000 (Gardner 2001). Gardner (2001) also noted angler reports of catching pallid sturgeon while bait fishing, totaling one adult and two juveniles.

Krentz (2000) reported capturing 23 pallid sturgeon in 2000 in RPMA#2 at the confluence of the Yellowstone and Missouri Rivers. These fish were primarily collected to obtain broodstock for propagation efforts. Krentz calculated catch rates for the period from 1998 to 2000. The catch-per-unit-effort (CPUE) for pallid sturgeon was 0.62/hour drifting in 1998, 0.41/hour drifting in 1999 and 1.66/hour drifting in 2000. The CPUE for pallid sturgeon was 1.16/hour drifting in 2001 and 0.80/hour drifting in 2002 (Krentz et al. 2002). However, Krentz (2000) stated that caution should be used in utilizing this

information for any analysis of relative abundance as the sampling was not random and productive habitats were targeted.

Krentz (2000) also determined average length and relative weights of pallid sturgeon for the period 1990 to 2000. The relative weights have remained fairly constant for the past eight years ranging from 83 Wr to 115 Wr with an average of 100 Wr, indicating the pallid sturgeon population is generally in good condition (Krentz 2000). Length frequencies were also calculated for adult pallid sturgeon captured from 1990 to 2000. Occasionally smaller fish are captured, but these are rare. Recruitment is lacking in RPMA#2 (Krentz 2000).

Yerk and Baxter (2001) reported capturing 17 adult pallid sturgeon in RPMA#2 during 2000. Eight of the adults were untagged fish. They reported that the smallest individual captured was likely a pallid/shovelnose sturgeon hybrid based on its character index value (346.1). Fifteen of these adults were captured in April at the confluence of the Missouri and Yellowstone Rivers. Yerk and Baxter (2001) also reported recapture of three hatchery reared pallid sturgeon.

Kapuscinski and Baxter (2003) summarized the second year results of a 5 year study to investigate pallid sturgeon recovery efforts in RPMA #2. During 2002, they captured 15 adult pallid sturgeon, however, only 3 of these adults were untagged individuals. They noted that the recapture rate (80 percent) was very high compared to previous years (53 percent in 2000 and 2001). Eleven of the 15 adult pallid sturgeon were captured during spring at the confluence of the Missouri and Yellowstone Rivers. The CPUE for pallid sturgeon averaged 0.18 per net drifted and 1.37 per drift hour. This compares to the CPUE of 0.50 per net drifted for 2001 (Yerk and Baxter 2000) and 1.67 per drift hour reported by Krentz (2000). In addition, they captured a total of 6 hatchery reared pallid sturgeon. They reported a catch rate for hatchery reared pallid sturgeon captured in drifted trammel nets of 0.1165/hr compared to 16.19/hr for shovelnose sturgeon (Kapuscinski and Baxter 2003).

Middle Missouri River (river segments 4 to 9) – Sport fishers have reported up to five pallid sturgeon catches per year on the Missouri River between the headwaters of Oahe Reservoir in North Dakota and Garrison Dam; however, no catches have been reported since 2002. Occasional catches were reported from the riverine reach above Gavins Point Dam to the Fort Randall Dam, suggesting that perhaps as many as 25 to 50 fish remain in each of these areas. No catches of adults have been reported since 1992. A small population also existed between Oahe Dam and the Big Bend Dam on the Missouri River in South Dakota with perhaps 50 to 100 fish remaining in the upper few miles of the riverine section above the headwaters of Lake Sharpe; however, no catches have been reported since 2001 (Steve Krentz, USFWS, pers. comm.).

Lower Missouri River (river segments 10 to 15) - Recent records of the pallid sturgeon in the Lower Missouri River from Gavins Point Dam (river mile 811.1) to the mouth of the Platte River (river mile 595.5) are rare. According to the Service's pallid sturgeon database a total of 20 pallid sturgeon have been reported in this reach. Eight of these fish

were reported for the unchannelized reach from Gavins Point Dam to Ponca, Nebraska (river mile 753.0). Thirteen of these records were reported prior to 1990. Seven pallid sturgeon have been reported since listing of the species in 1990. The Nebraska Game and Parks Commission has been conducting a study of the ecology of the Missouri River since 1998 by conducting sampling in various sections of the Missouri River including the unchannelized river below Gavins Point Dam and in the channelized river adjacent to Nebraska. In 2000, sturgeon were sampled with a modified benthic trawl. The CPUE averaged 1.54 shovelnose sturgeon in the spring and 0.24 in the summer (Mestl 2001). No pallid sturgeon were collected during this sampling effort. Additional benthic trawl sampling was conducted as part of mitigation site monitoring. This resulted in the collection of 16 shovelnose sturgeon at various locations and one pallid sturgeon which was collected at Goose Island (Mestl 2001). No data were provided concerning the pallid sturgeon in order to note whether this was a wild origin or hatchery reared fish.

During a Mississippi Interstate Cooperative Resources Agencies (MICRA) study from 1996 to 2000 (Grady et al. 2001), 21 pallid sturgeon were collected in the Lower Missouri River and Middle Mississippi River. Of the 9 pallid sturgeon collected in the Lower Missouri River, 7 were presumed to be of wild origin, while 2 were hatchery stocked fish. Of the 12 pallid sturgeon collected in the Middle Mississippi River, 1 was considered a wild origin fish and 11 were considered hatchery stocked fish (Table 6 in Grady et al. 2001). The ratio of wild pallid sturgeon to all river sturgeon collected dropped from 1 in 398 (0.25 percent) collected by Carlson et al. (1985) to 1 in 647 (0.15 percent) (Grady et al. 2001). The contribution of hatchery reared fish is evident as wild and hatchery raised pallid sturgeon accounted for 1 in 247 (0.41 percent) of all river sturgeon (Grady et al. 2001).

In 2001, the Service's Columbia Missouri Fishery Resources Office (CMFRO) began work on the Lower Missouri River Pallid Sturgeon Monitoring and Population Assessment Project. Sampling occurred in 6 reaches along 170 river miles and resulted in collection of 4,110 fish from 11 families with 77 trawl hauls and 12 net nights (Doyle et al., 2002). No pallid or hybrid sturgeon were collected, however, 198 shovelnose sturgeon and 2 lake sturgeon were collected. Fourteen YOY sturgeon were collected. While 4 of these have been identified as shovelnose sturgeon, 10 have not yet been identified to species (Doyle et al. 2003). In 2002, the CMFRO sampled 6 reaches along 200 river miles. Among the 27,903 fish collected were 12 pallid sturgeon, 12 pallid/shovelnose hybrids, 3,044 shovelnose sturgeon and 28 lake sturgeon (Doyle and Starostka 2003). Five of the pallid sturgeon were classified as juveniles. While four of these fish were from recent stocking of hatchery reared fish, one was presumed to be wild (Doyle and Starostka 2003). According to Doyle and Starostka (2003) pallid sturgeon continue to decline at a rapid rate. Within the 200 river miles they sampled, the ratio of pallid to all river sturgeon decreased from 1:311 in the 1996-2000 MICRA study to 1:387 in 2002. It should be noted that the sampling effort in 2002 does not reflect the same sampling effort or gear utilized during the MICRA study which was completed over a period of five years.

From January 2000 through March 2001, the CMFRO collected information on seasonal fish abundance and species composition in the area of the Highway 19 bridge replacement at Hermann, Missouri. They collected over 3000 fish including 3 pallid sturgeon, 14 hybrids and 1990 shovelnose sturgeon (Milligan 2002).

Middle Mississippi River (Upper Mississippi River miles 196.0 to 0.0) - In May 2002 the Corps' St. Louis District initiated a three year Pallid Sturgeon Habitat and Population Demographics study in the MMR. The study is being carried out by staff from the Corps' Waterways Experiment Station, the Missouri Department of Conservation (MoDOC), Open River Field Station (ORFS) and SIUC. By May 2003, a total of 41 pallid sturgeon and 3,636 shovelnose sturgeon had been collected from throughout the MMR (USACE 2003). The ratio of pallid sturgeon to shovelnose sturgeon (1:89) is much higher than in other parts of the pallid sturgeon's range. As of October 2003, a total of 47 pallid sturgeon have been collected in the MMR as part of this study (Jack Killgore, USACE, pers. comm.). It is conservatively estimated that approximately 60 percent of these pallid sturgeon are MoDOC hatchery reared fish released in 1994 and 1997 (Dave Herzog, MoDOC, pers. comm.). It is also possible that the higher ratio of pallid sturgeon to shovelnose sturgeon may be a result of declining numbers of shovelnose sturgeon due to commercial harvest of sturgeon flesh and roe (Dave Herzog, MoDOC, pers. comm.). In 2003, the Illinois Department of Natural Resources (IDNR) collected 9 pallid sturgeon while sampling for shovelnose sturgeon in the Chain of Rocks area (river miles 189.0 to 185.0) of the MMR (Rob Maher, IDNR, pers. comm.), possibly indicating this is a staging area for sturgeon spawning.

Lower Mississippi River and Atchafalaya River - During sampling in 2001, Hartfield et al. (2001) collected 383 shovelnose sturgeon (58 – 725 mm) and 3 intermediates. In late 2000 and early 2001, biologists collected a total of 83 pallid sturgeon and 109 hybrid sturgeon during sampling at the Old River Control Structure at the junction of the Mississippi and Atchafalaya Rivers in Louisiana (Reed 2002). A new 4-year pallid sturgeon study was initiated in 2001 which has thus far resulted in collection of 74 sturgeon. Of these, 11 were pallid sturgeon and 20 were classified as hybrids (Reed 2002).

Early life stages – As part of the Fort Peck Flow Modification Biological Data Collection Plan, Bratten and Fuller (2002) collected 1,970 larval fish samples from six sites. Sturgeon larvae (*Scaphirhynchus* sp.) have been identified in 20 samples for 3 sites (of the 1200 samples processed to date) (Bratten and Fuller 2002). The Data Collection Plan also included benthic sampling for YOY sturgeon. A total of 35 YOY sturgeon (average 21 mm) were collected with 71percent of these fish being collected downstream of the Yellowstone River confluence (Bratten and Fuller 2002). The species identification for these YOY sturgeon was not provided in the report. However, Bratten and Fuller (2002) later noted that two larval pallid sturgeon (21.6 mm and 23.1 mm) were collected downstream from the confluence of the Yellowstone River indicating successful spawning of pallid sturgeon in 2002. However, it is not known whether this spawning occurred in the Yellowstone River or the Missouri River (Bratten and Fuller 2002).

Larval pallid sturgeon have been collected in the Lower Missouri River, Middle Mississippi River and Lower Mississippi River which indicates that limited reproduction is occurring in the wild. In April and May 2001, the MoDOC collected 40 larval sturgeon utilizing the Missouri benthic trawl (Hrabik 2002). In spring of 2003, the MoDOC collected an estimated 50 larval sturgeon in the MMR (Dave Herzog, MoDOC, pers. comm.). It is unclear at this time how many of these larval sturgeon are pallid sturgeon or hybrids. From April to September 2002, the CMFRO collected 11 YOY sturgeon in Lisbon Bottoms on the Lower Missouri River. Five of these fish were identified as shovelnose sturgeon and six still need to be identified (Grady and Mauldin 2002). A total of eight larval sturgeon (4 in 2002 and 2 in 2003) have been collected in the Lower Missouri River as part of a larval fish sandbar habitat study being conducted by the University of Missouri (Kerry Reeves, Univ. of Missouri, pers. comm.). Two individuals have been identified to species, one pallid sturgeon and one shovelnose sturgeon, while the remainder await positive identification. In 2001, 11 pallid sturgeon, ranging in size from 203 to 785 mm (juvenile/subadult) were collected by trawling in the Lower Mississippi River in the vicinity of Vicksburg, Mississippi (Hartfield et al. 2002).

Restoration Stocking - Approximately 27,500 hatchery raised pallid sturgeon were released in 2002 and 2003 in the Missouri River. No hatchery reared pallid sturgeon have been released into the Mississippi River or the Atchafalaya River since 1998.

Summary

As noted with the above information, pallid sturgeon are widely distributed throughout their range and occur in small numbers relative to the closely related shovelnose sturgeon **(**see Table 5). Increasingly, the total numbers of pallid sturgeon collected during sampling reflect higher numbers of released hatchery reared fish and hybrids than wild fish. The collection of larval and juvenile pallid sturgeon is becoming more common due to increased effort and gear efficiency. However, the low numbers of these age classes suggests to most sturgeon researchers that pallid sturgeon reproduction is a rare event and recruitment from reproduction has not been documented. It should be noted that the numbers of larval and juvenile pallid sturgeon collected may also be an artifact of sampling gear bias and/or a variable level of effort aimed at these size classes.

As is shown in Table 5, data that are collected and reported throughout the range of the pallid sturgeon is inconsistent and difficult to compare between reaches. The Service concludes from the data represented in Table 5 and discussed in the text above that there is a continuous and ongoing decline in the population of adult pallid sturgeon in the Upper Missouri River reaches. Additionally, for both the Lower Missouri River alone, as well as the Lower Missouri River and the Middle Mississippi River combined, there appears to be a shift in the relative abundance of pallid sturgeon to shovelnose and other river sturgeon. Data from Grady et al. (2001) and MoDOC indicate that shovelnose sturgeon populations are either stable or declining, respectively. This indicates to the Service that there is a true reduction in the abundance of pallid sturgeon to reflect a lower ratio of pallid to other sturgeon species.

Table 5. Estimates of adult pallid sturgeon and ratio of pallid to shovelnose from the literature

	Upper Missouri River RPMA#2	Middle Missouri River	Middle Mississippi River RPMA#4	Lower Missouri River and Middle Mississippi River Combined RPMA#4/RPMA #5
Duffy et al. (1996)	200-300 (adults)			
Kapusinski (2001)	178 (adults)			
Kapusinski (2002)	166 (adults)			
Kapusinski (2003)	151 (adults) (89-236 95% Confidence)			
USACE (2003)			1:89 (1.1%)[8]	
Carlson et al. (1985)				1:398 (0.25%)[9]
Grady et al. (2001) Year 2000 data				1:647 (0.15%)
Grady et al. (2001) cumulative 1996-2000				1:311 (0.32%)[3]
Doyle and Starostka (2003) Year 2002 data				1:387 (0.25%)[3]
Krentz pers. comm. 2003		25-50 adults (GPD to FRD) 50-100 adults (above Lake Sharp)		

8 Ratio on Middle Mississippi River is to shovelnose sturgeon only
9 Ratio is to all river sturgeon (shovelnose, lake, pallid, hybrid)
3 Lower Missouri River

Habitat and Micro-Habitat Characteristics

Upper Missouri River (river segments 2 and 3) - Yerk and Baxter (2001) recaptured three hatchery reared pallid sturgeon in RPMA#2 during 2000. The three fish were captured in main channel habitat associated with sand bar complexes. The substrate was primarily sand; one fish was captured in an area with small amounts of gravel (10 percent). The specific depth where fish were captured is unknown, but the trammel nets were drifted at depths ranging from 0.6 to 2.4 m. The water temperature averaged 21.6° C and the turbidity averaged 41.1 Nephelometric Turbidity Units (NTU's).

Kapuscinski and Baxter (2003) recaptured six hatchery reared pallid sturgeon in RPMA#2 during 2002. These fish were captured in habitats similar to those reported by Yerk and Baxter (2001). The beam trawl and trammel nets were deployed at depths ranging from 0.91 to 4.27 m. The water temperature at the capture sites averaged 19.4° C and turbidity averaged 167.3 NTU's.

Middle Missouri River (river segments 8 and 9) - Stancill (2001, undated) noted hatchery reared radio-tagged pallid sturgeon utilizing primarily main channel habitat in the Missouri River below Fort Randall Dam. However, some study fish were recorded utilizing side-channel habitats and at the confluence of the Missouri and Niobrara Rivers. In 2002, study fish were consistently found in the river marsh area immediately around Springfield, South Dakota.

Lower Missouri River (river segments 10 to 15) - Pallid sturgeon collected from 1996 to 2000 as part of the MICRA study were collected in deep holes associated with wing dikes, except one collected in side channel border habitat (Grady et al. 2001). Pallid sturgeon were collected in water depths of 2.1 m to 13.1 m in the Lower Missouri River and 6.1 m to 14.5 m in the Middle Mississippi River.

Doyle and Starostka (2003) found juvenile sturgeon (<300mm) to be strongly associated with main channel sand bars over sand substrate and were caught throughout the range of velocities sampled. Two-thirds of the juvenile sturgeon were caught in velocities between 0.3 and 0.8 m/s. Doyle and Starostka (2003) collected young of the year (YOY) juvenile sturgeon and pallid sturgeon with trawls on sand bars, island tips and notched L-dikes. The YOY sturgeon were found along channel sand bars, as well as behind notched dikes with moderate flows. The authors surmise that there appears to be a preference for habitat created by dike modifications or islands which is used by pallid sturgeon, lake sturgeon and shovelnose sturgeon during early life stages (Doyle and Starostka 2003).

DeLonay and Little (2002) reported that radio-tagged sturgeon were almost exclusively found over a sand substrate (>95 percent) in the Lower Missouri River. Sand is the predominate substrate in this area. Pallid sturgeon were found in locations with current during all seasons, characterized by velocities ranging from 0.25 to 1.8 m/sec with the mean slightly greater than 1 m/sec (DeLonay and Little 2002). The depths at relocation points ranged from <1 to 10.5 m and averaged 3 m. DeLonay and Little (2002) noted

that the usefulness of descriptive measurements of habitat such as depth and velocity is suspect due to the dynamic nature of river habitats. They found that sturgeon were often found in locations of turbulence or complex current patterns, such as wing dike tips, off sand bars or near steep drop offs where current could vary by as much as 1.5 m/s between each side of the tracking vessel (DeLonay and Little 2002).

DeLonay and Little (2002) noted the need for a broader-scale assessment of physical habitat used by pallid sturgeon in which locations are correlated with bottom morphology, areas of habitat diversity or particular habitat features. They plotted relocation points against 1994 hydrographic surveys and digital orthoquad maps photographed during low water periods in the Lower Missouri River. They found that sharp changes in bottom relief (drop-offs, shelves and scours), the spacing of engineered flow training structures, and the position of the thalweg appear to have greater influence over sturgeon location than depth, substrate or velocity. Sturgeon were most often located in areas with moderate velocities at the channel margin or border, on outside bends, near sand islands and off the tips of wing dikes. Areas with slack water were not used and sturgeon were relocated with less frequency in narrow straight reaches with closely spaced wing dikes (DeLonay and Little 2002).

The CMFRO study of fish abundance and species composition at the Highway 19 bridge replacement site indicated that sturgeon appeared to be using deep scour holes below wing dikes for overwintering habitat from November through May (Milligan 2002).

Jacobson and Laustrup (2000) documented the results of aquatic habitat assessment of pallid sturgeon overwintering habitat in the Lower Missouri River. As part of that study, aquatic habitat was assessed at five sites (wing dikes) where pallid sturgeon were sampled as part of the MICRA sturgeon project (Grady et al. 2001). Their data documents habitat complexity around these engineered structures (wing dikes). This includes the formation of scour holes offshore and downstream from the tip of wing dikes and larger scour holes downstream of where the dike intersects with the shoreline. During high flow events, shoreline scouring resulted in the development of embayments that eroded laterally into the shoreline. Large woody debris accumulations at these sites may also contribute to scour during floods and flow convergence (Jacobson and Laustrup (2000). Scour holes are also associated with wing dike notches. The velocity through these notches is dependent on the geometry of the notch and discharge (Jacobson and Laustrup 2000). Sand bars accumulate downstream from wing dike tips. However, whether a sand bar forms or not is dependent of numerous factors, including channel geometry, dike orientation, and dike spacing (Jacobson and Laustrup 2000). In addition, notches can disrupt the recirculation zone and prevent sand bar development. Low velocity zones upstream and downstream of dikes were dominated by muddy substrates, and areas of higher velocity (main channel and convergence zones around dike tips) were dominated by coarser substrate (Jacobson and Laustrup 2000). Sandy substrates occurred in notch scours while shoreline scours typically have muddy substrates (Jacobson and Laustrup 2000).

Middle Mississippi River (Upper Mississippi River miles 196.0 to 0.0) – The MoDOC larval sturgeon collected in 2001 were nearly all captured at downstream island tips (Hrabik 2002). They surmise that sturgeons are being spawned at island heads or somewhere above and are being transported to eddy pools along island shores and at the tips (Hrabik 2002). Large amounts of detritus were collected with the larval sturgeon.

Sheehan et al. (2002) summarized the results of a telemetry study of pallid sturgeon in the MMR from 1995 through 2001. Study sturgeon were primarily located in the main channel (38 percent of relocations), but also used main channel border and wingdam border (between wingdams) habitats extensively (27 percent and 14 percent of relocations, respectively). During cold temperatures (below 4° C), study sturgeon were found in association with current-disrupting habitat features such as downstream island tips and wingdams downstream (immediately downstream of a wing dam) more frequently than at other times (12 percent and 9 percent of relocations, respectively). Habitat associations during the spring months deviated from those during the rest of the year (Sheehan et al. 2002). The use of wingdam border (between wingdams) habitats increased greatly during the spring (33 percent of relocations) while use of main channel border habitats remained similar to other seasons (21 percent of relocations). Downstream island tips (13 percent of relocations) and wingdams downstream (8 percent of relocations) were also used during the spring timeframe. The number of contacts (n = 24) during spring was low due to radio-tracking difficulties during spring flooding (Sheehan et al. 2002).

Strauss's selectivity index was used to determine if radio-tagged sturgeon exhibited positive or negative selection of various habitats. Study sturgeon exhibited a positive selection for main channel border, downstream island tips, between wingdams and wingdam tip habitats while exhibiting negative selection for main channel and wingdams downstream and upstream habitats (Sheehan et al. 2002). This is based on the availability of habitats compared to habitat use.

Study sturgeon were found in locations with water depths ranging from 1.82 to 19.17 m (Sheehan et al. 2002). The majority of sturgeon relocations (88.8 percent) were in water with maximum depths from 3 to 12 m and most commonly in depths ranging between 6 and 9 m (Sheehan et al. 2002). These are common depths in the main channel and main channel border areas of the MMR.

Study sturgeon were found over sand substrates 81.8 percent of the time, sand/gravel substrates 9.1 percent of the time and mud/silt substrates 5.5 percent of the time (Sheehan et al. 2002). The mean surface water velocity at relocation points was 0.55m/s (Sheehan et al. 2002).

A Chi-square, goodness-of-fit test was used to determine the effects of temperature and discharge on habitat use (Sheehan et al. 2002). The distribution of habitat use by study sturgeon was significantly different from the habitat availability at each temperature regime and at low, medium and high discharge regimes (Sheehan et al. 2002). However, temperature did not appear to have a substantial effect on either habitat use or habitat

selection by pallid sturgeon in the MMR. In addition, there were no shifts between habitat selection and avoidance over the three different discharge regimes (Sheehan et al. 2002). Previous studies have found that temperature can severely affect swimming ability and mortality of riverine fishes at winter temperatures less than 4° C (Sheehan et al. 1994, Sheehan et al. 1990). However, habitat use and selection by pallid sturgeon appeared to be minimally affected by temperature and discharge in the MMR (Sheehan et al. 2002). Pallid sturgeon habitat use differed from the norm only during spring months with water temperatures between 4 and 10° C (Sheehan et al. 2002).

Lower Mississippi River - Hartfield et al. (2002) found that all sturgeon captures in the Lower Mississippi River have been associated with moderate to strong currents, depth ranging from 13 – 45 ft, sand or sand and gravel substrate and structure present (sand reefs, dunes, secondary channels). However, pallid sturgeon captures were associated with greater depths than other sturgeon (25 – 45 ft) (Hartfield et al. 2002).

Food and Feeding Habits

While additional research is underway, there has not been any significant additional information reported for pallid sturgeon food and feeding habits since issuance of the 2000 Biological Opinion.

Rangewide Distribution and Abundance of Habitat

As discussed in the 2000 Biological Opinion, the distribution, abundance and quality of habitat has been severely altered throughout the range of the pallid sturgeon. Pallid sturgeon habitat for all life stages has been altered by impoundments and subsequent operation of reservoirs and by channelizing the sturgeon's riverine habitat for navigation and bank stabilization purposes. Subsequent to navigation channel development, large areas of floodplain have been isolated from the river due to large-scale levee projects.

Upper Missouri River (river segments 2 and 3) – Physical habitat conditions beneficial to sturgeon are present in the Upper Missouri River, but are restricted to inter-reservoir areas. The amount and availability of habitat varies depending upon the amount of storage contained in the reservoirs. Dam operations affect current/velocity, turbidity, water depth, substrate, temperature and the hydrograph. The dams and reservoirs block upstream and downstream movements of pallid sturgeon. Sediment transport and availability for habitat creation and maintenance is significantly impaired. New bank stabilization construction and maintenance of existing bank stabilization structures continue in this reach. Habitat conditions on the Yellowstone River are suitable and some semblance of the natural hydrograph exists. However, access to upstream habitat (approximately 170 river miles) in the Yellowstone River is blocked by the Intake Diversion Dam is under the authority of the U.S. Bureau of Reclamation. Providing pallid sturgeon access to the reach of the Yellowstone River above the Intake Diversion Dam would have significant positive effects. There is relatively little bank stabilization in this river compared to other reaches. The habitat conditions in the Upper Missouri River remain relatively unchanged since the 2000 Biological Opinion except for water allocations in the Yellowstone River.

Middle Missouri River (river segments 3 to 10) – Physical habitat conditions are present in the Middle Missouri River, but are restricted to inter-reservoir areas. Dam operations affect current/velocity, turbidity, water depth, substrate, temperature and the hydrograph. The scope of these affects depends on location along the river. Sediment transport and availability for habitat creation and maintenance are significantly impaired. Dams and reservoirs block upstream and downstream movements of pallid sturgeon. New bank stabilization construction and maintenance of existing bank stabilization structures continue in this reach. Habitat conditions in this reach remain relatively unchanged since the 2000 Biological Opinion.

Lower Missouri River (river segments 10 to 15) – From Gavins Point Dam downstream to Sioux City, Iowa, suitable physical habitat conditions exist, but, dam operations affect current/velocity, turbidity, water depth, substrate and the hydrograph. From Sioux City downstream to the mouth of the Platte River, the physical habitat conditions are substantially reduced due to channelization and the hydrograph is significantly altered due to Corps' operations. From the mouth of the Platte River downstream to the Mississippi River, the physical habitat conditions are altered, but improved compared to further upstream. The alteration of the hydrograph due to Corps' operations is attenuated due to the influences of tributary inflow. Sediment transport and availability for habitat creation and maintenance is significantly impaired.

According to the 2000 Biological Opinion, approximately 77,000 acres (105 acres/mile) of shallow water, slow velocity, habitat occurred in the predevelopment river below Sioux City, Iowa. It was estimated that approximately 2-5 percent or 2.1-5.25 acres/mile of the historical acreage remains between Sioux City and the Grand River confluence in the developed river. Since issuance of the 2000 Biological Opinion, the Corps conducted new modeling studies that estimate approximately 18.0 acres/mile of shallow water habitat currently occurs below the Grand River in the Lower Missouri River (6,017 total acres). The 2000 Biological Opinion RPA specified that 20-30 acres of shallow water habitat should be created in the Lower Missouri River. As such, an estimated 8,000 to 14,000 additional acres of shallow water habitat must be established.

Since the 2000 Biological Opinion, bank stabilization and maintenance continues throughout this river reach. Land acquisition (1,100 acres) has occurred from Gavins Point Dam to Sioux City, Iowa, to benefit pallid sturgeon and other species. However, restoration has not occurred. From 2001 to 2003 Corps' modifications to the BSNP resulted in the creation of 1,365 acres of shallow water habitat. The projects include excavation of over 400 notches, construction of reverse dikes/notches at Marion and Plowboy Bends, side channel construction at Overton Bottoms, Tobacco Island and California Bend, buried dike excavation and notching at Overton Bottoms, chevron dike construction and dike lowering near Nebraska City, and modification of dike maintenance at selected locations from Sioux City to the mouth of the Missouri River to encourage aquatic habitat development. The Corps is in the final design stages of chute/backwater projects at Glovers Point Bend (river mile (RM) 712), Hole-in-the-Rock (RM 706), Lower Hamburg Bend (RM 553) and Kansas Bend (RM 546) and construction of major dike modifications is underway in the Nebraska City area (USACE 2003).

Middle Mississippi River (Upper Mississippi River miles 196.0 to 0.0) - In the Middle Mississippi River, physical habitat is becoming homogeneous. With construction of the nine-foot channel navigation project on the Upper Mississippi River, the river bank top width has been reduced, side channels, islands and ephemeral sand bars have been lost, and the physical process of channel meandering has been arrested. Sediment transport and availability for habitat development have been significantly impaired as a result of Corps' actions on both the Upper Mississippi River and the Missouri River. The result has been the loss of aquatic habitat diversity over time. This process is on-going. In April 2000, the Service issued a jeopardy Biological Opinion for pallid sturgeon to the Corps for continued operation and maintenance of the nine-foot channel navigation project. The Corps accepted the RPA and is in the process of implementing it. The RPA called for: 1) conducting a pallid sturgeon habitat study in the Middle Mississippi River; 2) development of a pallid sturgeon conservation and restoration plan, which would include monitoring of pallid sturgeon and habitat; 3) implementation of a long-term aquatic habitat restoration program to restore habitat quantity, quality and diversity; and 4) implementation of short-term aquatic habitat restoration measures (e.g., pilot projects). Although the pallid sturgeon conservation and restoration plan is still under development, to date the Corps has completed a number of pilot projects that have improved habitat conditions on a local scale. These projects include rehabilitation of Santa Fe Chute side channel, placement of woody debris piles in various locations, incorporation of woody debris into dikes during maintenance, dike notching, and construction of a chevron dike to facilitate development of a mid-channel sand bar island and associated aquatic habitat. It is assumed the Corps will continue to implement the RPA as described, including the long-term aquatic habitat restoration program. Thus, overall habitat conditions on the MMR should improve over time.

Lower Mississippi River – The amount of aquatic habitat lost in the Lower Mississippi River has not been assessed. The Lower Mississippi River Conservation Committee has developed a Lower Mississippi River Aquatic Resource Management Plan. One objective of this plan is to identify, define, describe and delineate habitats in the Lower Mississippi River. To that end, the Lower Mississippi River Resource Assessment was authorized in the Water Resources Development Act of 2000. To date funding has not been appropriated to complete the assessment.

There are a number of large Corps' projects either under study or approved that may severely impact pallid sturgeon habitat and productivity in the Lower Mississippi River. The St. John Bayou/New Madrid Floodway Project will further isolate the Mississippi River from its associated floodplain, specifically isolating approximately 12,000 acres of floodplain wetlands. Other Corps' projects with the potential to impact aquatic habitats in the Lower Mississippi River include the Mississippi River and Tributaries Project Mainline Levee Enlargement and Berm Construction Project, Yazoo Pumps Project, and Big Sunflower River Maintenance Project.

Atchafalaya River – The Atchafalaya River is a distributary to the Mississippi River. The upper reach of the river has been channelized and cut-off from the main channel of the

Mississippi River through construction of several Corps' projects and a hydroelectric project. Pallid sturgeon are believed to enter the Atchafalaya River through the Old River Control Structure and then become isolated from other pallid sturgeon populations.

Factors Affecting the Species Rangewide

Habitat Loss and Degradation

Destruction and alteration of big-river ecological functions and habitat that were once provided by the Missouri and Mississippi Rivers are believed to be the primary cause of declines in reproduction, growth, and survival of pallid sturgeon (USFWS 1993). The physical and chemical elements of channel morphology, flow regime, water temperature, sediment transport, turbidity and nutrient inputs that once functioned within a big river ecosystem have been dramatically altered by the construction of mainstem and tributary dams, construction of navigation projects (e.g., channelization) and subsequent isolation of the floodplain through flood control projects. Although restoration projects have been implemented in the Lower Missouri River and Middle Mississippi River, the rate of change is not believed to have stabilized and habitat diversity, quantity and quality is believed to be declining. However, implementation of positive actions for habitat creation and maintenance on the Missouri River and Middle Mississippi River should result in stabilization and improvement in habitat conditions over the long-term.

Commercial Harvest

It has previously been reported that mortality of pallid sturgeon occurs as a result of illegal and incidental harvest from both sport and commercial fishing activities. Herzog (2002) reports that the commercial fishers observed over the years are non-discriminate in their take of sturgeon (including pallid sturgeon). Recently, the MoDOC has documented incidental/illegal harvest of pallid sturgeon as a result of commercial sturgeon fishing (Craig Gemming, MoDOC, pers. comm.). The value of native sturgeon roe has increased dramatically in recent years due to the collapse of the Russian caviar industry. As the commercial harvest of shovelnose sturgeon roe increases, there will be an increased by-catch of pallid sturgeon incidental to this harvest. This has the potential to further depress pallid sturgeon populations. For example, Williams (2002) recently summarized reports from various states for the harvest of shovelnose sturgeon (flesh and eggs). In Illinois, the harvest of shovelnose sturgeon roe has increased from 47 pounds reported in 1990 to 8,197 pounds in 2001. The commercial shovelnose sturgeon catch (flesh and roe) in Missouri increased from 12,183 pounds in 1999 to 65,128 pounds in 2001 for the Mississippi River and from 7,472 pounds in 1999 to 12,370 pounds in 2001 for the Missouri River. The increase harvest pressure of shovelnose sturgeon has also created concern for the population status of this species. Herzog (2002) reports that the catch per unit effort for Middle Mississippi River shovelnose sturgeon collections declined from 527 fish (25 net nights) in 1997 to 30 fish (20 net nights) in 2002. The high was 1,052 fish (54 net nights) in 1998. As a result, the MoDOC has proposed regulation changes to further protect sturgeon populations and the Iowa Department of Natural Resources has closed commercial sturgeon fishing in the Missouri River (Steve Krentz, USFWS, pers. comm.).

Pollution/Contaminants

The 2000 Biological Opinion suggested that environmental contaminants may play a role in the decline of pallid sturgeon, citing fish consumption health advisories from Kansas City to the mouth of the Mississippi, representing 45 percent of the pallid sturgeon's total range. In addition, PCBs, cadmium (Cd), mercury (Hg), and selenium (Se) were detected at elevated but below lethal levels in tissues of three pallid sturgeon tissues from the Missouri River in North Dakota and Nebraska. Detectable levels of chlordane, DDE, DDT and dieldrin were also reported (Ruelle and Keenlyne, 1994). The 2000 Biological Opinion also hypothesized that the "prolonged egg maturation cycle of pallid sturgeon, combined with a bioaccumulation of certain contaminants in eggs, could make contaminants a likely agent adversely affecting eggs and embryo, development or survival of fry, thereby reducing reproductive success." Environmental contaminants, although suspected to have a role in sturgeon dynamics, have only recently begun to be more fully examined in relation to sturgeon reproduction and health in both the MMR and Missouri River and more information is needed.

Coffey et al. (2000) conducted a preliminary contaminant investigation on fish collected from a chlordane consumption advisory site (contaminants known to be present) in the Middle Mississippi River and from a reference site without advisories (contaminants not known to be present). Results indicate that wild shovelnose collected from the consumption advisory site exhibited enlarged livers, often an indicator of contaminant exposure. In addition, plasma estrogen and testosterone ratios were >1 for three males and vitellogenin (an egg production protein with no known function in males) was induced in two of these three males. Two other males exhibited intersex characteristics after histological examination (Harshbarger et al. 2000). Since sturgeon are gonochoristic, intersex characteristics are rare for this species (Van Eenennaam and Doroshov, 1998). These affected fish were also determined to have among the highest tissue concentrations of organochlorine compounds and metabolites. Some results were a bit contradictory, with one fish having high residue levels and no health anomalies, and some results were observed in fish from both contaminated and reference areas. However, sample sizes in this study were small. These preliminary data suggest that the role of environmental contaminants on sturgeon dynamics needs to be further evaluated.

Coffey et al. (2001) also conducted a risk assessment for Middle Mississippi River pallid sturgeon. Using conservative assumptions in most parts of the assessment, they determined that water and sediment may carry biologically important concentrations of contaminants, at levels reducing the food base and increasing exposure and bioaccumulation in pallid tissues. Most notable were the eight heavy metals found in sediments that have been detected in fish tissue, including in sturgeon, above adverse effect thresholds (As, Cd, Cu, Pb, Hg and Se). This is also the case for DDD, DDE, chlordane and dieldrin.

Papoulias et al. (draft preliminary results, 2003) sampled adult shovelnose sturgeon monthly in the Lower Missouri River between May 2001 and June 2002. Investigations noted an unusually high incidence of sturgeon with characteristic gonadal anomalies consistent with abnormal hermaphroditism (AH). AH in an animal is characterized by

possessing both male and female gonads or abnormal gonads exhibiting both male and female characteristics within the same organ (ovo-testes). Ovo-testes were identified in 25 of 379 shovelnose collected (Papoulias et al.). Most fish appeared to be genetic males with the addition of eggs/oocytes on the surface of the testes. The United States Geological Survey (USGS) reports in its preliminary assessment that from the late 1960's to the early 1970's the incidence of AH in the Missouri River was 2 percent. Their current research finds the incidence at 7 percent, ranging from 0-28 percent. There is no causal agent discussed here but senescence, genetic abnormalities, hybridization, radiation, chemicals, diet, temperature and environmental disturbance have all been implicated in the literature. Papoulias et al. (2003) found that "gonadal abnormalities may indicate the potential for reproductive impairment in this species and others and should be investigated".

Hybridization

Recent sturgeon survey work indicates the rate of hybridization between shovelnose sturgeon and pallid sturgeon is increasing in the Lower Missouri River, Mississippi River and Atchafalaya River. During the MICRA study from 1996 to 2000, seven pallid/shovelnose sturgeon hybrids were collected in the MMR and 15 were collected in the Lower Missouri River. The rate of hybridization increased from 1 in 365 (0.27 percent) river sturgeon in the late 1970's (Carlson et al. 1985) to 1 in 235 (0.42 percent) in the 1990's (Grady et al. 2001).

Surveys conducted as part of the Highway 19 bridge replacement project near Hermann, Missouri, resulted in collection of 3 pallid sturgeon, 14 hybrids and 1,990 shovelnose sturgeon (Milligan 2002). In addition, as part of the Lower Missouri River Pallid Sturgeon Monitoring and Population Assessment Project, CMFRO collected 12 pallid sturgeon, 12 hybrids and 3,022 shovelnose sturgeon (Doyle and Starostka 2003).

In the Lower Mississippi River, Hartfield et al. (2002) collected 11 pallid sturgeon, 3 intermediates and 383 shovelnose sturgeon. Hartfield (2002) later reported collection of 9 pallid sturgeon, 615 shovelnose sturgeon, 7 intermediates that were tentatively identified as pallid sturgeon and 6 intermediates that were more similar to shovelnose sturgeon. Reed (2002) reported collecting a total of 83 pallid sturgeon and 109 hybrid sturgeon as part of sampling at the Old River Control Structure in the Atchafalaya River. Based on visual identification of sturgeon collected at the Old River Control Structure 10 percent were pallid sturgeon, 35 percent were hybrids and 55 percent were shovelnose sturgeon (Dean 2002)**.**

Entrainment

Sand and Gravel Dredging - In 1998, the Corps' Waterways Experiment Station published a Technical Note that summarizes existing literature regarding potential impacts to aquatic organisms caused by entrainment during dredging and dredged material disposal operations (Reine and Clarke 1998). Entrainment was defined as the direct uptake of aquatic organisms by the suction field generated at the draghead or cutterhead (Reine and Clarke 1998). Armstrong et al. (1982) reported entrainment rates that ranged from 0.001 to 0.135 fish/cy for both pipeline and hopper dredging activities.

They found that both small and large fish were entrained in similar proportions and concluded that large fish did not actively avoid the dredge any more than small fish. Armstrong et al. (1982) reported an initial mortality rate of 37.6 percent. Larson and Moehl (1990) reported entrainment rates ranging from <0.001 to 0.341 fish/cy during a 4-year study at the mouth of the Columbia River in Oregon. The majority of fish entrained were demersal with a few pelagic species also being collected (Larson and Moehl 1990).

Buell (1992) monitored entrainment by the hydraulic dredge *R.W. Lofgren* during dredging operations in the Columbia River. Buell reported an entrainment rate of 0.015 fish/cy for white sturgeon (*Acipenser transmontanus*). Substantial numbers of juvenile white sturgeon (300 to 500 mm) were entrained, largely attributed to dredging in an area referred to as the local "sturgeon hole". However, the overall entrainment rate reported by Buell (1992) is comparable to rates reported for other species of fish. To date, no studies have been completed in the Missouri or Mississippi Rivers to evaluate possible fish entrainment due to commercial sand and gravel dredging or navigation channel maintenance. The Corp has previously stated that entrainment of pallid sturgeon due to navigation channel maintenance dredging could not be ruled out (USACE 1999).

Towboats - The effect of towboat propellers on fish populations is a concern associated with potential increases in commercial navigation traffic on the Upper Mississippi River (Killgore et al. 2001). To date, there has been no evaluation of the baseline effects of current navigation traffic in either the Missouri or Mississippi Rivers. Cada (1990) reported that fish eggs and larvae that pass through water currents induced by a propeller may come in contact with the blade and can experience stresses from pressure changes and shear forces. Killgore et al. (2001) evaluated the mortality of icthyoplankton entrained through a scale model of a towboat propeller. Fish species tested included larval shovelnose sturgeon, larval lake sturgeon, the larvae and eggs of paddlefish, larval blue sucker and juvenile common carp. Fish were subjected to treatments at various shear stress levels ranging from 634 to 4,743 dynes/cm2 (1 dyne = the force that would give a free mass of 1 g an acceleration of 1 cm/s^2) (Killgore et al. 2001). They found mortality to be a linear function of shear stress for all species and life stages. Larger larvae (e.g., shovelnose sturgeon) experienced lower mortality, while smaller larvae (e.g., lake sturgeon and blue suckers) experienced higher mortality (>75 percent). All larval species experienced delayed mortality, particularly at higher stress levels, however, common carp juveniles and paddlefish eggs did not experience delayed mortality (Killgore et al. 2001). Shear stress from propeller jet velocities can exceed 5,000 $dynes/cm^2$. Killgore et al. (2001) concluded that shear stress due to towboat traffic is probably a primary force contributing to the mortality of ichthyoplankton entrained during vessel passage, but the magnitude of mortality is dependent on individual size of ichthyoplankton. Based on this information, it is likely that towboat traffic is a source of incidental mortality to larvae of pallid sturgeon. The extent of mortality would be a function of the amount of tow traffic in a given river system, towboat speed and traffic levels during the time of year when larvae are most susceptible to shear stress (e.g., early developmental phase) (Killgore et al. 2001).

Gutreuter et al. (2003) developed a method to estimate mortality rates of adult fish caused by entrainment through the propellers of commercial towboats operating in river channels. They estimated entrainment mortality rates of adult fishes in Pool 26 of the Upper Mississippi River and Alton Pool of the Illinois River where fish kills attributed to entrainment were observed. Their estimates of entrainment mortality rates were 0.53 fish/km of towboat travel (80 percent confidence interval, 0.00-1.33) for shovelnose sturgeon. They concluded that their approach applies more broadly to commercial vessels operating in confined channels, including other large rivers and intracoastal waterways. Based on this information, it is likely that towboat traffic is a source of incidental mortality to adult pallid sturgeon.

Invasive Species

Since issuance of the 2000 Biological Opinion, Asian carp populations have greatly increased in the Missouri River and Mississippi River systems. Bighead carp and silver carp have become the most abundant large fish in portions of the Lower Missouri River (Duane Chapman, USGS, pers. comm.). The abundance of these fish, coupled with their ability to consume massive quantities of phytoplankton and zooplankton, presents a great risk to the productivity of the Missouri River and Mississippi River aquatic food web. Bighead and silver carp have the potential to consume and retain large quantities of energy from lower trophic levels of the river's food web. This could occur to such a degree that pallid sturgeon and most other native fishes will be negatively impacted. In addition, pallid sturgeon larvae may be preyed upon by bighead and silver carp while they are part of the ichthyoplankton.

Bighead Carp - Bighead carp are known to school and occupy the upper to middle layers of the water column. They prefer large rivers and depend on velocity, a spring rise in the hydrograph and temperature regimes to spawn (Lin 1991). Five ontogenic shifts in feeding ecology of bighead carp were summarized by Lazareva et al. (1977) in fish less than 1 year of age. These included feeding on phytoplankton, then shifting to protococcaeceans, diatoms, bluegreen algae and *Rotaria* eggs, and finally to feeding on zooplankton exclusively. Bighead carp have a large suction volume, fast growth rates and voracious appetites enabling them to decimate concentrations of zooplankton quickly. Preliminary data from the Missouri River indicates that bighead carp can also feed on detritus, which gives them an alternate food source in periods when zooplankton concentrations are low (Duane Chapman, USGS, pers. comm.).

Laird and Page (1996) state that bighead carp have the potential to deplete zooplankton populations that could negatively impact the food availability for many larval fish, adult filter feeding fish and native mussels to a significant degree. Most species of fish in the Missouri and Mississippi Rivers have a larval stage in which the fish are part of the plankton, and thus can be vulnerable to Asian carp predation. Bighead carp host a number of disease causing agents, including 2 bacteria, 1 fungus, 22 protozoa, 6 trematoda, 3 cestoda and 3 copepoda species (Jennings 1988). The impact of these agents on native fish has not been assessed.

Silver Carp - Silver carp are known to school and occupy the upper to middle layers of the water column. Similar to bighead carp, silver carp feeding ecology shifts as the fish ages. As adults, they feed primarily on phytoplankton with zooplankton as a secondary food source. Due to a modified gill structure, the fish filters food items at a ratio of 248:1. Silver carp also feed on organic detritus and associated bacteria, indicating opportunistic feeding behavior. In large numbers, the silver carp has the potential to cause enormous damage to native species because it feeds on plankton required by larval fish and native mussels (Laird and Page 1996) and has the potential to compete with adult native fish that rely on plankton for food (Pflieger 1997). Intraspecific feeding competition between silver carp and endemic fishes in backwater habitats, lakes, pools, etc., appears to be the greatest threat. Silver carp may also displace native river fish from spawning habitats.

Grass Carp - Grass carp are herbivorous and depend on floodplain habitats for successful recruitment. In most rivers where grass carp reproduce successfully, floodplains provide a large volume of still, shallow, warm water containing vegetative cover. There are few macrophytes in the Missouri or Mississippi Rivers. However, ongoing efforts to reconnect the floodplain in these river systems, while essential to native species, will also likely benefit grass carp.

Rangewide Recovery Objectives

As stated in the 2000 Biological Opinion, the Pallid Sturgeon Recovery Plan (USFWS 1993) has identified four Recovery Priority Management Areas (RPMAs) on the Missouri River for priority implementation of recovery actions. These river reaches exhibit remnant elements of what is believed to be suitable pallid sturgeon physical habitat, provided that the hydrology and chemical elements of the aquatic ecosystem, such as temperature and turbidity, are restored. The recovery priority areas from the headwaters to the Mississippi River are: 1) the mouth of the Marias River to the headwaters of Fort Peck Reservoir, 2) Fort Peck Dam to the headwaters of Lake Sakakawea, including the Yellowstone River (Segment 2), 3) 20 mi (32 km) upstream of the mouth of the Niobrara River to the headwaters of Lewis and Clark Lake (portions of Segment 9), and 4) Gavins Point Dam to the Mississippi River (Segments 10-15).

The short-term recovery objective for the pallid sturgeon is to prevent species extinction with the use of artificial propagation and population augmentation. The long-term objective is to downlist and delist the species by 2040 through protection, habitat restoration, and propagation activities. Downlisting and delisting will be initiated when pallid sturgeon are reproducing naturally, juveniles are recruiting into the population, and populations are self-sustaining within designated river reaches. Under the current preliminary criteria, downlisting may be considered when 1) a population structure with at least 10 percent sexually mature females occurring within each recovery-priority management area has been achieved, and when 2) sufficient population numbers are present to maintain stability. Those criteria will be further quantified as additional information becomes available to conduct a Population Viability Analysis, and may be modified or expanded in the future.

The Service, other Federal agencies, state agencies, and academia have made considerable progress in achieving the short-term recovery objective. The four focus areas and noteworthy achievements of the Pallid Sturgeon Recovery Plan are:

1. Protect and restore populations, individuals, and their habitats.Federal agencies are engaged in ensuring their actions do not jeopardize the continued existence of pallid sturgeon.

- State agencies are evaluating the threat of commercial and sport harvest of shovelnose sturgeon on pallid sturgeon, and some have closed the sport and commercial harvest of all sturgeon where the two coexist.
- Numerous outreach efforts have increased public awareness.

2. Conduct research necessary for survival and recovery.

- Research is underway and is addressing important questions on life history and habitat requirements, genetics, behavior, age and growth, status and trends, and propagation.

3. Develop and implement a captive propagation program.

- Propagation and stocking plans have been developed and are being implemented.
- Genetic materials from heritage populations are held in preserved hatcheries as broodstock, cryo-preserved sperm, and progeny.
- More than 40,000 juveniles have been stocked back to the wild across the species' range.

4. Coordinate and implement conservation and recovery.

- Three Recovery Workgroups have been organized to regionally implement the Recovery Plan.

Summary
Since issuance of the 2000 Biological Opinion, additional pallid sturgeon research and survey work has been initiated. This includes additional collection of small numbers of pallid sturgeon larvae and juveniles. However, evidence of reproduction of wild origin pallid sturgeon is lacking. The species is largely being maintained through artificial propagation programs, particularly in the Upper Missouri River where the sub-population below Fort Peck Dam is predicted to be extirpated by 2018. An exception to this is the Lower Mississippi River, where the species status is largely unknown with the exception of recent collections in several locations. However, the rate of hybridization with the closely related shovelnose sturgeon in the Lower Missouri River and Mississippi River is increasing at a high rate.

Pallid sturgeon are threatened by many factors, including hybridization, habitat loss and degradation, commercial fishing, and contaminants/pollutants. These threats to the

species are increasing rather than decreasing and serve to jeopardize the survival of this species in the wild. Hybridization between these species is believed to be a function of many factors including the loss and degradation of habitat, commercial fishing for shovelnose sturgeon and evidence of contaminant effects. Additional threats to the species further compound the species status. Entrainment due to dredging operations and towboats represents an unknown, but perhaps significant, threat to the species through direct mortality. The presence of exotic Asian carp has increased dramatically in the Missouri and Mississippi Rivers. These species compete with native river fish for food and habitat and may present a significant long-term threat to the pallid sturgeon.

STATUS OF THE SPECIES WITHIN THE ACTION AREA AND THE ECOSYSTEMS UPON WHICH THEY DEPEND

LEAST TERN

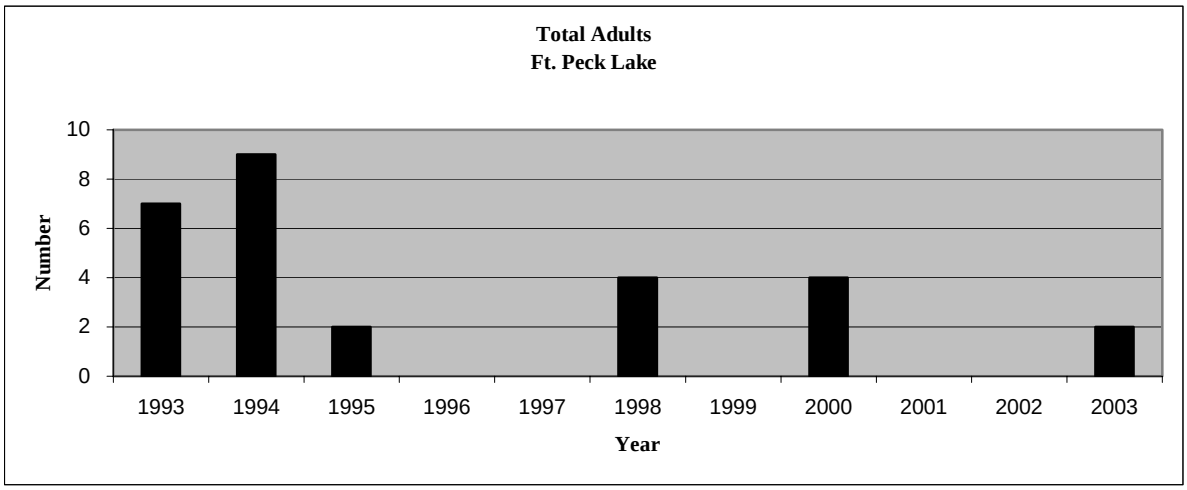
Distribution, Abundance, Productivity and Mortality in the Action Area

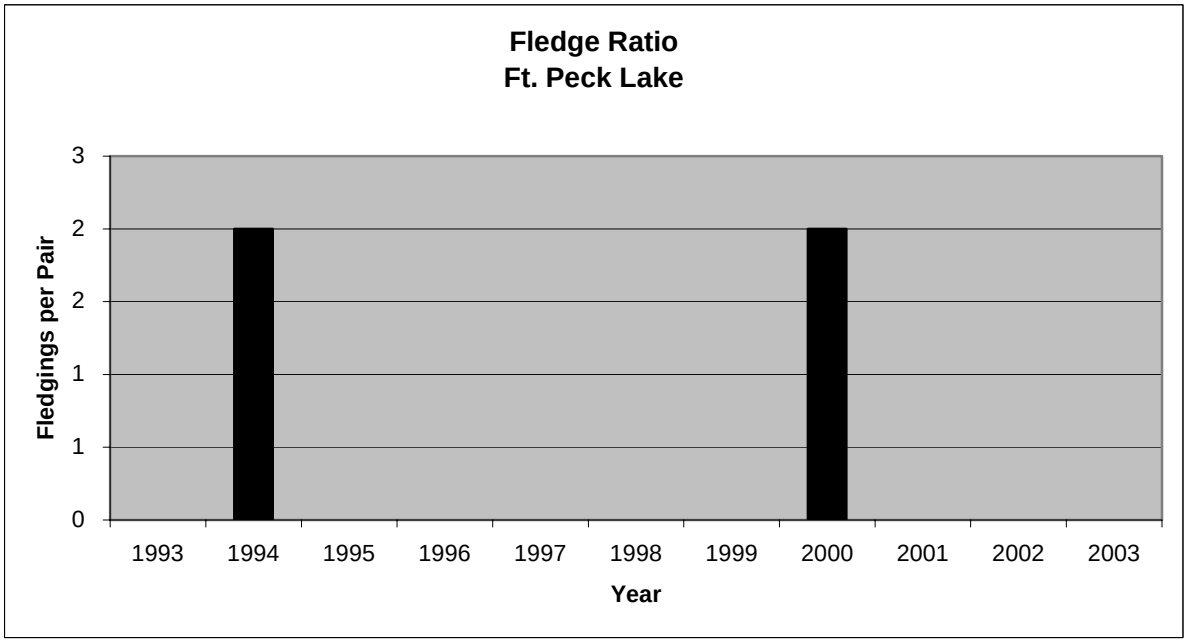
The Historic and Current Distribution in the Action Area section from the 2000 Biological Opinion was reviewed and is incorporated by reference here. In addition, updated information on abundance, productivity and mortality in the action area is included here for each segment of the action area (Figures 2-9; data obtained from C. Kruse, Corps, November 2003).

The overall number of adult least terns on the Missouri has increased since 2000. The highest number of adult terns surveyed was 741 in 2003 with an average of 703 for the 3 year period. The 741 adult terns in 2003 was 182 more than the total number surveyed in 2000 and 36 less than the highest number of adult terns recorded on the Missouri (in 1994). All river reaches except the Ft. Randall Dam to Niobrara River reach had increasing or stable number of adult terns. The river reach with the highest increase during this 3 year period was the Gavins Point Dam to Ponca State Park reach. The highest number of adult terns ever recorded for this reach (366) occurred in 2003.

Overall productivity on the Missouri River since 2000 continued a downward trend from the peak recorded in 1998 (ratio of 1.74 fledging to breeding pair). The fledging to breeding pair ratio remained above 1.00 in 2001 and 2002 and dropped to 0.87 in 2003. The Lake Oahe and Garrison Dam to Lake Oahe reaches had the highest fledge ratio during this 3 year period followed by the Gavins Point Dam to Ponca State Park and Lewis and Clark Lake headwaters reaches. Habitat quality has been slowly degrading since 1997 and this is believed to be the primary cause of the continual decline in productivity (fledge ratios).

Figure 2. Abundance, productivity, and mortality of Interior least terns in Fort Peck Lake, Segment 1, RM 1882.7 - 1771.5.





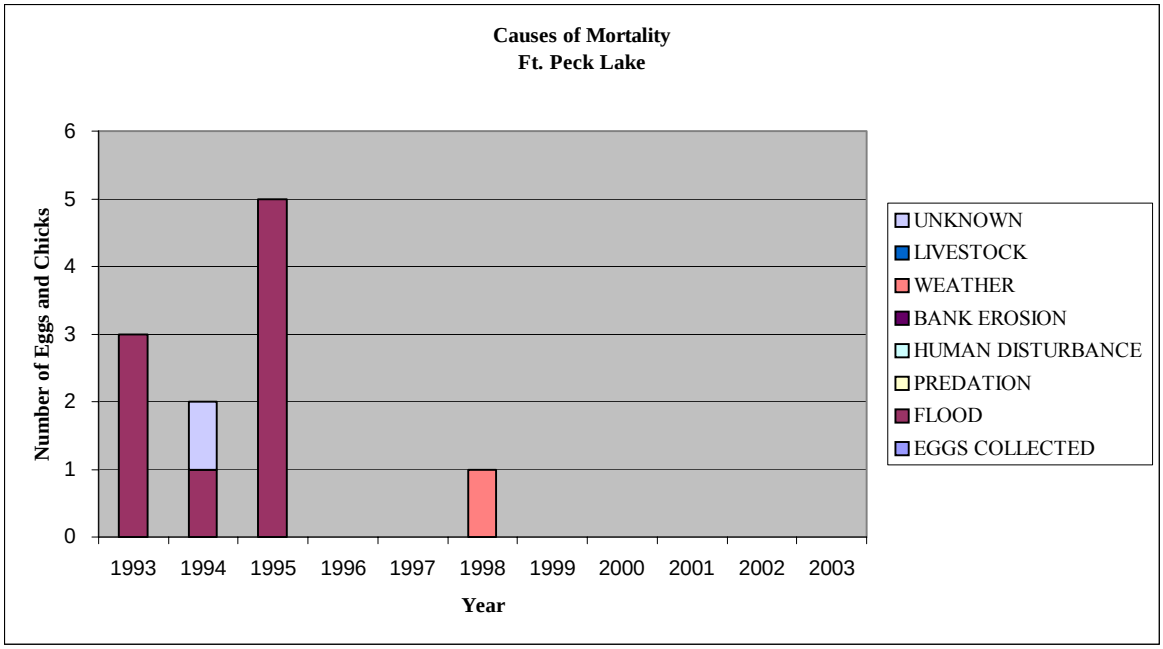
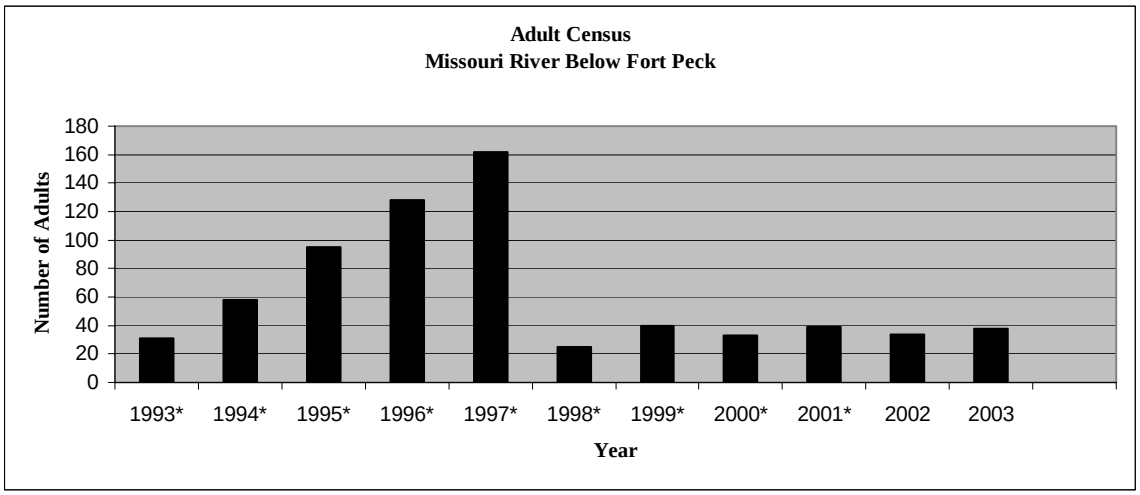
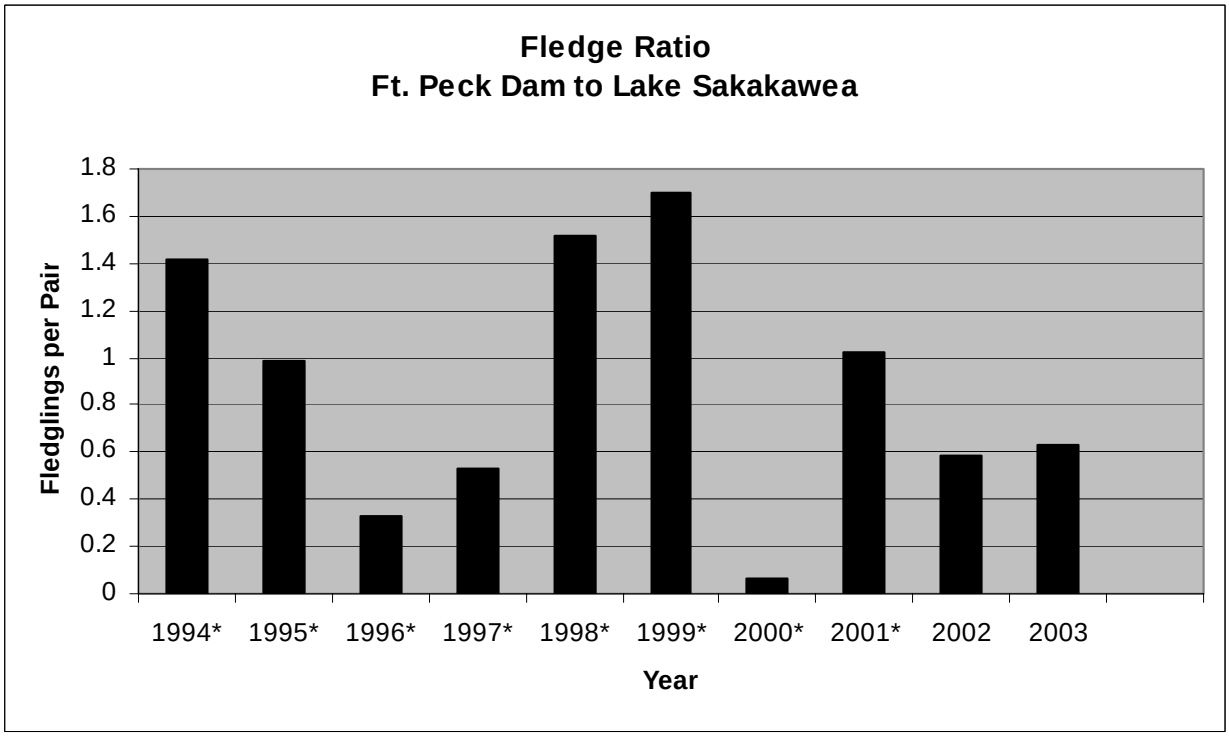

Causes of Mortality
Ft. Peck Lake
Number of Eggs and Chicks
0
1
2
3
4
5
6
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 3. Abundance, productivity, and mortality of interior least terns in Fort Peck Dam to Lake Sakakawea Headwaters near Williston, ND, Segment 2, RM 1771.5 - 1568.0.





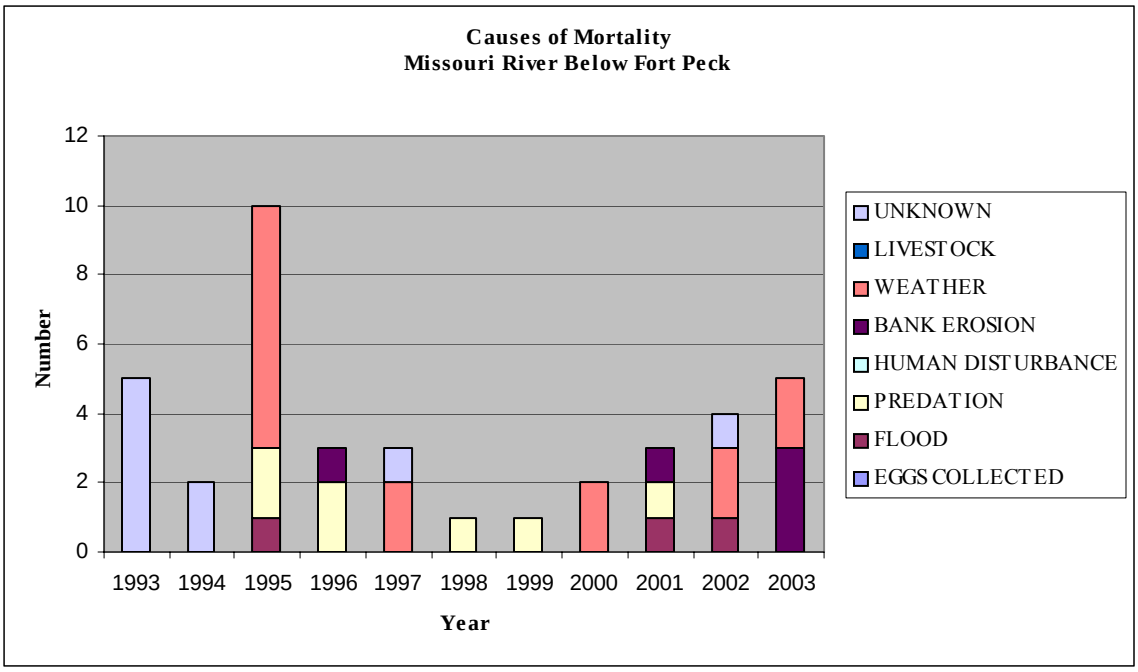
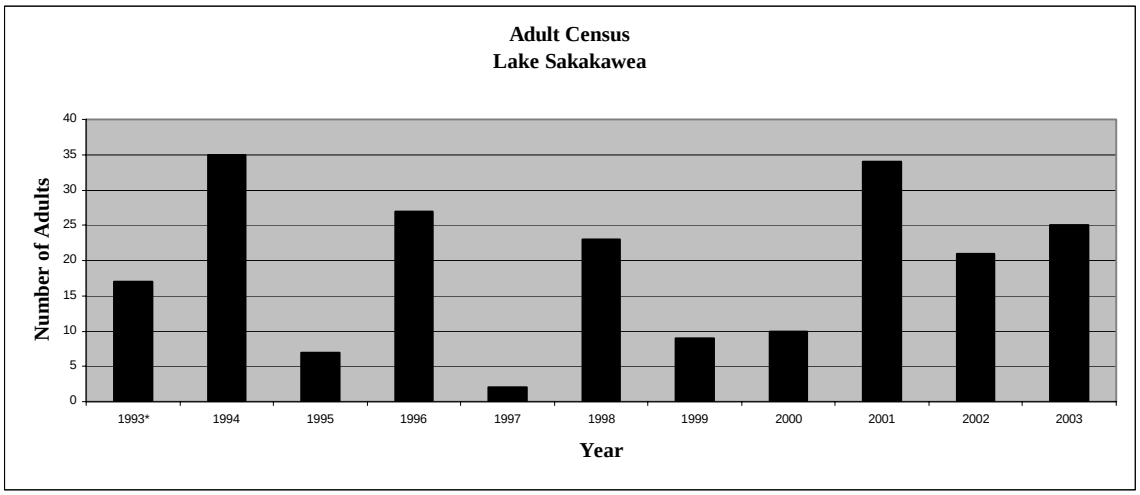
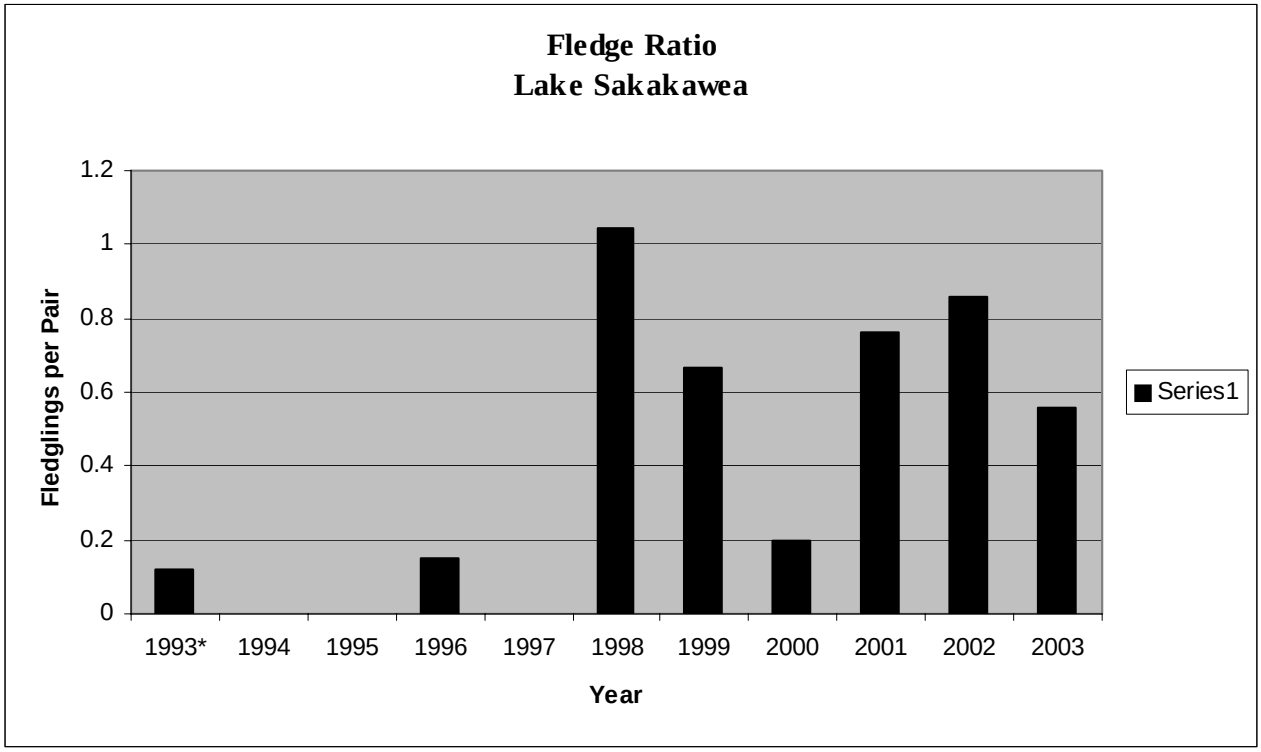

Causes of Mortality
Missouri River Below Fort Peck
Number
12
10
8
6
4
2
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 4. Abundance, productivity, and mortality of interior least terns in Lake Sakakawea and Lake Audubon, Segment 3, RM 1568.0 - 1389.9.





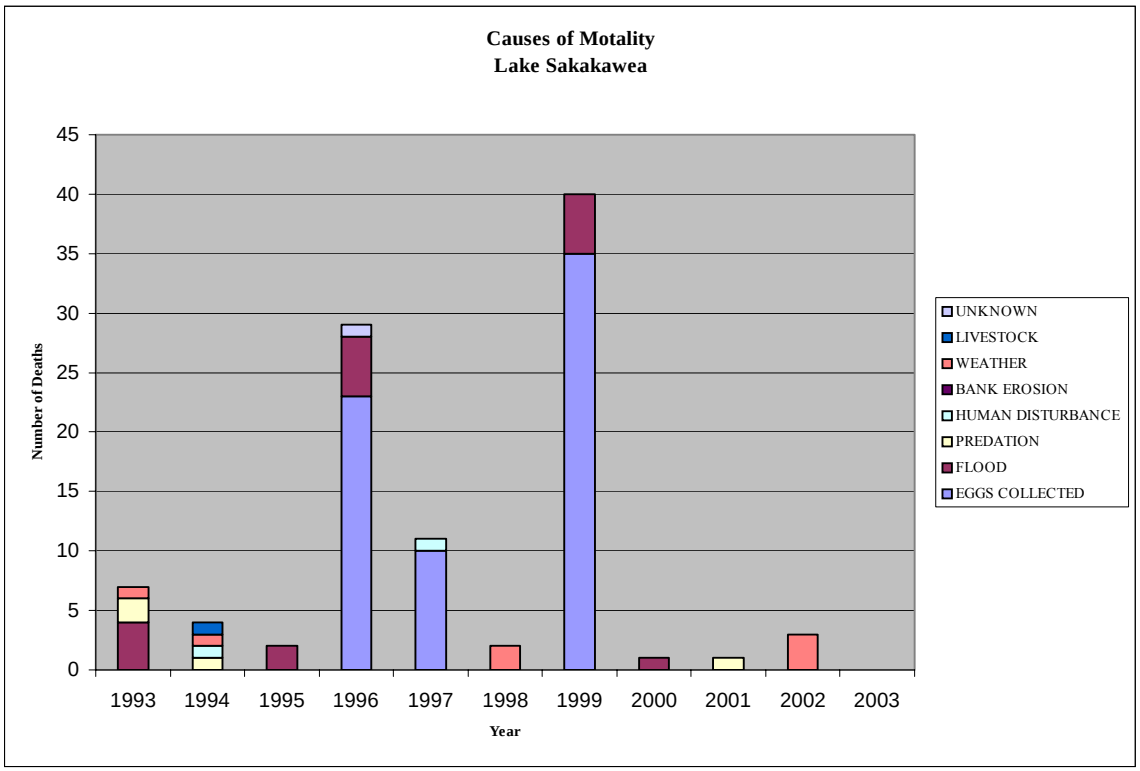
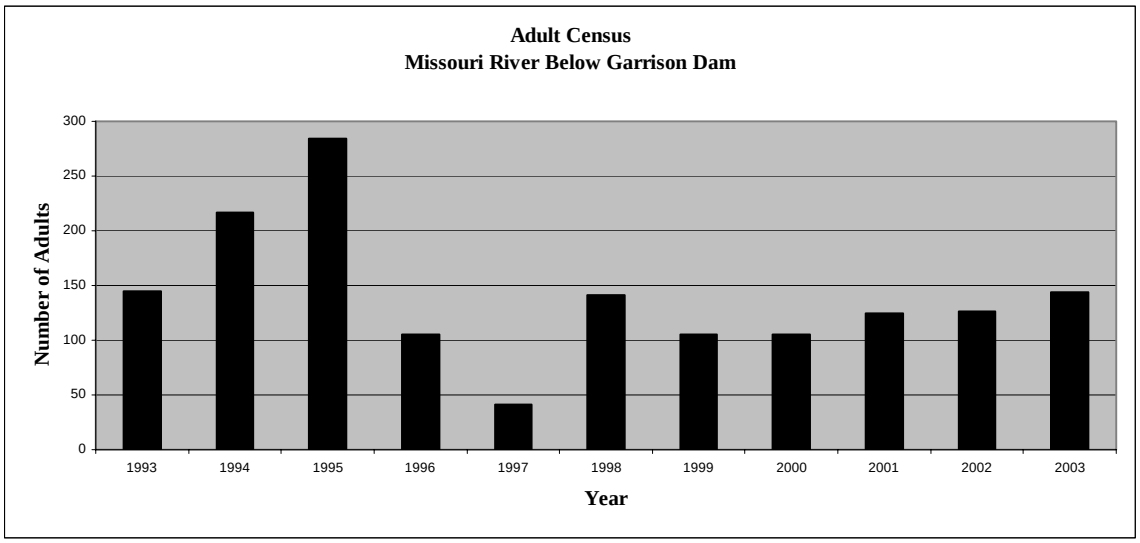
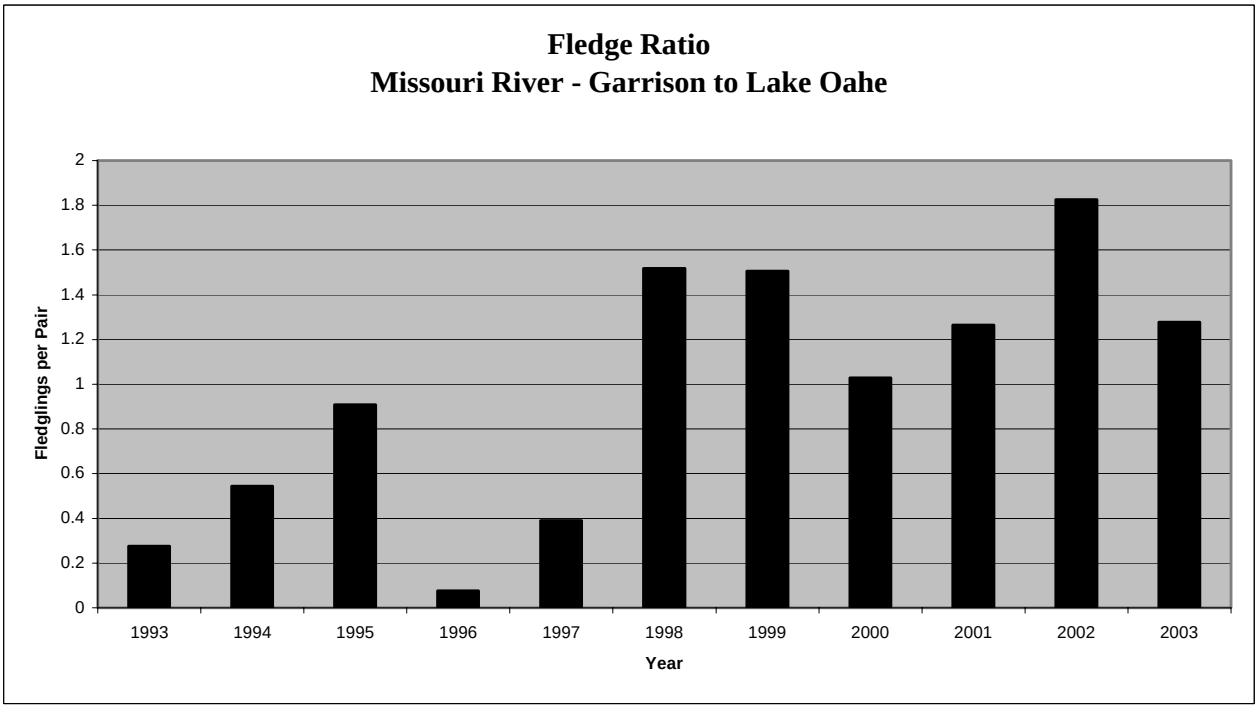

Causes of Motality
Lake Sakakawea
Number of Deaths
45
40
35
30
25
20
15
10
5
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 5. Abundance, productivity, and mortality of interior least terns in Garrison Dam to Lake Oahe Headwaters near Bismarck, ND, Segment 4, RM 1389.9 - 1304.0.





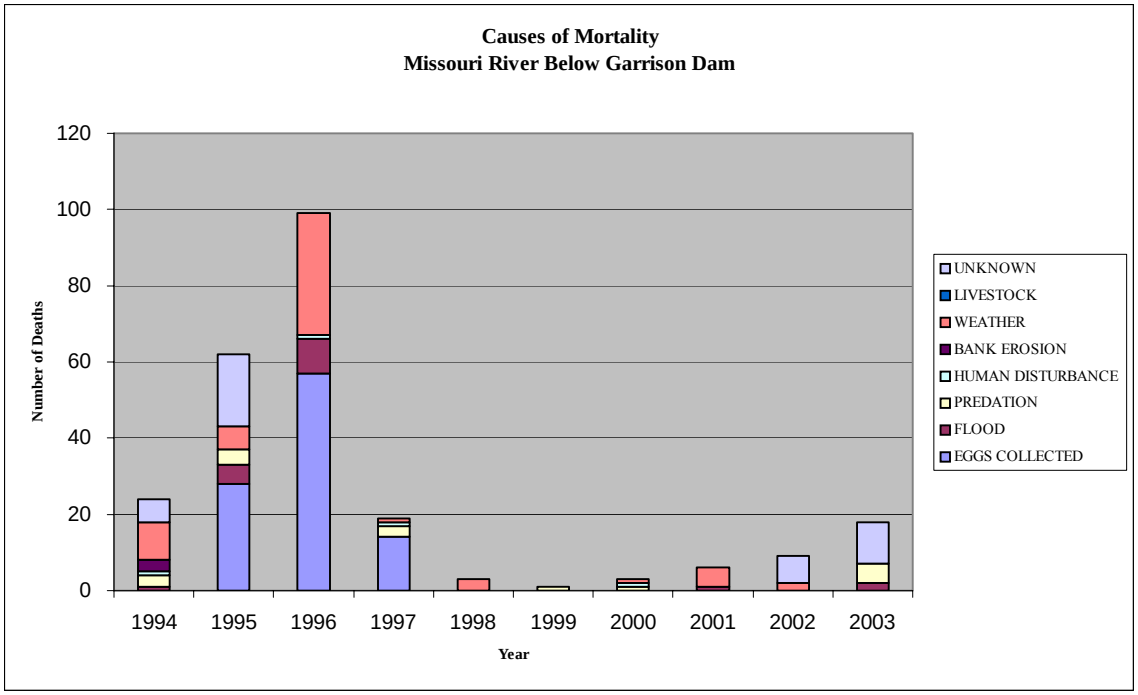
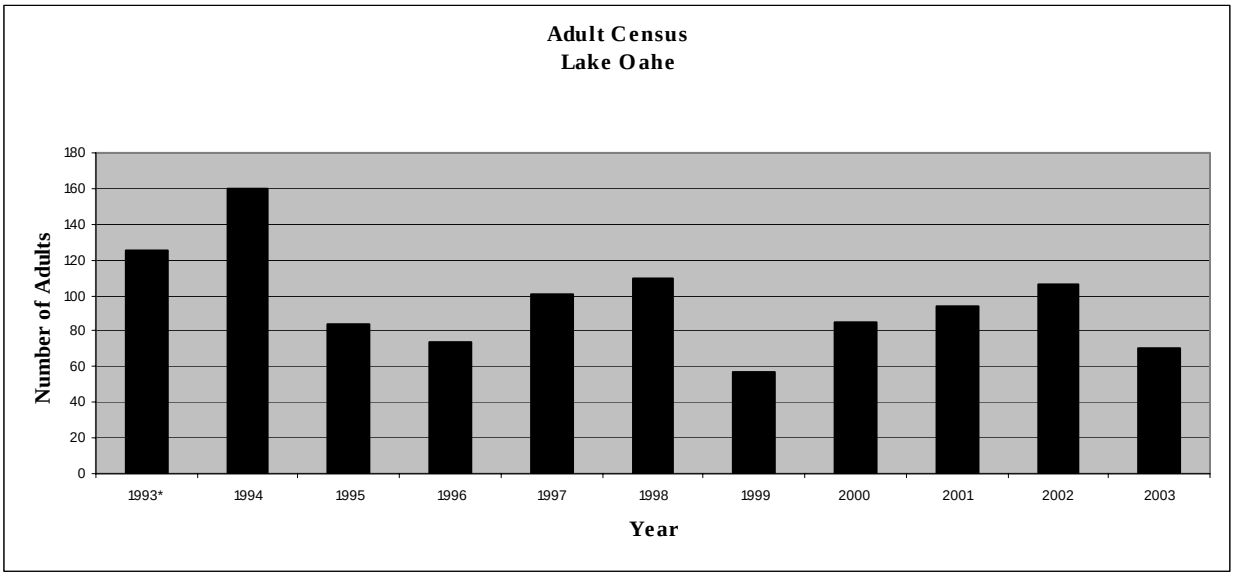
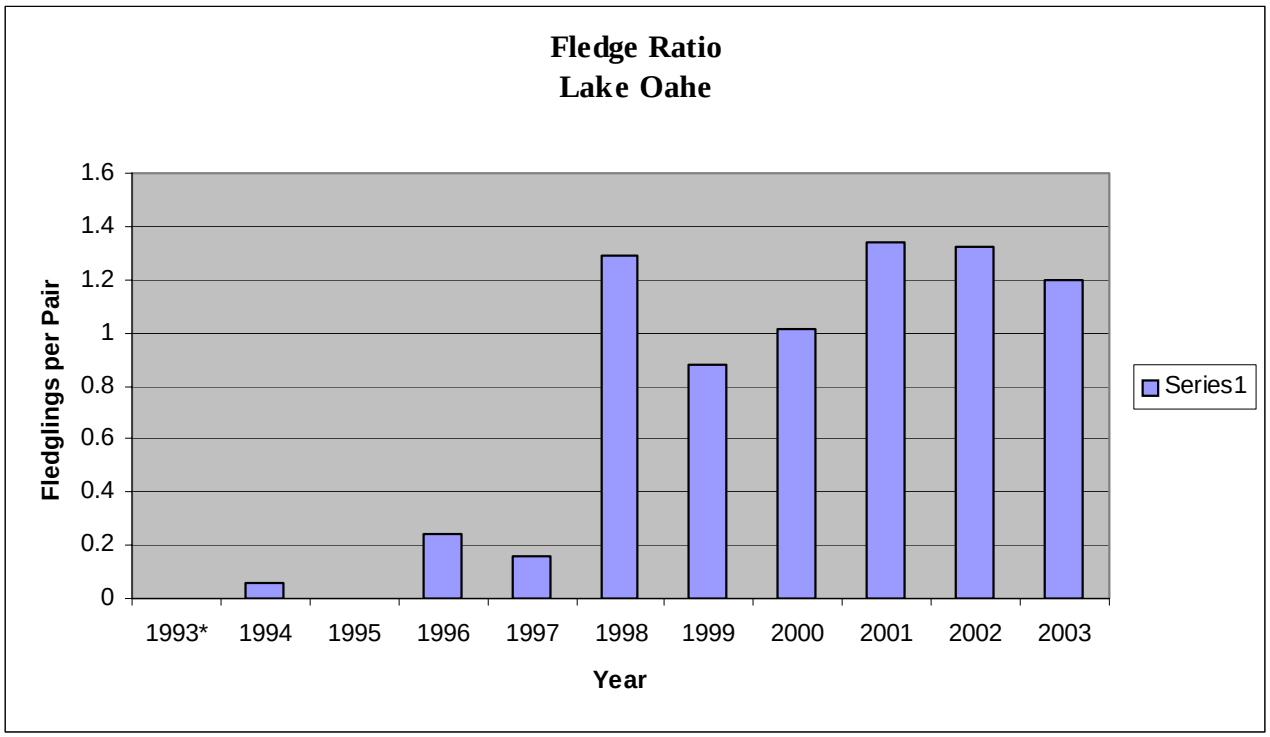

Causes of Mortality
Missouri River Below Garrison Dam
Number of Deaths
120
100
80
60
40
20
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 6. Abundance, productivity, and mortality of interior least terns in Lake Oahe, Segment 5, RM 1304.0 - 1072.3.





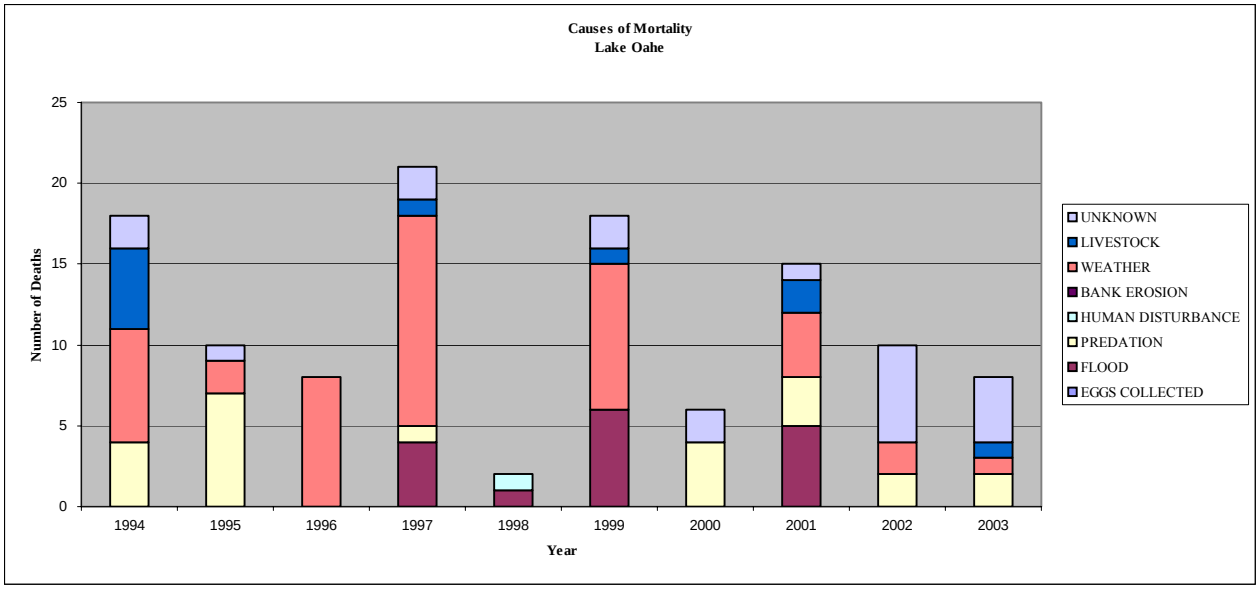
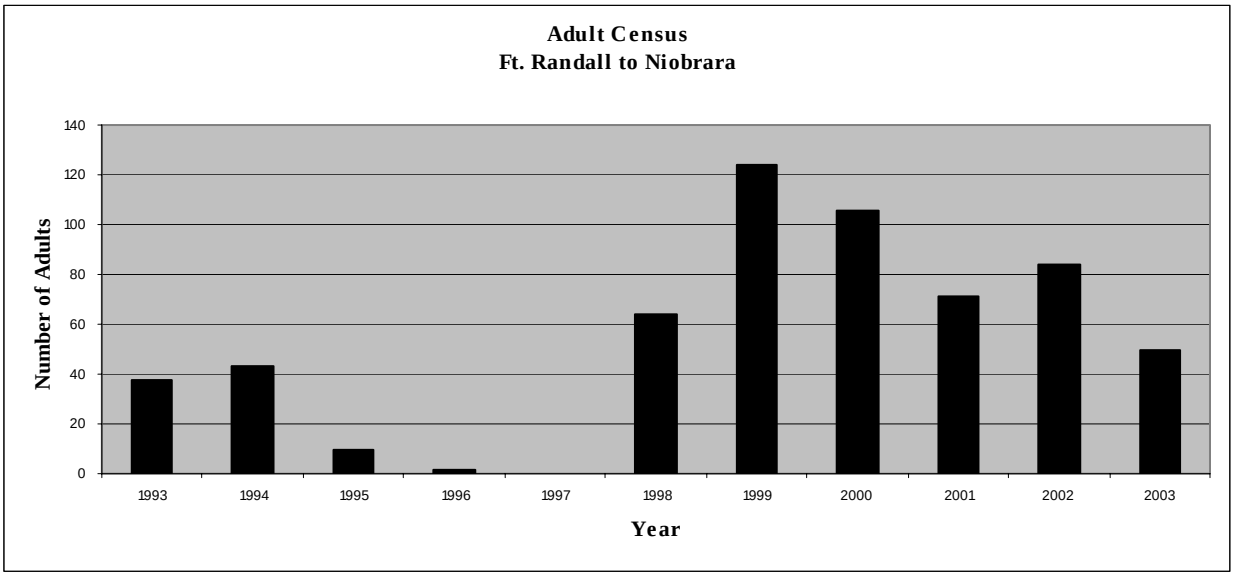
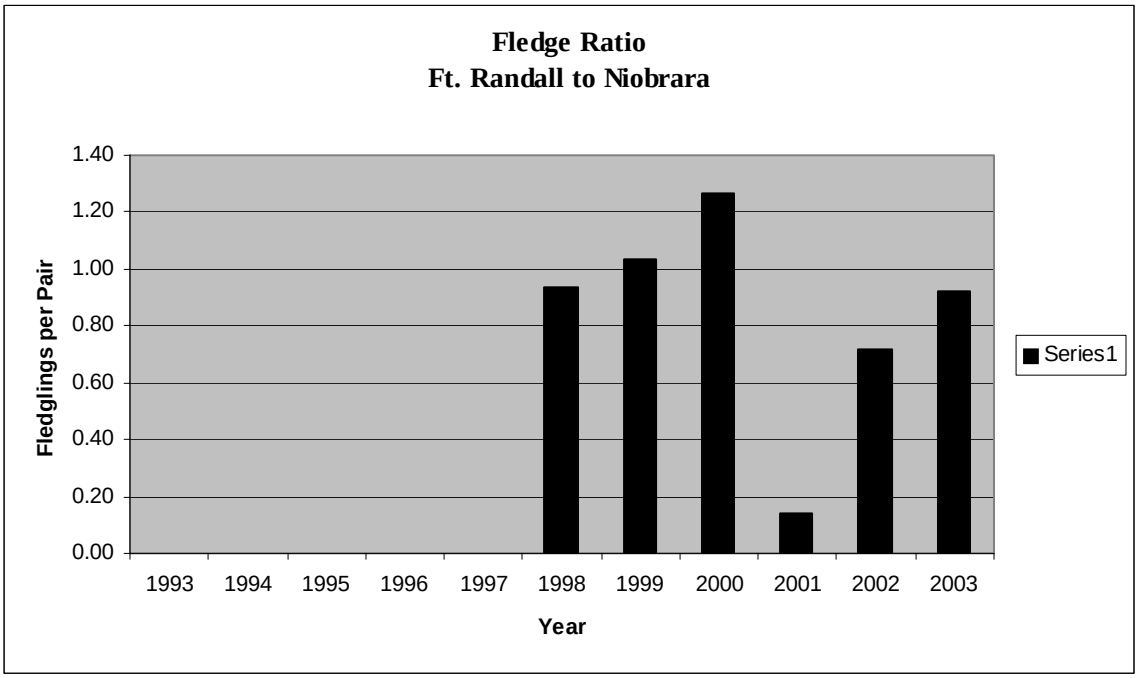

Causes of Mortality
Lake Oahe
Number of Deaths
25
20
15
10
5
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 7. Abundance, productivity, and mortality of interior least terns in Fort Randall Dam to Niobrara River, Segment 8, RM 880.0 - 845.0.





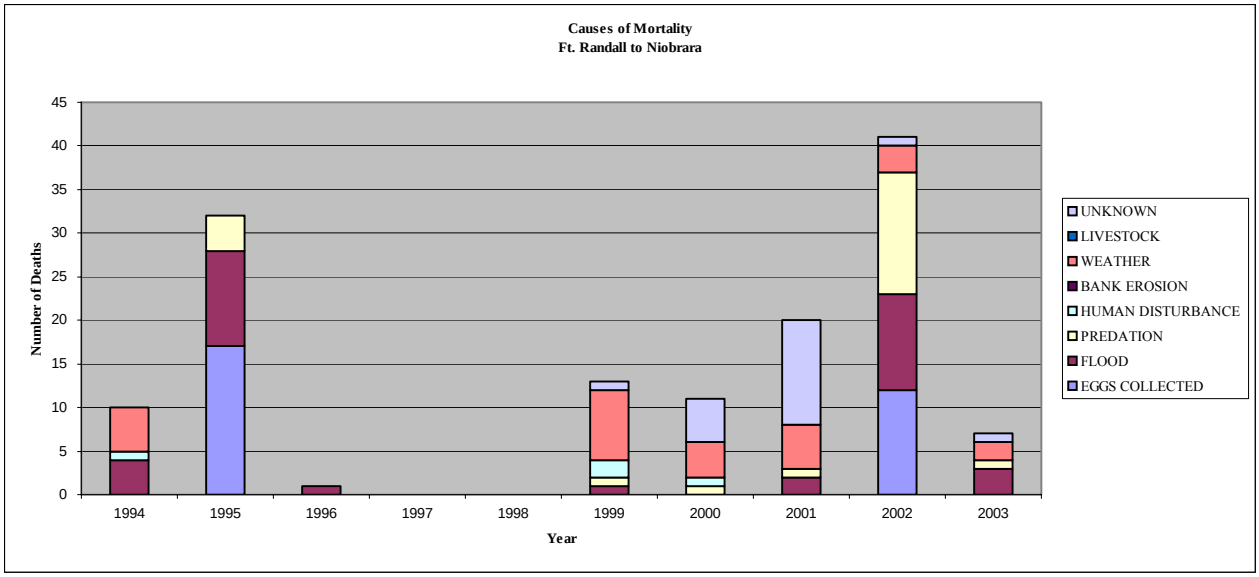
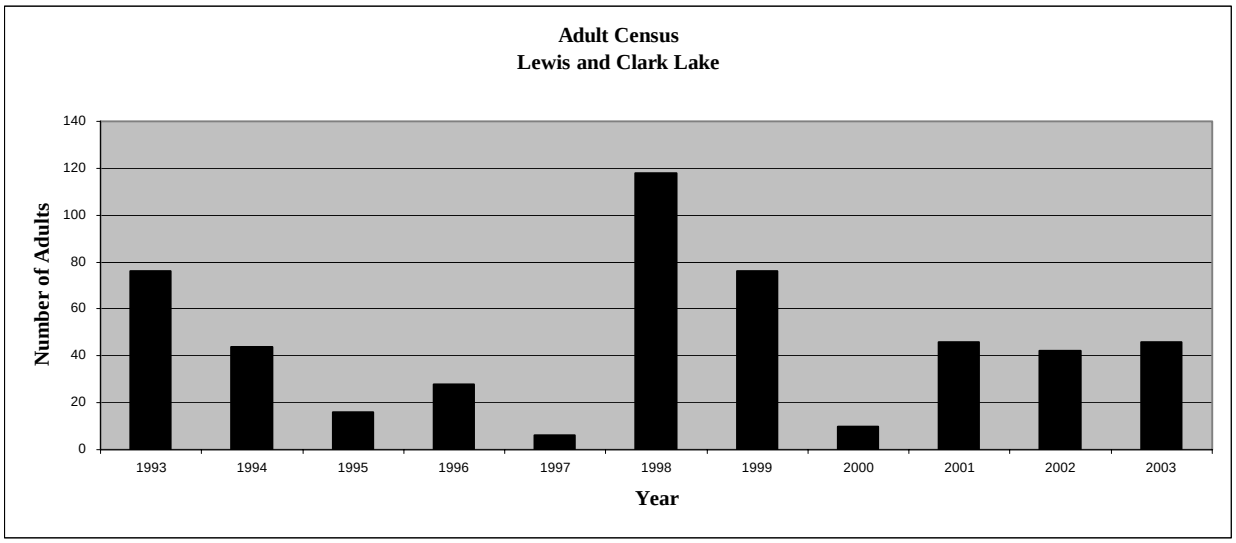
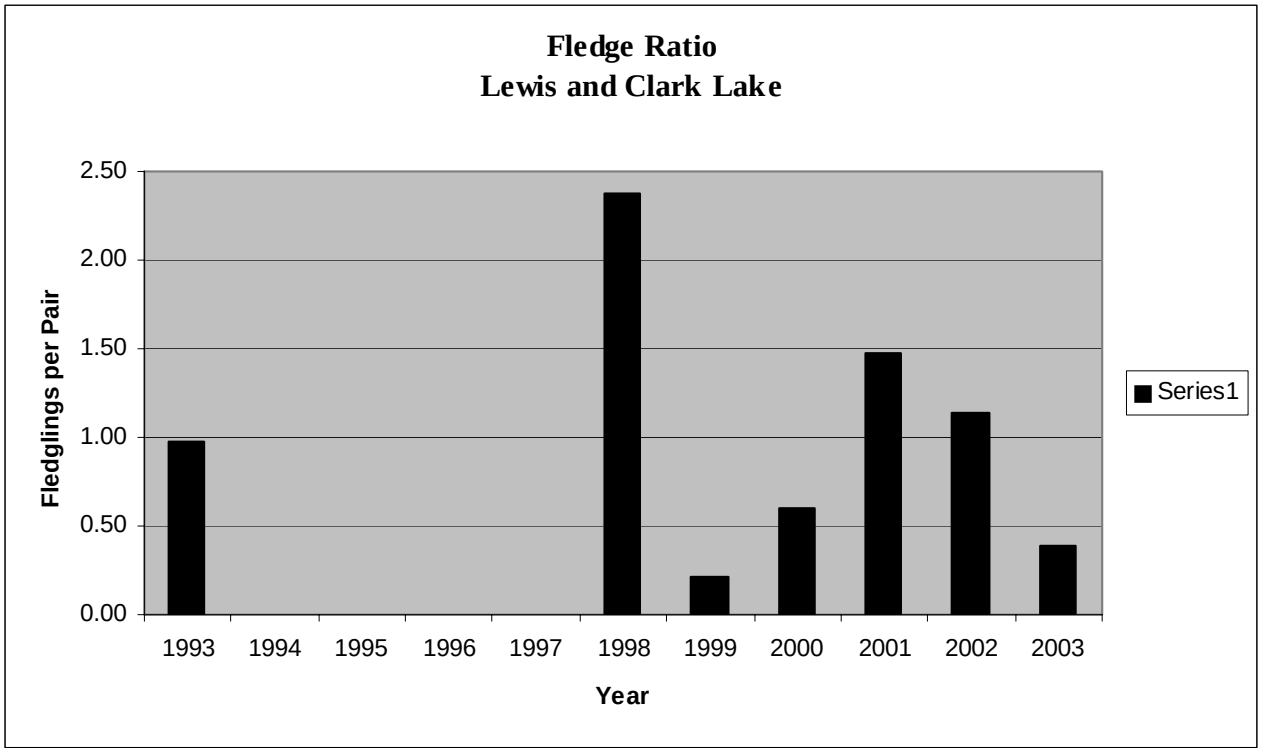

Causes of Mortality
Ft. Randall to Niobrara
Number of Deaths
45
40
35
30
25
20
15
10
5
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 8. Abundance, productivity, and mortality of interior least terns in Niobrara River to Headwaters of Lewis and Clark Lake, part of Segment 9, RM 845.0 - 828.0.





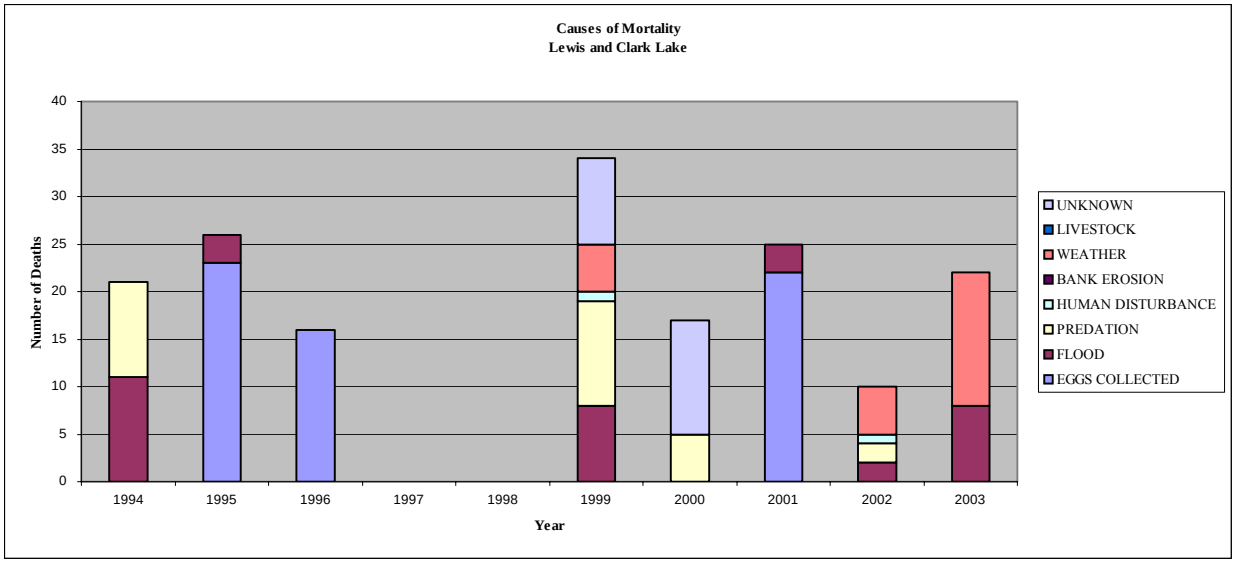
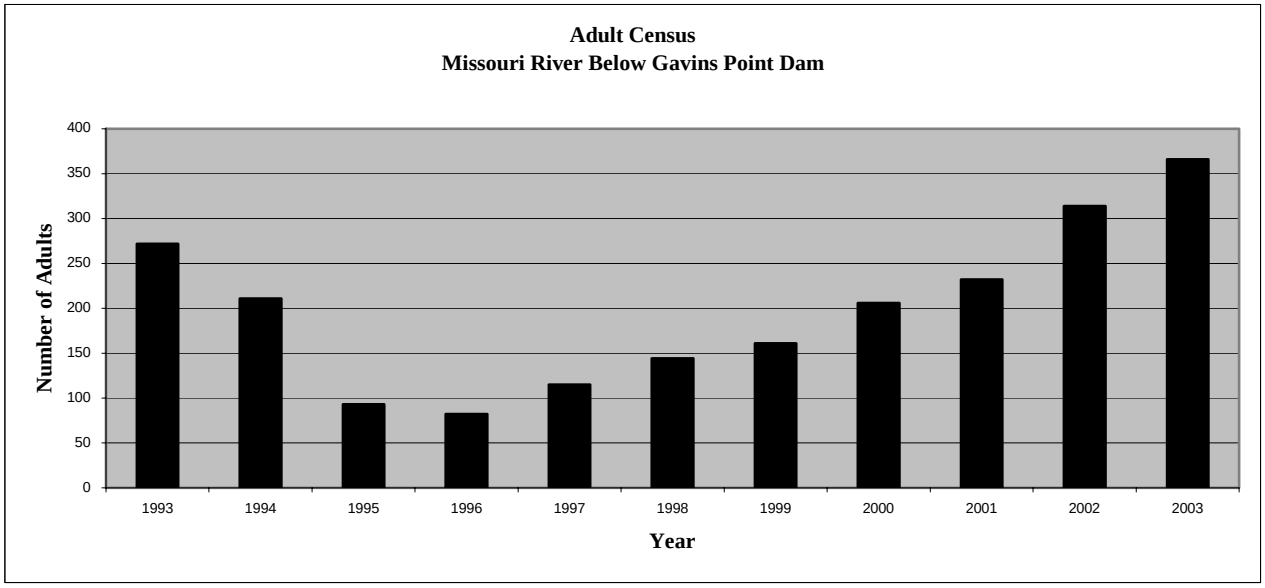
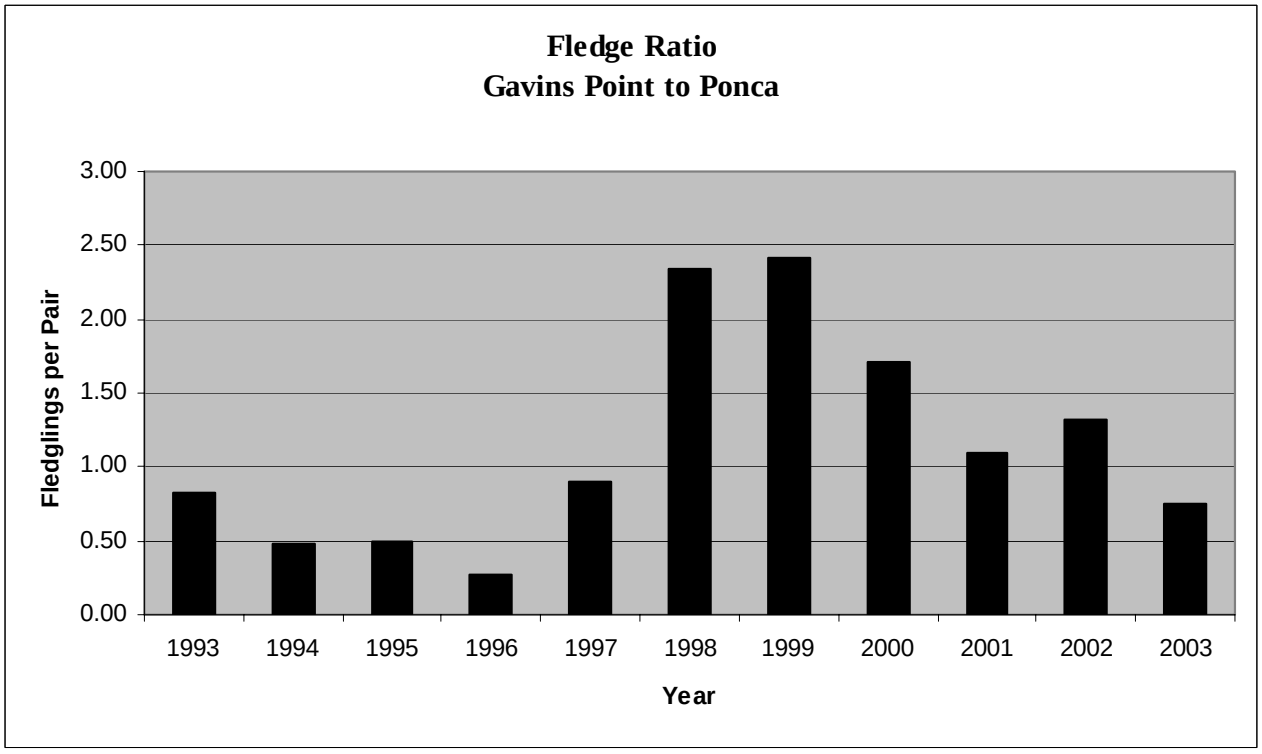
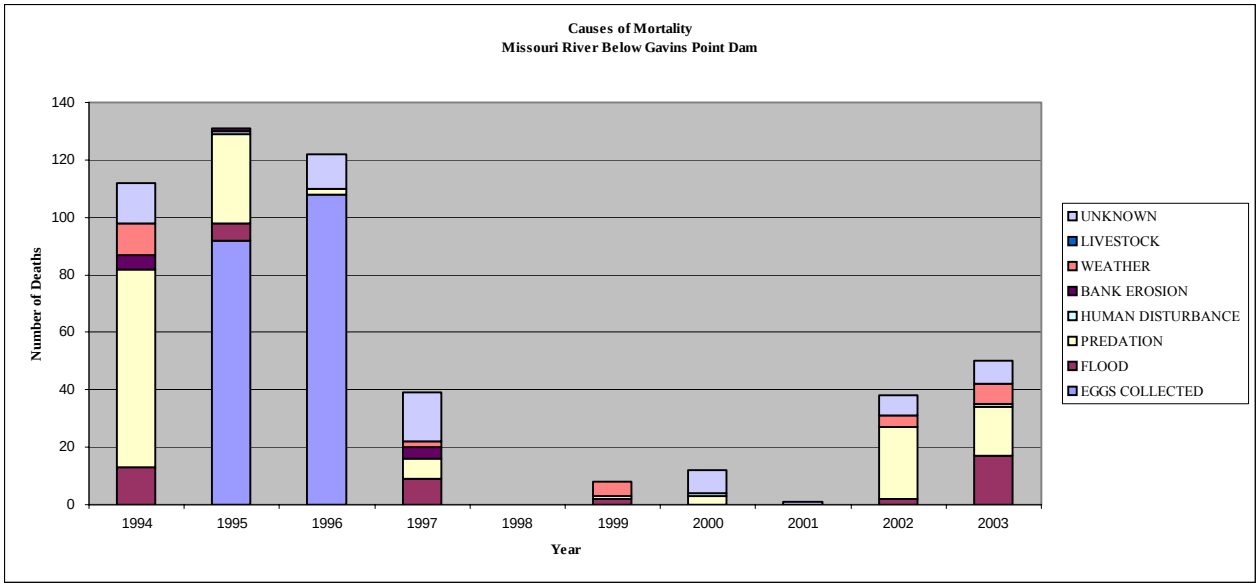

Causes of Mortality
Lewis and Clark Lake
Number of Deaths
40
35
30
25
20
15
10
5
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Figure 9. Abundance, productivity, and mortality of interior least terns in Gavins Point Dam to Ponca, NE, Segment 10, RM 811.1 - 753.0.






Causes of Mortality
Missouri River Below Gavins Point Dam
Number of Deaths
140
120
100
80
60
40
20
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Year
UNKNOWN
LIVESTOCK
WEATHER
BANK EROSION
HUMAN DISTURBANCE
PREDATION
FLOOD
EGGS COLLECTED

Mortality

The Corps has collected comprehensive information on mortality of least tern eggs in the action area since 1993 (USACE 2003c; Table 6). Kreil (in litt. 2003) analyzed the Corps' data (USACE 2003c) according to a worst case scenario that attributed to Corps' operations all nest losses due to human disturbance and predation. We have determined that while some losses due to disturbance and predation are influenced by Corps' operations, we cannot quantify this portion, and that therefore it is not appropriate to assume all of these losses are due to Corps' operations. The true amount of egg mortality due to Corps' operations is likely somewhere between the Corps' conservative estimate and Kreil's (in litt. 2003) liberal estimate. Regardless, we note that egg and chick mortality due to all factors is reflected in the number of fledglings produced per breeding pair on each river segment that we analyzed.

Therefore, the following summary was derived from the Corps' Historical Mortality Report (CITATION?). The total number of eggs laid, total number of eggs lost, and the loss that was attributable to the Corps was recorded. For the purposes of this analysis, Corps-caused mortality includes eggs lost to flooding or salvage of eggs before flooding. since 1993, 14 percent of the total eggs laid have been lost before hatching.

Table 6. Amount of mortality of least tern eggs on the Missouri River (1993 to 2003), including the percentage of mortality attributable to Corps' operations (i.e., flooding and egg collection).

Reach	Number of Eggs	Amount of Egg Mortality	Amount of Egg Mortality Attributable to the Corps' Operations	Percent Mortality of Total Number of Eggs	Percent of Total Egg Mortality Attributable to the Corps' Operations
Ft. Peck Lake	36	14	6	39%	17%
Ft. Peck to Sakakawea	479	28	2	6%	0.42%
Lake Sakakawea	349	101	94	29%	27%
Garrison to Lake Oahe	2,033	254	100	12%	5
Lake Oahe	1,477	194	143	13%	10%
Ft. Randall Dam to Niobrara	998	121	63	12%	5%
Lewis and Clark Lake	868	202	78	23%	9%
Below Gavins Point	4,023	539	221	13%	5%
Total	10,263	1,453	707	14%	7%

Seven percent of the total eggs laid were lost because of Corps operations. The total number of eggs lost varied from a low of 2 in 1998, to a high of 307 in 1993. The amount of eggs taken by Corps' activities varied on an annual basis, with a high of 207 recorded in 1995, and the lows of 1, 2, and 2 eggs recorded in 2003, 2000, and 2001, respectively (Appendix X).

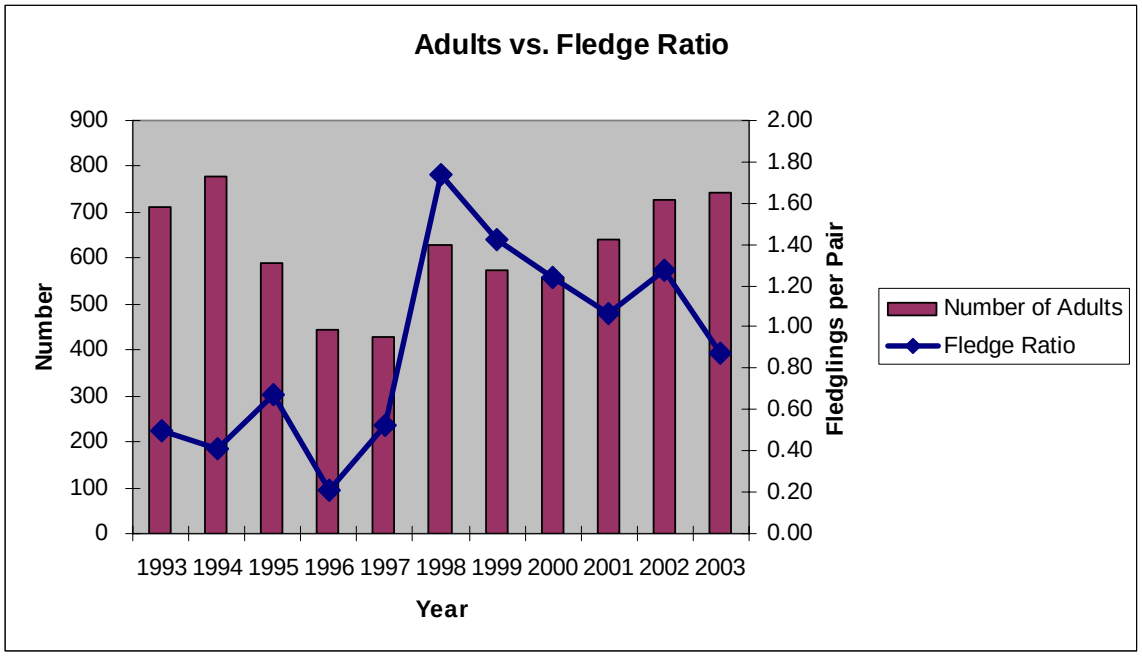
Between 1988 and 1992, surveys were conducted on only three river reaches: Fort Randall to Niobrara, Lewis and Clark Lake, and Gavins Point to Ponca. The average

mortality calculated over all the years is 31 percent; with 13 percent of the total mortality directly attributable to Corps' actions.

Loss of eggs from the wild was highest during the 1995 and 1996, when the Corps collected 158 and 182 eggs, respectively, for hatching and rearing in captivity (USACE 2003d). The fate of eggs successfully hatched and returned to the wild as chicks is unknown, but all are presumed dead based on evidence of no band returns and direct observations of mortality (Mike Olson, USFWS, pers. comm. 2003).

The amount of egg mortality is reflected in the fledgling per pair ratios Figure 9, but it is difficult to interpret the effect of egg loss on fledge ratio because of the manner in which the data are recorded: fledge ratio is calculated on a per pair basis, and egg mortality is summed across all pairs annually. Reach specific information on fledgling ratio and causes of mortality is presented in Figures 2 through 9. The year with the highest egg mortality, 1993, was not the year with the lowest fledgling per pair ratio. The total average fledge ratio for the Missouri River is 0.81, including information collected from Fort Randall to Niobrara, Lewis and Clark Lake, and Gavins Point to Ponca (1998 to 1992) and comprehensive surveys of the entire Missouri River from 1993 to 2000.

Figure 10. Total number of adults plotted against fledgling per pair ratios for interior least terns on the Missouri River 1993-2003.



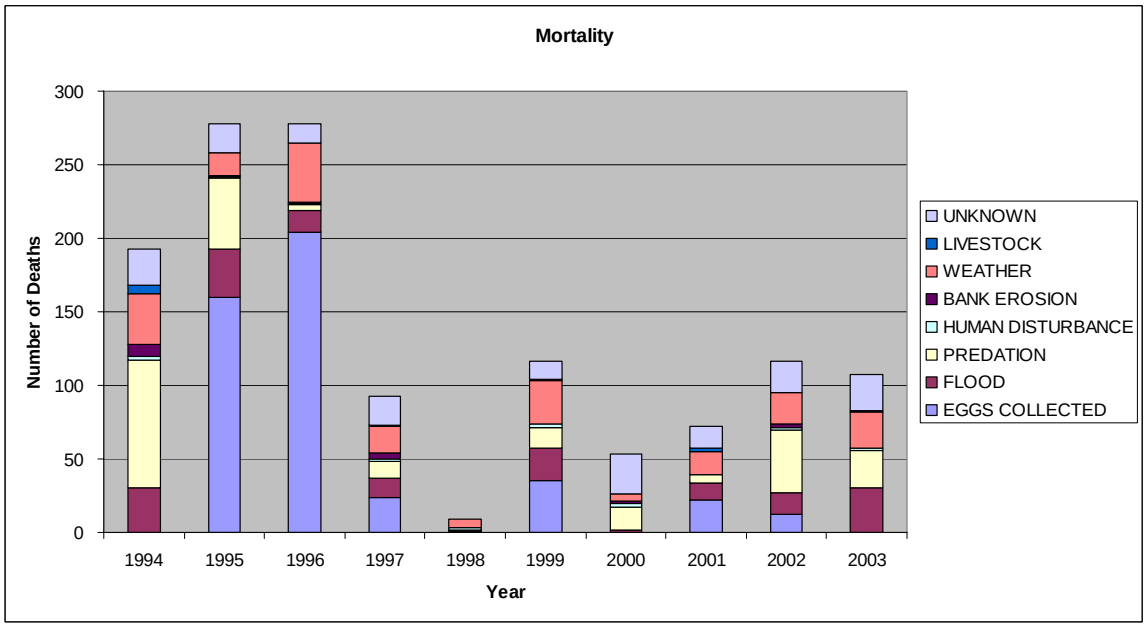


Figure 11. Causes of annual nest loss along the Missouri River (1993 to 2003) (USACE 2003d).

Mortality can be attributed to variety of causes (Figure 11). Corps data indicate that between the years of 1993 to 2003, flooding and egg collection together were the greatest

cause of nest loss (Figure 11). Egg collection for the purposes of salvaging eggs was undertaken during the years of 1995, 1996, and 1999 through 2002. Eggs were only collected when a nest was in imminent threat of flooding because of Corps activities, therefore it is correct to attribute egg collection to Corps operations. At least 749 nests were lost to egg collection and flooding combined, between 1993 and 2003.

The second leading cause of nest loss was predation, with 275 nests lost since 1993. It is highly likely that Corps operations on the Missouri River contribute to take of nests and eggs from predators because of the effects of water management on the shoreline and sandbar habitats. Mediation of extreme flows has reduced the amount of scouring taking place along shorelines; consequently vegetation regrowth provides a habitat for predators of least tern eggs and chicks. No information is known on mortality of sub-adults and adults within the action area.

In summary, mortality of chicks has been comprehensively monitored and recorded by the Corps since 1993. Approximately 14 percent of all eggs die before hatching and about 50 percent of that mortality is attributable to Corps' operations.

Current Distribution and Abundance of Habitat in the Action Area

The current distribution and abundance of habitat of the least tern from the 2000 Biological Opinion (USFWS 2000) was reviewed and is incorporated by reference. In addition, refer to the section entitled "Rangewide Distribution and Abundance of Habitat – Foraging Habitat**"** of this 2003 Amended Biological Opinion for updated information about foraging habitat in the action area. The following information provides update of information about distribution and abundance of nesting habitat in the action area since the 2000 Biological Opinion:

Nesting Habitat

Extensive least tern nesting habitat was created in the action area, particularly in the segment between Gavins Point Dam and Ponca State Park, by high flows during 1996 and 1997. This new habitat supported increased number of nesting terns; however this habitat is declining in quality and quantity (Vander Lee 2003). Drought conditions currently exist on the Missouri River, with the upper basin experiencing a severe drought. The drought, lack of high flows to replenish and scour sandbars, and retention of sediments in the reservoirs are compounding factors currently impacting habitat.

Vander Lee (2003) documented changes in the total acreage, individual size, and amount of vegetation on sandbars on the Missouri River below Gavins Point Dam after the high flow releases in 1997. Vegetation on persistent interchannel increased 3-fold sandbars between 1998 and 2000. Another 1,100 acres of sandbar were lost to erosion during this period. Total sandbar acres decreased by 60 percent and the average sandbar size decreased by 55 percent in 2000.

The Corps provided information on the current status of sandbar habitat below Gavins Point Dam (as of September 2002, USACE 2003d). The maximum acreage of unvegetated habitat (approximately 3,000 acres) occurred in 1998 and has gradually

declined since then. Of the current 1,760 acres of total emergent habitat in the action area, 1168 acres (67 percent) are more than 10 percent vegetated and therefore are unavailable for nesting terns. Approximately 582 acres of potential habitat (that which is less than 10 percent vegetated) currently exist at 25,000 cfs, 192 acres at 27,000 cfs, and 0 acres at 29,000 cfs. However, 322 of these acres are small, low elevation sandbars that do not provide suitable nesting habitat (Bruce Vander Lee, USACE, pers. comm. 2003). The remaining 260 acres are higher, unvegetated sandbars. These 260 acres provide the primary suitable nesting habitat below Gavins Point Dam (Bruce Vander Lee, USACE, pers. comm. 2003).

There is no updated quantitative information on the amount and quality of habitat below Ft. Peck, Garrison, and Randall Dams. The latest information is from 1998, which was presented in the 2000 Biological Opinion. The Corps indicated that habitat conditions below these dams are experiencing similar trends in both erosion of sandbars and increase in vegetation as to conditions below Gavins Point Dam (i.e., the majority of the sandbars are vegetated) but they have not quantified these trends (Bruce Vander Lee, USACE, pers. comm. 2003).

Importance of Missouri River to the Least Tern

Interior least terns on the Missouri and Kansas Rivers may currently account for approximately 6 percent of the listed entity (779 least terns in Missouri and Kansas Rivers/12,305 rangewide; Table 1). This proportion ranged between 6.5 percent in 2003 and 11.4 in 1992. We hypothesize that while Interior least terns are thought to exhibit some level of fidelity to the natal breeding area, the dynamic nature of their habitat suggests that it is likely they move from one river system to another in years when the natal area may not contain suitable habitat. We noted that in years when water was very high on the Missouri River system and few nesting sites were available (1996 and 1997), numbers of adults counted on the Missouri River decreased and numbers of adults counted on the lower Platte River increased slightly over the preceding year (Table 1). The Missouri River system appears to be an important component of the overall distribution of the listed entity and the numbers of adults observed appears to be steadily increasing since the low numbers counted during the high water years of 1996 and 1997. The total number of adult birds estimated to use the Missouri River system (779 in 2003) has not met the stated recovery goal of 2,100 birds in the system.

Importance of Kansas River to Least Tern

This section is incorporated by reference from the 2000 Biological Opinion and is reproduced here for clarity:

> **"**The least tern is not known to nest on the Kansas River historically, although historic records exist of nesting terns on some of the larger tributaries in the western part of the basin. The first records of nesting least terns on the main stem Kansas River occurred in 1996 near Wabaunsee. Their occurrence is believed to be due to available suitable habitat resulting from floods in 1993 and 1995, and because other habitats were unavailable during nest initiation due to prolonged flooding on the

Missouri, Platte, and lower Mississippi Rivers. Nesting terns have returned every year since, ranging between 12 and 38 birds between 2000 and 2003."

PIPING PLOVER

Historical Distribution in the Action Area

The Service summarized the historical distribution of piping plovers in the action area in the November 2000 Biological Opinion. That information, found on page 143 of the 2000 Biological Opinion is incorporated by reference. In summary, piping plover nesting has been recorded along the Missouri River downstream to Plattsmouth, Nebraska, (RM 595) and upstream to Fort Peck Lake in eastern Montana.

Current Distribution and Abundance in the Action Area

To clarify the current status and distribution of piping plovers on Missouri and Kansas River Segments, we reiterate and update much of the information for this section from the November 2000 Biological Opinion. Segment names in bold indicate a correspondence to the segments described in Figure 12.

Data summaries for each segment below are based on the database, "Mainstem Missouri River Piping Plover Productivity Monitoring 1986-2003," maintained by the Corps, Yankton, South Dakota. Adult censuses and nest monitoring began on some segments in 1986, but monitoring did not take place on all segments until 1993. Therefore, to provide for consistent comparisons among reaches and to summarize data for the entire action area, most summaries are based on 1993-2003 data. Where available and appropriate, pre-1993 data are also presented. In 1995, the Corps began collecting eggs from nests that were likely to be flooded by rising water. Results of captive propagation are summarized below for each segment from which the Corps has removed eggs.

Fort Peck Lake (**Fort Peck Lake, Segment 1**, RM 1882.7 - 1771.5): This reach defines the western edge of piping plover breeding habitat. Biologists have counted a mean of 12 plovers during annual censuses conducted in this segment from 1987-2003 (Figure 13). The numbers of plovers that nest in this segment varies inversely with reservoir levels and there are zero nests here in years when reservoir levels are at extreme highs (e.g., in 1996 and 1997). Numbers of fledglings peaked at 35 in 1990, but have remained below ten in all years since 1993. Of the nests monitored since 1986, flooding has destroyed 45 percent. Plovers have been found primarily along Bear Creek Bay and the Dry Arm of the lake. They typically arrive in early May and initiate nests by mid-May.

Fort Peck Dam to Lake Sakakawea Headwaters near Williston, ND (**Fort Peck River, Segment 2**, RM 1771.5 - 1568.0): Since piping plover censuses and nest monitoring began in 1988 in this segment, an annual mean of 11 adults has been counted (Figure 13) and total nests has never exceeded 6 in any year. Total fledglings peaked at 35 in 1995, but have remained at ten or less since 1997. As in the Fort Peck Lake reach, flooded (42 percent) and "fate unknown" (30 percent) have been the predominant fates of unsuccessful nests in this river reach. The capture of sediment and regulation of flows at

Fort Peck Dam, which is at the upstream end of this segment, likely limits piping plover habitat elsewhere in this reach. Plovers using this reach are often found near the mouths of the Milk and Yellowstone Rivers where sediment plumes from these rivers create sandbars with conditions suitable for nesting. Most of the nests monitored in the reach have been initiated in late May and early June.

Lake Sakakawea and Lake Audubon (**Lake Sakakawea, Segment 3**, RM 1568.0 - 1389.9): The average adult census for piping plovers over the last 12 years on this segment has been 147 birds (Figure 13). This segment supports the highest numbers of piping plovers on the Missouri River. The number of nests found within this reach has risen steadily from 13 in the flood year of 1997 to 235 in 2003. Major fates of unsuccessful nests monitored since 1993 have been flooded (36 percent), fate unknown (16 percent), destroyed by weather (15 percent), and destroyed by unknown cause (10 percent). Since 1995, the Corps has collected 51 nests in this reach to keep them from being flooded; 147 chicks from collected nests have fledged (average =16/year). Nesting is widely distributed on Lake Sakakawea, although Steinke Bay, Douglas Creek Bay, the Van Hook Arm, Little Egypt, and tobacco Garden Bay are especially important. Timing of nest initiation (early to mid-May) is similar to that observed on nearby prairie coteau wetlands.

Garrison Dam to Lake Oahe Headwaters near Bismarck, ND (**Garrison River, Segment 4**, RM 1389.9 - 1304.0): The yearly average for the adult annual census on this reach is 114 plovers (Figure 13). The number of nests found in this reach peaked at 136 in 1995, the year before the 1996-1997 floods. During the 1997 flood only one nest was found in this reach, but nest numbers have since risen and have leveled off to approximately 86 nests in the last three years (2001-2003). Flooding is a relatively unimportant cause of nest failure in this reach – 9 percent of unsuccessful nests in this reach have been flooded since nest monitoring began in 1993. Predominant fates of unsuccessful nests in this reach have been destroyed due to unknown causes (23 percent), destroyed by weather (22 percent), fate unknown (17 percent), abandoned (12 percent), and predated (10 percent). Most nest initiation on the Garrison River Reach has occurred during the first three weeks in June. Since 1995, the Corps has collected 22 nests in this reach, resulting in the fledging of 48 chicks.

Lake Oahe (**Lake Oahe, Segment 5**, RM 1304.0 - 1072.3): The mean annual census of adult piping plovers on Lake Oahe is 92 plovers (Figure 13). As in other reaches, nests in this segment have risen from lows during the floods of 1996-1997 to a high of 161 in 2003. Predominant fates of unsuccessful nests are flooding (25 percent), fate unknown (20 percent), destroyed unknown (19 percent), weather (13 percent), and abandoned (10 percent). The plovers begin arriving as early as late April, with the majority of nest initiations during the last three weeks in May. Important nesting sites for the plovers include the upper part of the lake from RM 1295.0 to 1299.0, Dredge Island at RM 1270, Swiftbird Bay, Kennel Flats, Little Bend and the Cheyenne River Arm. Since 1995, the Corps has collected 20 nests in this reach, resulting in the fledging of 38 chicks.

Oahe Dam to Fort Randall Dam **(Lake Oahe, Segments 6 and 7**, RM 1072.3 - 880.0): Only a few records of nesting piping plovers along the 192 miles of the Missouri inundated by these dams have been recorded.

Fort Randall Dam to Niobrara River (**Fort Randall River**, Segment 8, RM 880.0 - 845.0): The mean annual census of adult piping plovers in this reach is 21 plovers (Figure 13). As in other reaches, nest numbers in this reach rose after the 1996-1997 floods and peaked at 40 in 2000. Since 2000, however, nest numbers declined to 22 in 2003. Predominant fates of unsuccessful nests in this reach are "destroyed by unknown cause" (34 percent), flooding (25 percent), destroyed by weather (23 percent), and predated (10 percent). Most of these piping plover nests have been initiated during the first two weeks in June. The Corps first collected nests here in 1998 and has collected a total of 6 nests in this reach, resulting in the fledging of 18 chicks.

Niobrara River to Headwaters of Lewis and Clark Lake (**Lewis and Clark Lake**, part of Segment 9, RM 845.0 - 828.0): The yearly average for the adult census on this reach is 27 plovers (Figure 13). As in other reaches, numbers of nests on Lewis and Clark Lake peaked after the 1996-1997 floods at 62 nests in 1999. Nest numbers declined sharply in 2000, however, and only 10 nests were found on the reservoir in 2003. Predation is especially high among unsuccessful nests on Lewis and Clark Lake. Of all nests monitored on the reservoir since 1988, 29 percent of the unsuccessful nests have been predated; "destroyed due to unknown cause" (28 percent), flooding (24 percent), and weather (23 percent) are also major causes of nest failure. The plovers have been concentrated in the upper reach of Lewis and Clark Lake with the majority on sites located three miles above and below Chief Standing Bear Bridge (RM 841.0). Piping plovers arrive on the lake in mid-May with the majority of the nest initiations occurring during the last two weeks of the month. The Corps first collected nests in 1995 and has collected a total of 29 nests, resulting in the fledging of 58 chicks.

Gavins Point Dam to Ponca, NE (**Gavins Point River**, Segment 10, RM 811.1 - 753.0): Biologists have counted an average of 141 adult plovers per year on this riverine reach (Figure 13), second only to Lake Sakakawea in the action area. After the 1996-1997 floods, the number of nests in this reach rose to approximately the same levels as during the drought of 1988. Post-flood nest numbers continued to rise in 2003 to a high of 176 for this reach. Fledge ratios between these two periods (i.e., late 1980s drought and post-1996/1997 flood), however, differed markedly. The fledge ratio in 1988 was 0.62, whereas the weighted mean fledge ratio for the years 1998-2003 was 1.99. This reach and the reach of the Missouri River below Garrison Dam ("Garrison River" segment) are the only segments where less than 10 percent (7 percent) of unsuccessful nests have been assigned a cause of flooding. Predominant fates assigned to unsuccessful nests were "destroyed by unknown cause" (33 percent), predated (31 percent), and "fate unknown" (12 percent). Piping plovers begin arriving on the reach as early as the last week in April. The highest number of nest initiations occurs during the last two weeks of May. The Corps first collected nests here in 1995 and has collected a total of 52 nests in this reach, resulting in the fledging of 121 chicks.

Ponca State Park, NE, to St. Louis, MO, Segments 11, 12, 13, 14, and 15, RM 753.0 - 0.0: In the 1980s piping plovers were recorded as nesting on power plant ash ponds near the Missouri River in Woodbury and Pottawattamie Counties, Iowa (USFWS 1988).

Kansas River, Segment 16, RM 170 – 0.0: Piping plover nests on the Kansas River included three in 2001, four in 2002, and six in 2003. In 2001 and 2003, no chicks fledged; in 2002, two nests fledged two young each. Previously, in 1998 and 2000, two pairs fledged 6 young; while in 1999, two pairs fledged no young. Overall, the fledge ratio for six years of data on the Kansas is 1.22 (Boyd 2001, Boyd and Thomas 2002, Boyd and Sexon 2003).

Nesting and Fledging Success in the Action Area

In addition to conducting annual censuses of adults, the Corps has, since 1993, monitored the number and productivity of piping plover nests in all known piping plover nesting areas of the Missouri River (Figure 13) (USACE 2003); nests were also monitored from 1988-1992 on four segments and the Corps has data for selected areas since 1986. Nest success, the proportion of monitored nests that the Corps determined to have been successful (i.e., hatching at least one egg in the clutch), did not rise uniformly with increases in total nests after 1997, but has remained above 70 percent since 2000 (Figure 14). These figures overestimate nest success to an unknown degree, assuming that the Corps does not find all nests that piping plovers initiate.

The Corps assigns a fate to each nest once it is no longer active: hatched, destroyed, abandoned, nonviable eggs, collected, and undetermined. For each destroyed nest, the Corps records a cause for its destruction based on the evidence collected at the nest site. Causes of nest destruction include flooding, weather, predation, sandbar erosion, livestock, human disturbance, and unknown (Figure 15). Of the nests in the Missouri River system that the Corps has determined to have failed since 1993, the cause of failure of 25 percent is unknown. Of the nests to which the Corps has been able to assign a cause, most have failed due to flooding (33 percent), predation (22 percent), and weather (22 percent). This does not include nests from which the Corps collected the eggs to prevent loss due to flooding caused by their water control operations. Since the Corps began such collections in 1995, they have collected 5.4 percent of all nests.

The Corps' control of the water in the Missouri River system results in the failure of a proportion of the nests that are unsuccessful. Unsuccessful nests are those that fail before hatching or those that the Corps collects to prevent their loss due to water level manipulations. As described above, the Corps records one of the following causes for each destroyed nest: flooding, weather, predation, sandbar erosion, livestock, human disturbance, and unknown.

In 2003, the Corps attempted to determine the number of nests and eggs that were destroyed or taken into captivity as a result of its control of the Missouri River system. The Corps assumed that its operations were only responsible for the destruction of a portion of those nests that were collected, flooded, or whose cause for destruction was unknown. The Corps' analysis assumed that nests assigned any other fate (see above)

were not destroyed due to their operations. The Corps divided the flooded nests into those flooded as a result of their operations and those flooded as a result of other causes, such as "localized fetch action", "wake overwash from passing watercraft," or rain events "resulting in uncontrolled runoff." For river and reservoir reaches, the Corps assumed that only those flooded nests that were destroyed during a period when the river or pool stage was observed to rise as a result of increased releases or increased storage, respectively, were attributable to its operations. The Corps also attempted to determine how many of the nests assigned a destroyed-unknown nest fate were flooded as a result of their operations, based on similar associations with fluctuations in river stages or pool elevations. Finally, they decided that it was "very unlikely" that a flooded nest would have been assigned a destroyed-unknown fate after 1992, due to the weekly site visits and standardized techniques that were instituted in 1993.

Based on the above analysis, the Corps has determined that its operations have resulted in the loss of 369 piping plover nests and 1,119 eggs since 1988 in the action area. This was 7.9 percent of the nests and 6.9 percent of the eggs, respectively, monitored between 1988 and 2003. The Corps' approach to determine the proportion of nest loss caused by its operations may be conservative.

Some nest failure that cannot be directly attributed to the Corps' operations may be an indirect result of its regulation of river flows. This regulation results in the reduction in the frequency of scouring or pulsing flows associated with the natural spring flood pulse. Reduced scouring and flooding leads to expansion of vegetation over time on existing sandbars and a reduction or cessation in the creation of new sandbars and sparsely vegetated islands. Stability in location of nesting habitat from year-to-year likely increases the incidence of predation (Kruse et al. 2001). This leads to increased abundance of predators and a decrease in the distances between plover nests and predator habitat (e.g., denning sites). Therefore, some predation is likely a result of the Corps' regulation of river flows. In addition, some nest abandonment may occur when flows increase the saturation of sandbars on which plovers are nesting. The Corps assumed that no nest abandonment was a result of their operations. Of all nests monitored in the period 1988-2003, 2.6 percent were abandoned. Nest failure due to both human disturbance and sandbar erosion (1.2 percent and 0.3 percent of nests monitored 1988-2003) may be partially attributable to the Corps' actions (See November 2000 Biological Opinion, pages 209-210).

Kreil (in litt. 2003) analyzed the Corps' data (USACE 2003c) according to a worst case scenario that attributed to Corps' operations all nest losses due to human disturbance and predation. We have determined that while some losses due to disturbance and predation are influenced by Corps' operations, we cannot quantify this portion.

The Corps also determines the number of young that successfully fledge. Birds seen flying or "jump-flying" and birds seen alive at least 20 days after hatching and not seen on a subsequent visit at least five days later are counted as fledged (G. Pavelka, U.S. Army Corps of Engineers, pers. comm., November 25, 2003). Fledglings produced as a result of the Corps' captive propagation of collected eggs are not included in the annual

sums of fledglings. That is, these birds are not counted in the annual calculation of fledge ratios (see below).

A statistic used by population biologists to gauge the viability of piping plover populations is fledge ratio – the number of fledglings produced per pair of nesting adults. The methods used to determine the numbers of fledglings produced each year are summarized above. To determine the fledge ratio, the Corps divides the total number of fledglings by the number of nesting pairs (total number of adults counted divided by two). The Service's 2000 Biological Opinion required that the Corps reinitiate consultation if the three-year running average fledge ratio on the entire system dropped below 1.13. From 1993 – 1997, the overall fledge ratio was 0.69. Fledge ratios on the Missouri River system increased markedly, however, after the 1996-1997 floods. They declined in 1999, but remained above 1.4 through 2000-2003 (Figures 16 and 17), with some variation among segments. In the years 1986-1992, when only a portion of the nesting areas along the Missouri River were monitored, overall fledge ratios ranged from 0.09-0.94 fledglings among years. When data collected since 1986 is used, the fledge ratio is 1.18. However, not all birds were surveyed between 1986-1992. Since 1993, when the Corps first monitored all nesting areas on the Missouri River system and instituted standardized monitoring methods, the fledge ratio for piping plovers on the Missouri River is 1:36.

Population Status and Trends in the Action Area – Available habitat for piping plovers along the Missouri River and on its reservoirs generally increases both during droughts and after floods. During droughts, water levels drop on reservoirs and formerly flooded areas become suitable nesting habitat until vegetation encroachment renders the areas unsuitable for piping plovers. Piping plovers showed a general upward trend from 1986 through 1991 during and immediately after a drought, with a system-wide peak of 623 adults in 1991. This was followed by a downward trend during most of the 1990s before the floods of 1996-1997.

In the years following the 1996-1997 floods, the number of piping plover nests found by the Corps has risen each year from 1998-2003 (Figure 13). In the riverine reaches, these increases are most likely due to the new sandbar habitat created by sediment transport and deposition and by the scouring of vegetation from sandbars. Since the total area of suitable habitat peaked in 1998, it has decreased steadily as a result of sandbar erosion and vegetation growth. In the reach below Gavins Point Dam, greater than 50 percent of the habitat created by the 1996-1997 floods had become unsuitable by 2003 (USACE, unpubl. Data); similar trends are also evident in the important reach below Garrison Dam (C. Kruse, USACE, pers. comm.. 2003). Increases in nests since 1998 around Missouri River reservoirs are primarily a result of increases in available habitat as a result of drought conditions.

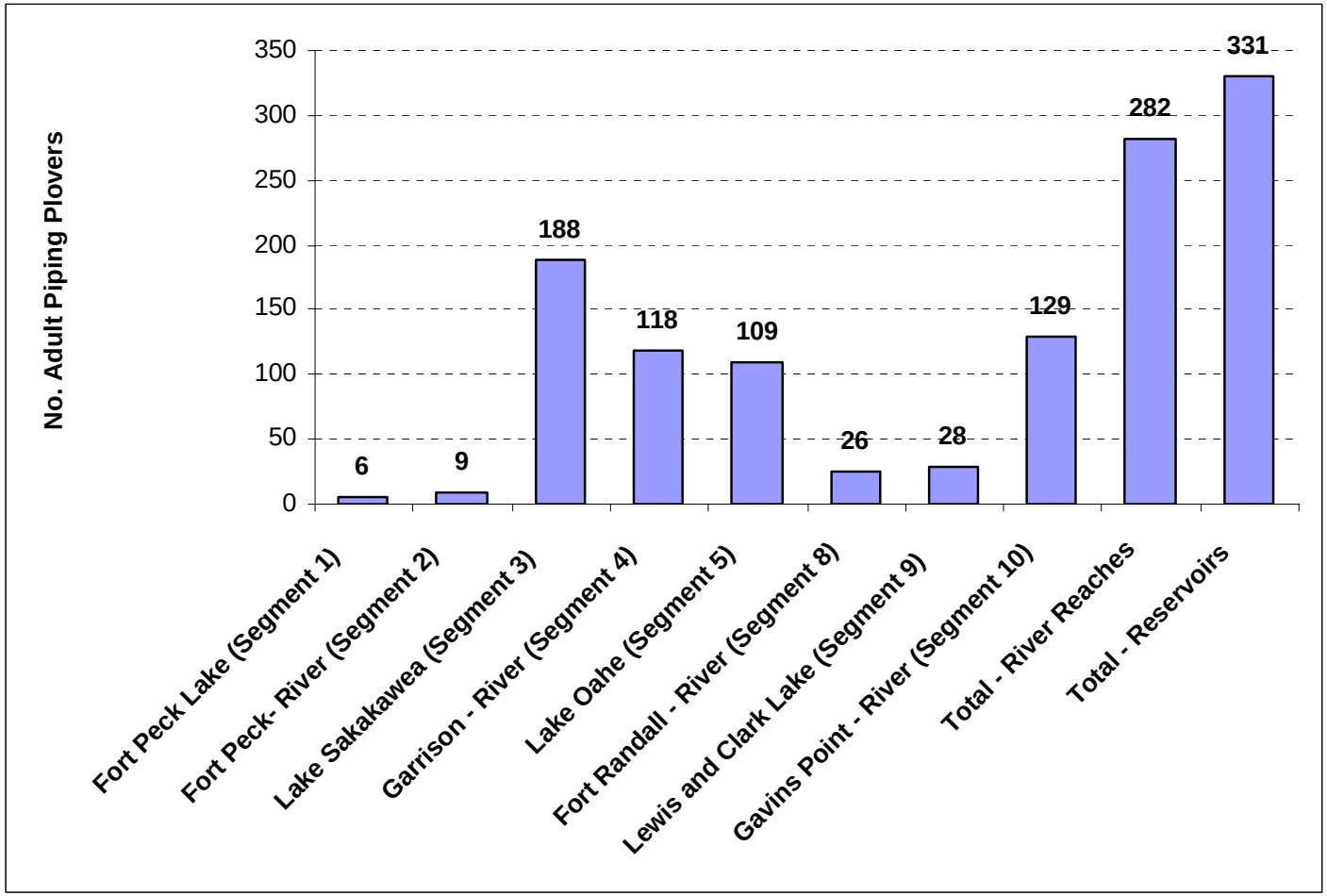


Figure 12. Mean annual adult abundance (1993-2003) for each segment of the Missouri River in which piping plovers nest. Totals for the four riverine reaches and the four reservoir areas are also shown. Segments are shown in order from upstream to downstream (left to right). There are no nesting piping plovers in segments 6-7 and downstream of the Gavins Point reach.

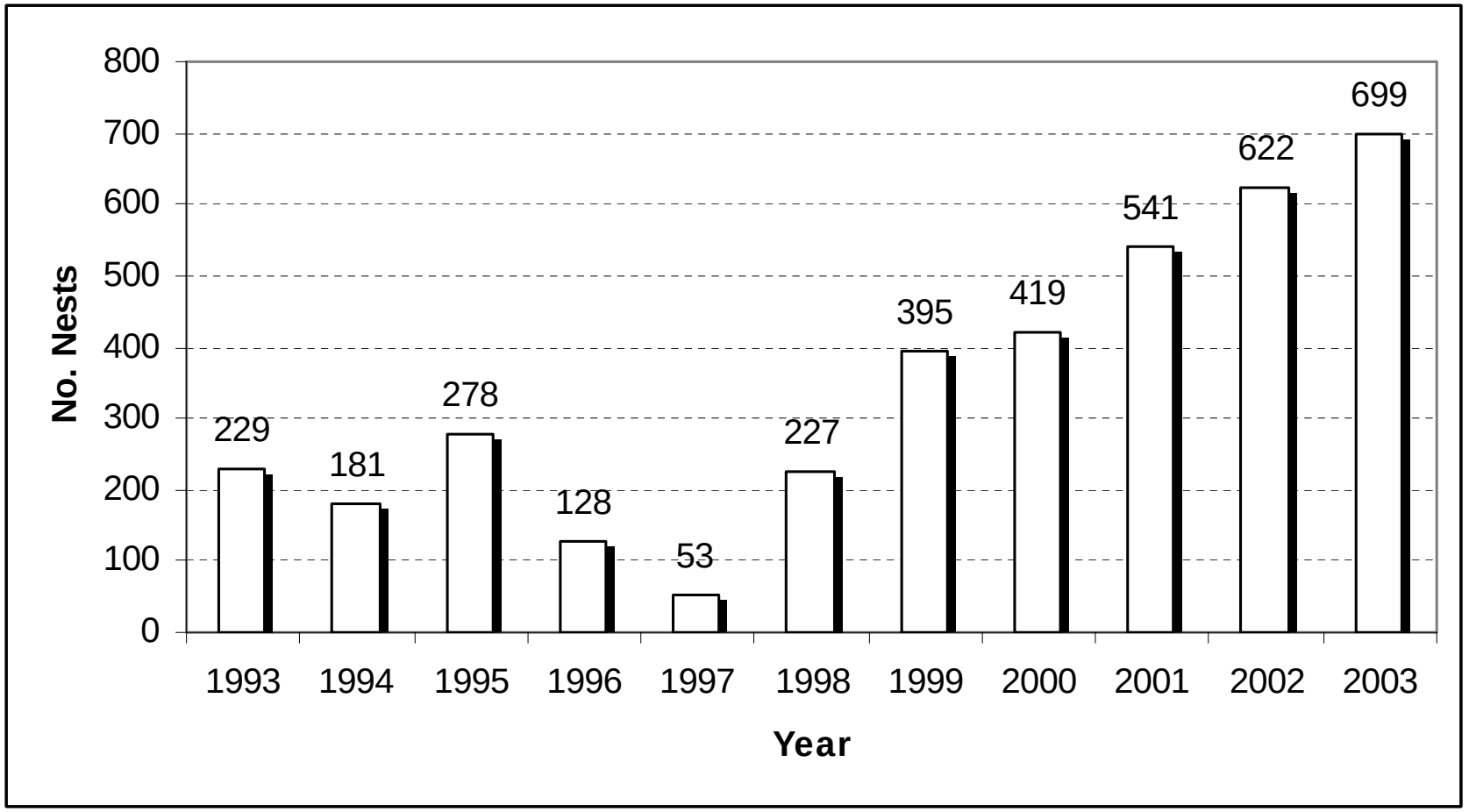


Figure 13. Number of piping plover nests found during searches of all known nesting areas on the Missouri River system 1993-2003.

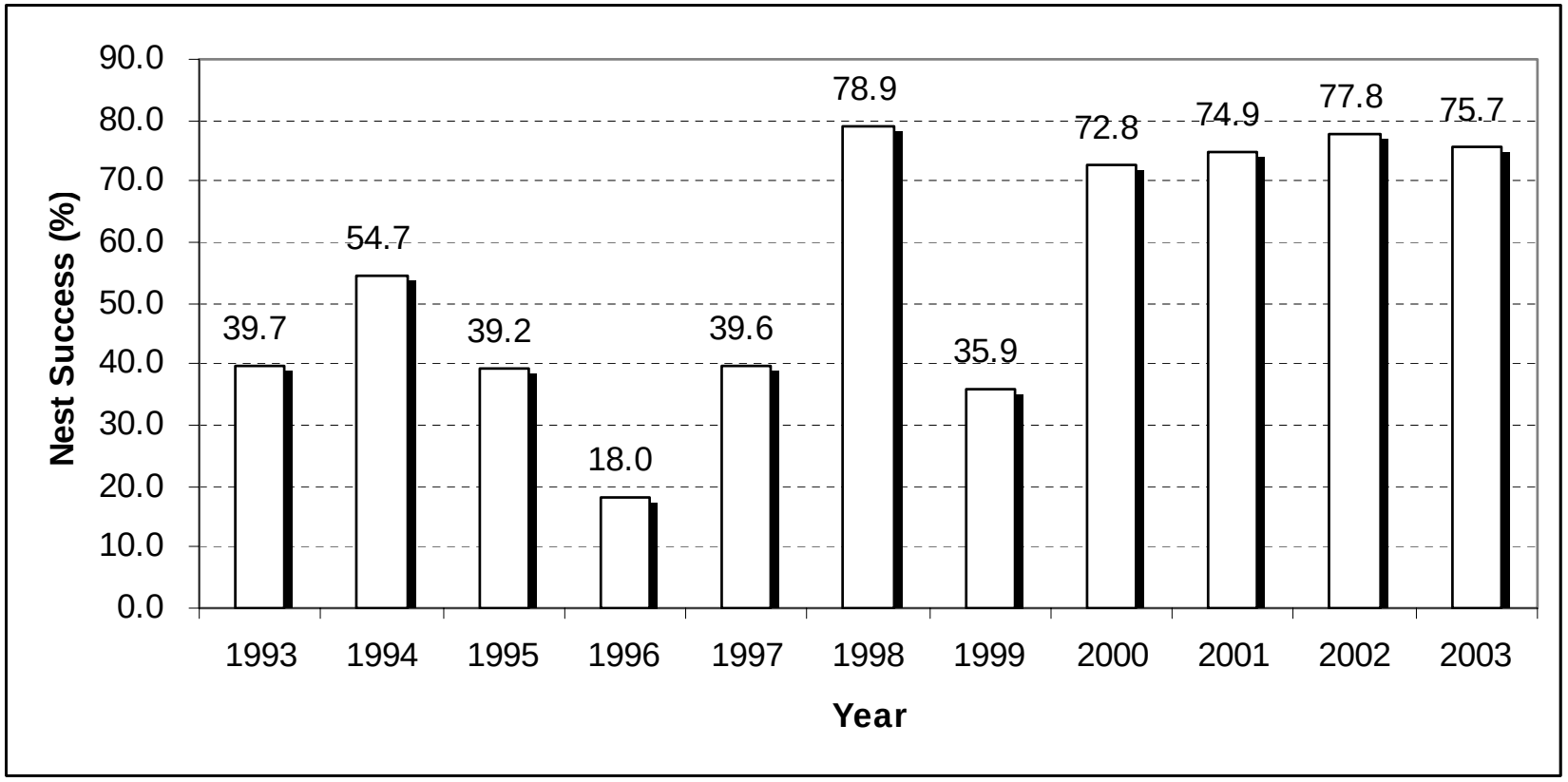


Figure 14. Nest success of piping plover nests found in all known nesting areas in the Missouri River 1993-2003.

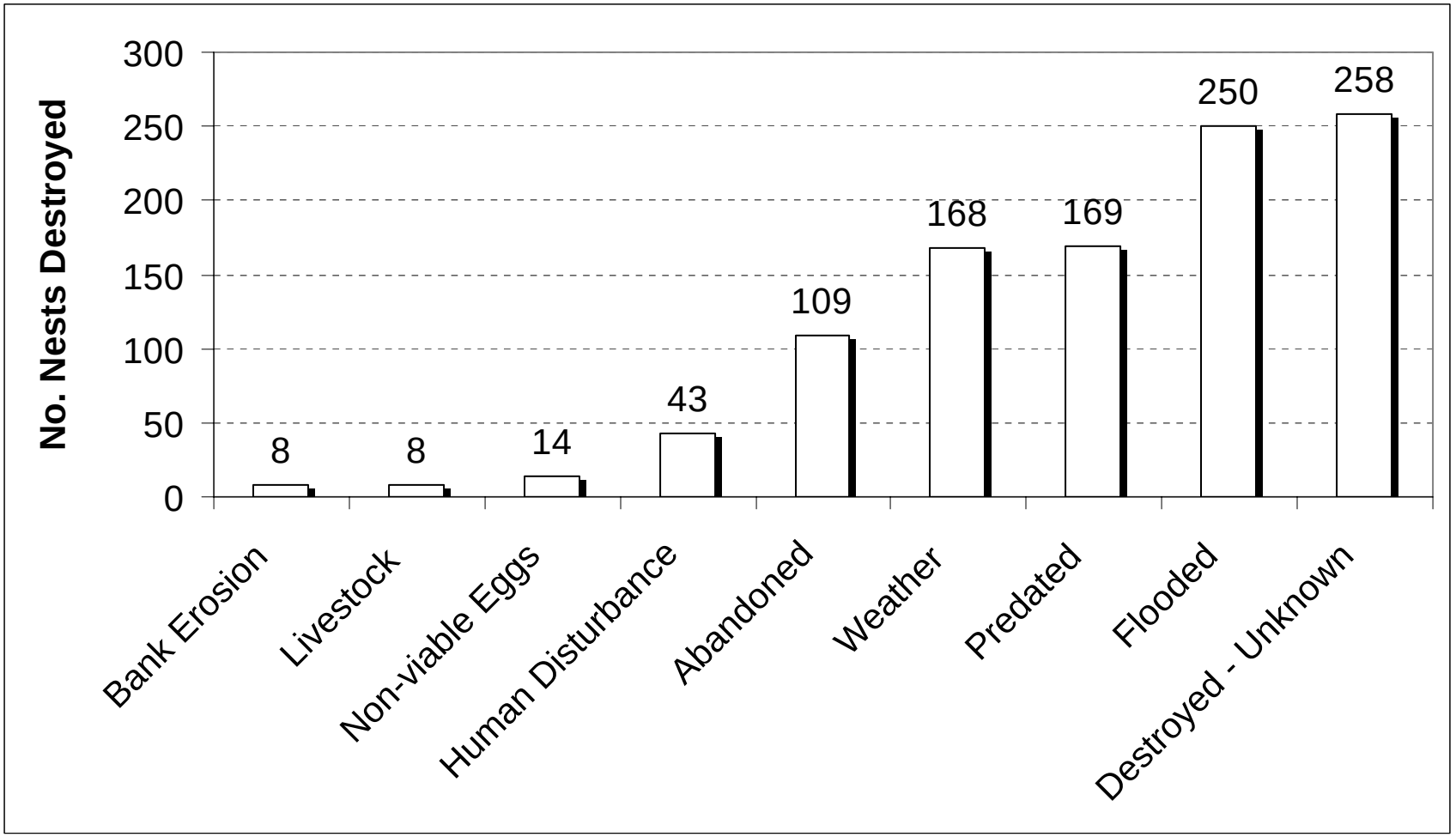


Figure 15. Causes and magnitude of nest destruction based on monitoring of piping plover nests in all known nesting areas in the Missouri River system 1993-2003.

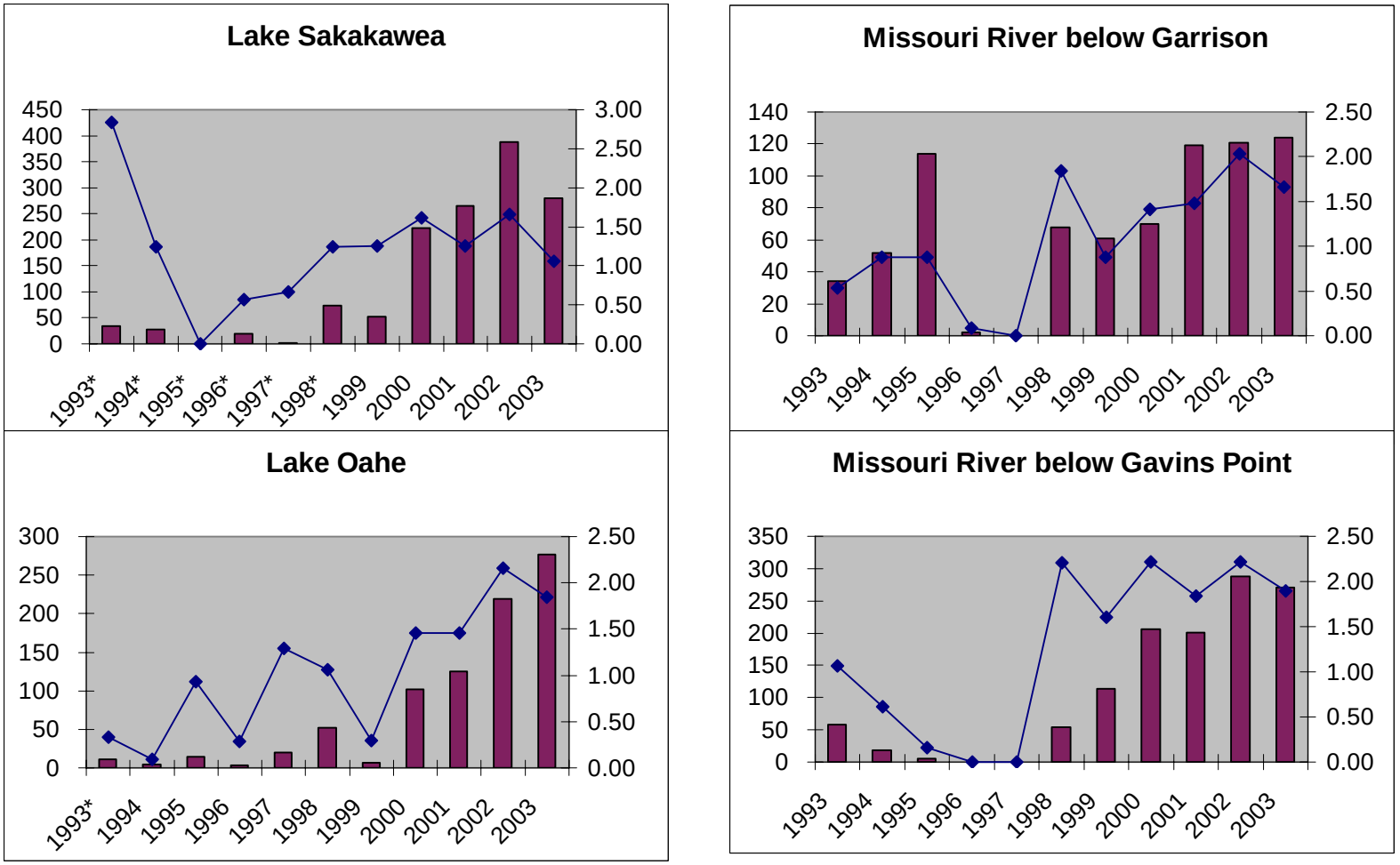


Figure 16. Fledge ratios and total fledglings for selected Missouri River segments used by piping plovers for nesting, 1993-2003.

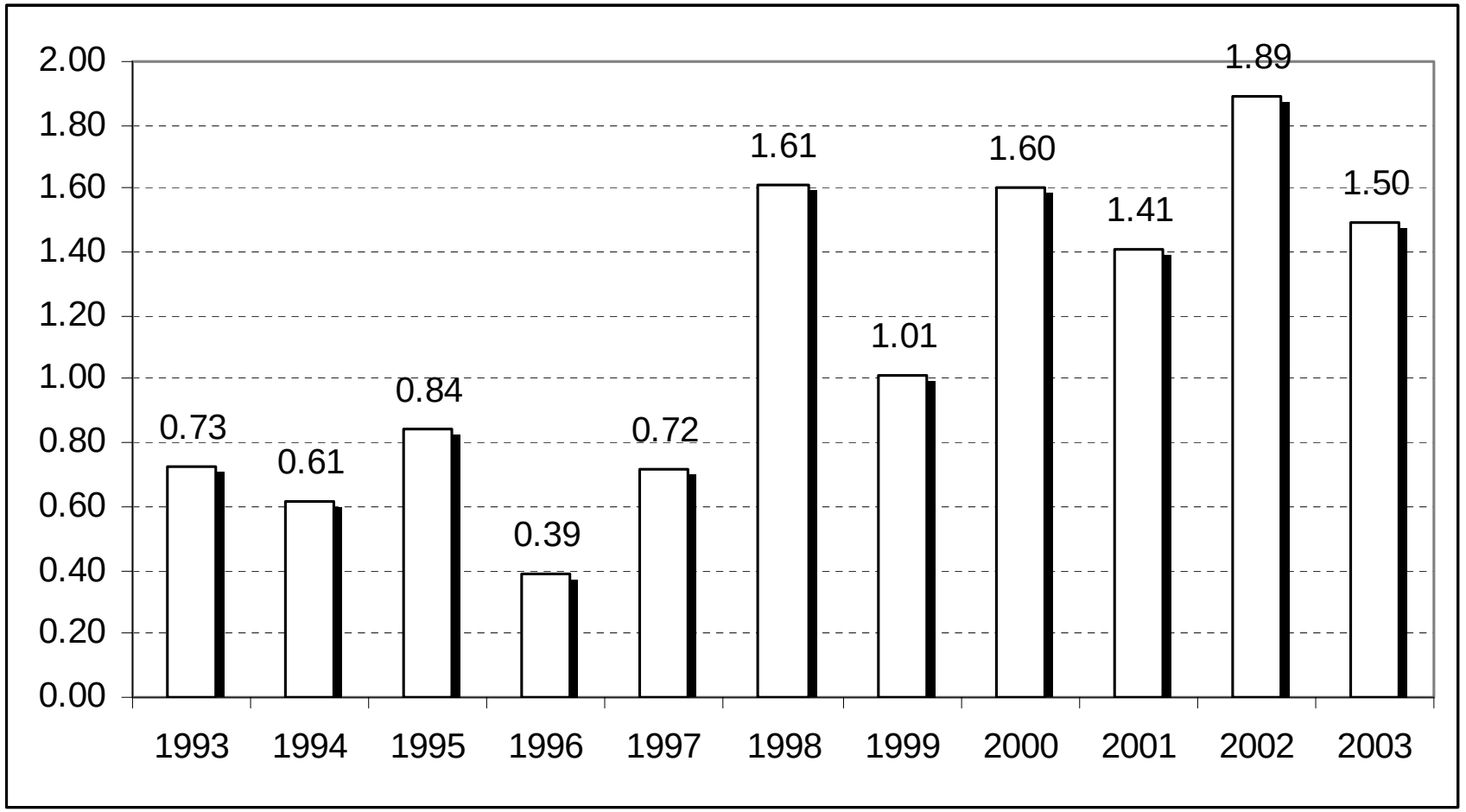


Figure 17. Fledge ratios (no. fledglings/adult pairs) based on USACE monitoring of all known piping plover nesting areas in the Missouri River system 1993-2003.

Distribution and Abundance of Habitat in the Action Area
Both piping plovers and least terns nest on the Missouri and Kansas Rivers. Habitat distribution and use are similar as the 2000 Biological Opinion notes and from which we quote:

> "Depending on the annual runoff, habitat distribution and abundance will vary considerably from reach to reach and year to year on the Missouri River. Below normal runoff will lead to low lake elevations and low releases from the dams resulting in exposure of thousands of acres of potential habitat. Conversely, above normal runoff will inundate lake habitat as the reservoirs capture the spring runoff and higher releases from the dams will flood downriver habitat.
>
> However, high runoff is not necessarily detrimental, as periodic high runoff is needed to retard vegetation encroachment on sandbars and beaches. Another factor influencing the quality of habitat is the presence of residential development along the river. Otherwise good plover habitat may not be used if there is heavy recreational use of the habitat. Below is a reach by reach description of habitat distribution and abundance.
>
> **Fort Peck Lake, Segment 1:** Habitat is widely scattered across beaches along the eastern part of Fort Peck Lake. The relative abundance of habitat varies annually with the amount of water captured in the reservoir during the spring runoff. The average maximum elevation of the lake in the summer is 2239.1 feet mean sea level (msl), which generally leaves an adequate amount of beach habitat for the plovers. The highest elevation recorded on the lake has been 2251.6 feet msl. The lowest annual maximum recorded on the lake has been 2214.0 feet msl. Generally when the lake rises to its normal maximum operating pool of 2246.0 feet msl, virtually all plover beach habitat is inundated. Over the past 33 years (1967 to 1999) this has occurred 21 percent of the time (7/33) (Corps Reservoir Control Center). This is not necessarily a negative as a high lake elevation does have the benefit of inundating encroaching vegetation and thus restoring beach habitat.
>
> **Fort Peck Dam to Lake Sakakawea Headwaters, Segment 2**: Piping plover habitat on the Missouri River is created by scouring vegetation off sandbars and the building of sandbars by sediment deposition. Construction of Fort Peck Dam has altered habitat creation by reducing the frequency of flooding downriver and eliminating a substantial amount of sediment deposition. Over the past 33 years (1967 to 1999) releases from Fort Peck Dam during the nesting season (May through August) has averaged 10.4 Kcfs. Upper decile releases of 15 Kcfs or greater have occurred three times (1975, 1976, & 1996) over the past 33 years (1967 to1999). These upper decile releases have been effective in reducing vegetation encroachment on the sandbars.
>
> "Sediment deposition does occur within the reach through erosion and inflows from the Milk and Poplar Rivers. Sandbars especially have built up below the

Milk River confluence as a result of river's relatively high contribution of suspended particulate matter. The Poplar River also transports a considerable amount of suspended fine sediments.

Lake Sakakawea, Segment 3, and Lake Audubon: The amount of habitat available on Lake Sakakawea can vary considerably from year to year. Habitat availability depends on two factors: runoff into the Missouri River watershed and vegetation encroachment from the previous year. High runoff means less habitat as beaches flood when the reservoir fills to capture the spring rise. However, habitat quality and quantity will also decline as vegetation encroaches on beaches that are not periodically inundated.

The average maximum elevation of the lake in the summer is 1843.9 feet msl. This generally leaves a sufficient amount of beach habitat. The highest elevation recorded on Lake Sakakawea has been 1854.8 feet msl. The lowest annual maximum recorded on the lake has been 1823.4 feet msl (Corps' Reservoir Control Center). Generally when the lake rises above its normal maximum operating pool of 1850.0 feet msl, virtually all plover beach habitat is inundated. Over the past 33 years (1967 to 1999) this has occurred 9 percent of the time (3/33) (Corps' Reservoir Control Center). These high lake elevations do have the benefit of inundating encroaching vegetation and thus restoring beach habitat.

Garrison Dam to Lake Oahe Headwaters, Segment 4: Habitat first becomes available on the Missouri 9 mi (14 km) below Garrison Dam at RM 1380.0. Historically this reach contains the largest amount of habitat but several factors influence the quality and quantity of the habitat. The lack of a flood pulse has reduced the ability of the river to prevent encroachment of vegetation on the sandbars. Over the past 33 years (1967 to 1999) releases from Garrison Dam during the nesting season (May through August) has averaged 27,300 cfs (Corps' Reservoir Control Center). Upper decile releases of 37 Kcfs or greater have occurred just twice (1975 and 1997) over the past 33 years (1967 to 1999) (Corps' Reservoir Control Center).

Sediment deposition within the reach has been severely reduced by the construction of Garrison Dam and the armoring of the shoreline. Approximately 35 percent of the shoreline from the dam to the headwaters of Lake Oahe has been protected by bank stabilization projects. The Knife and Heart Rivers contribute some sediment load but this generally is insignificant beyond the confluences.

Habitat is further affected by human recreation use. The cities of Bismarck and Mandan lie adjacent to the Missouri from RM 1320 to RM 1312 with new residential developments springing up both above and below the metropolitan area on the river. The Bismarck/Mandan metropolitan area brings heavy human "use to the sandbars including such activities as picnicking, volleyball, golf, hiking, swimming, pet use, and boating.

Lake Oahe, Segment 5: As with Fort Peck Lake and Lake Sakakawea above it, the amount of habitat available to piping plovers on Lake Oahe varies annually and depends how high the lake rises during the spring runoff. The average maximum elevation of the lake in the summer is 1609.2 feet msl. At this elevation normally there is a sufficient amount of habitat available to the plovers. The highest elevation recorded on Lake Oahe has been 1618.7 feet msl. The lowest annual maximum recorded on the lake has been 1589.3 feet msl (Corps' Reservoir Control Center). When the lake rises above the normal maximum operating pool of 1617.0 ft msl, most of the plover habitat is inundated. Over the past 33 years (1967 to 1999) this has occurred 18 percent of the time (6/33) (Corps' Reservoir Control Center).

Oahe Dam to Fort Randall Dam (Lake Sharpe and Lake Francis Case), Segments 6 and 7: Little, if any, habitat has been found on these two lakes.

Fort Randall Dam to Niobrara River, Segment 8: Habitat first becomes available on the Missouri 7½ mi (12 km) below Fort Randall Dam at RM 871.5. Over the past 33 years (1967 to 1999) releases from Fort Randall Dam during the nesting season (May through August) have averaged 30,900 cfs. Upper decile releases of 45,800 cfs or greater has occurred just once (1997) over the past 33 years (1967 to 1999) (Corps' Reservoir Control Center). Habitat is quite limited within the reach occurring from only RM 871.5 to RM 865.0 and from RM 852.5 to RM 848.0. Extensive summer home developments have occurred along the river, especially on the Nebraska side. These occur at RM 869, RM 865 and from RM 853 to RM 851. All of these developments are adjacent to nesting areas and present a potential conflict between the birds and recreationists.

Niobrara River to Headwaters of Lewis & Clark Lake, part of Segment 9: Habitat on Lewis & Clark Lake is limited to the headwaters of the lake from RM 844.0 to RM 828.0. This part of the lake is dominated by a sedimentation zone caused by inflows of the Niobrara River at RM 844.0. Just below the confluence with the Niobrara numerous sandbar complexes are available for the terns and plovers from RM 843 to RM 838. Farther down the lake, small pockets of sandy beaches are available within the sedimentation zone, but the majority of islands are dominated by cattails and other aquatic vegetation. High releases from Fort Randall Dam and high inflows from the Niobrara River can scour vegetation off of sandbars in the uppermost part of the lake. However, Lewis & Clark Lake is maintained at a constant elevation around 1206 feet msl during the nesting season. This allows little opportunity for flooding of vegetation once it becomes established in the lower part of the sedimentation zone.

Gavins Point Dam to Ponca, NE, Segment 10: Habitat first becomes available on the Missouri River 3 mi (5 km) below Gavins Point Dam at RM 807.0. Over "the past 33 years (1967-1999) releases from Gavins Point Dam during the nesting season (May through August) have averaged 33,500 cfs. Upper decile releases of 51,000 cfs or greater have occurred just once (1997) over the past 33

years (1967-1999). The high flows in 1997 have significantly improved both the quality and quantity of habitat that had become degraded through vegetation encroachment.

Sediment deposition has been greatly reduced by Gavins Point Dam. Some sediment replenishment occurs from inflows of the James River, the Vermillion River and bank shore sloughing. The latter has been reduced by numerous bank stabilization projects in the reach. Several summer home developments occur on both sides of the Missouri. For the most part however these sites are not adjacent to current nesting areas.

Ponca, NE to St. Louis, MO, Segments 11, 12, 13, 14, and 15: Because of the channelization of the Missouri River in the 1930s, 1950s, 1960s, and 1970s virtually no habitat is available for nesting on the river.

Kansas River, Segment 16, RM 170-RM 0: Sparsely vegetated sandbar/island habitat is widely distributed throughout the Kansas River, varying in quantity and quality from one reach to another. Aerial photography indicates that this section averages two to three large sandbars every mile of river, with some sandbars extending a mile or more in length, and often located on opposite banks directly across from one another. Upstream from the mouth of the Blue River (RM 148), sandbars are much smaller and less suitable, sometimes farther apart. Downstream from Lawrence (RM 50), the river contains very few large sandbars, probably a result of a history of sand and gravel dredging in this stretch.

Several sandbars were scoured free of vegetation on the Kansas River between Manhattan and Wamego following the large and prolonged flood flows of 1993. Potential nesting habitat for the birds has been recorded upstream of Wabaunsee and as far downstream as St. Mary's.

Plover habitat is a function of dynamic ecological processes dependent on dynamic hydrologic wet-to-dry cycles. For river habitat, one suitable habitat site may become flooded and eroded away as another habitat site is created. High river flows create a complex of habitats. The dynamic nature of river and flow management is important to long term habitat creation and maintenance. For reservoir habitat, habitat available and suitable for plovers is produced as reservoir levels drop. Subsequent high water (increased reservoir levels) years are necessary for long-term maintenance of reservoir shoreline habitat. The distribution and abundance of piping plover habitat within the action area is highly variable within the type of habitat (river or reservoir), and between the habitat types. Fluctuations in the distribution and abundance of habitat is to be expected, and is part of the naturally complex environment in which the plover evolved."

Updated Information on the Current Habitat Status
Extensive piping plover nesting habitat was created in the action area, particularly in the segment between Gavins Point Dam and Ponca State Park by high flows during 1996 and 1997. This new habitat supported increased numbers of nesting piping plovers; however, this habitat is declining in quality and quantity (Vander Lee 2003). Drought conditions currently exist on the Missouri River with the upper basin experiencing a severe drought. The drought, lack of high flows to replenish and scour sandbars, and retention of sediment in the reservoirs are compounding factors currently impacting habitat.

Vander Lee (2003) documented changes in the total acreage, individual size, and amount of vegetation on sandbars on the Missouri River below Gavins Point Dam after the high flow releases in 1997. Since that event, Vander Lee (2003) documented a three-fold increase in vegetation on persistent interchannel sandbars between 1998 and 2000. Another 1,100 acres of sandbar were lost to erosion during this period. Total sandbar acres decreased by 60 percent, and the average sandbar size decreased by 55 percent in 2000.

The Corps provided information on the current (as of September 2002) status of sandbar habitat below Gavins Point Dam (USACE 2003). This information was presented in two graphs. One graph shows acres of total emergent interchannel sandbar and potential sandbar habitat (less than 10 percent vegetated) at 500 cfs increments between flows of 25,000 cfs and 32,000 cfs. There is approximately 582 acres of potential habitat at a flow of 25,000 cfs, 192 acres at a flow of 27,000 cfs, and 0 acres at a flow of 29,000 cfs. The other graph displays acres of total emergent sandbars and vegetated sandbars (greater than 10 percent vegetation) from the years 1996 to 2003. The maximum acreage of habitat with the lowest extent of vegetated sandbars (approximately 3,000 acres) occurred in 1998 and has gradually declined since. Of the current 1,760 acres of total emergent sandbar habitat, 1168 acres (67 percent) is more than 10 percent vegetated, leaving 582 acres of potential nesting habitat (less than 10 percent vegetated) below Gavins Point Dam. However, 322 of these acres are small, low elevation sandbars that do not provide suitable nesting habitat (B. Vander Lee pers. com. 2003). The remaining 260 acres is higher, unvegetated sandbars. These 260 acres provide the primary suitable nesting habitat below Gavins Point Dam (B. Vander Lee pers. com. 2003).

There is no updated information on the amount and quality of habitat below Fort Peck, Garrison, and Randall Dams. The latest information is from 1998, which is presented in the 2000 Biological Opinion. The Corps indicated that habitat conditions below these dams are similar to conditions below Gavins Point Dam (i.e., the majority of the sandbars are vegetated) (B. Vander Lee pers. com. 2003). The Corps has observed similar trends in both erosion of sandbars and increases in vegetation in the Garrison Reach as below Gavins Point, but has not quantified this except for the Gavins Point Reach.

Productivity and Recovery Objective in the Action Area
According to the 1988 Piping Plover Recovery Plan (USFWS 1988), recovery goals for the piping plover include maintenance of 425 adult pairs of birds on the Missouri River for a period of 15 years. Since 1991, the year of the first International Census, the

number of pairs counted on the Missouri River has ranged from a low of 43 in 1997 to a high of 669 in 2003. The mean number of nesting pairs in this period 1991-2003 is 302.

Knetter et al. (2002) stated that managers must consider the high degree of both spatial and temporal variation in plover reproductive success when estimating recovery goals for plovers that nest on alkali lakes in the Northern Great Plains. Plovers evolved in a highly ephemeral environment where water levels and the amount of available breeding habitat varied tremendously among years and regions within their breeding range. The opposing trends in available habitat and numbers of nesting pairs on alkali lakes (Murphy et al. 2001) and on the Missouri River (fig. 2) during a period of above-normal precipitation (1996-1997) demonstrates this intra-regional variation.

Importance of the Missouri River to the Piping Plover

The 2001 International Piping Plover Census reported 1048 adult piping plovers on Missouri River breeding grounds. This represents about 35 percent of the total U.S. Northern Great Plains/Prairie Canada population or about 52.9 percent of birds counted in the U.S. Earlier censuses in 1991 and 1996 showed that the Missouri River accounted for 31 percent and 12 percent, respectively, of plovers censused in the U.S. and 18 percent and 6 percent, respectively of all plovers in the U.S. Northern Great Plains/Prairie Canada population.

The Missouri River is especially important for providing nesting habitats during drought when most of the nesting habitat at ephemeral alkali wetlands in the prairie is dry. Between 1991 and 2001, there was a 2.5 percent reduction in the U.S. Northern Great Plains Plover population; however, between 1996 and 2001, there was a 23.9 percent increase in the population. Along the Missouri River, a 70 percent decline in birds between 1991 and 1996 was followed with a 460 percent increase between 1996 and 2001. Piping plovers in prairie Canada declined by 32 percent between 1991 and 2001 (Ferland and Haig 2002). The Service (USFWS, 2002) stated that habitat for Northern Great Plains breeding populations is probably not a factor limiting recovery.

Fluctuations in population sizes between the U.S. Northern Great Plains piping plover and Prairie Canada piping plover may reflect a relationship with plovers in prairie Canada. Plovers may have temporarily dispersed to unusually good habitat conditions in the U.S. Northern Great Plains - particularly on the Missouri River (67 FR 57638). Decreased habitat quality and availability in prairie Canada further increases the importance of the Missouri River to the piping plover. The importance of the Missouri River to piping plovers as a migratory corridor is unknown. Plovers have been staging on the Missouri River in the fall and large flocks of plovers have been seen at tributary deltas during spring migration (USFWS 2000).

PALLID STURGEON

The environmental baseline within the action area is described in detail in the 2000 Biological Opinion on pages 150 to 154. The environmental baseline in the 2000 Biological Opinion is incorporated by reference. Information in this updated

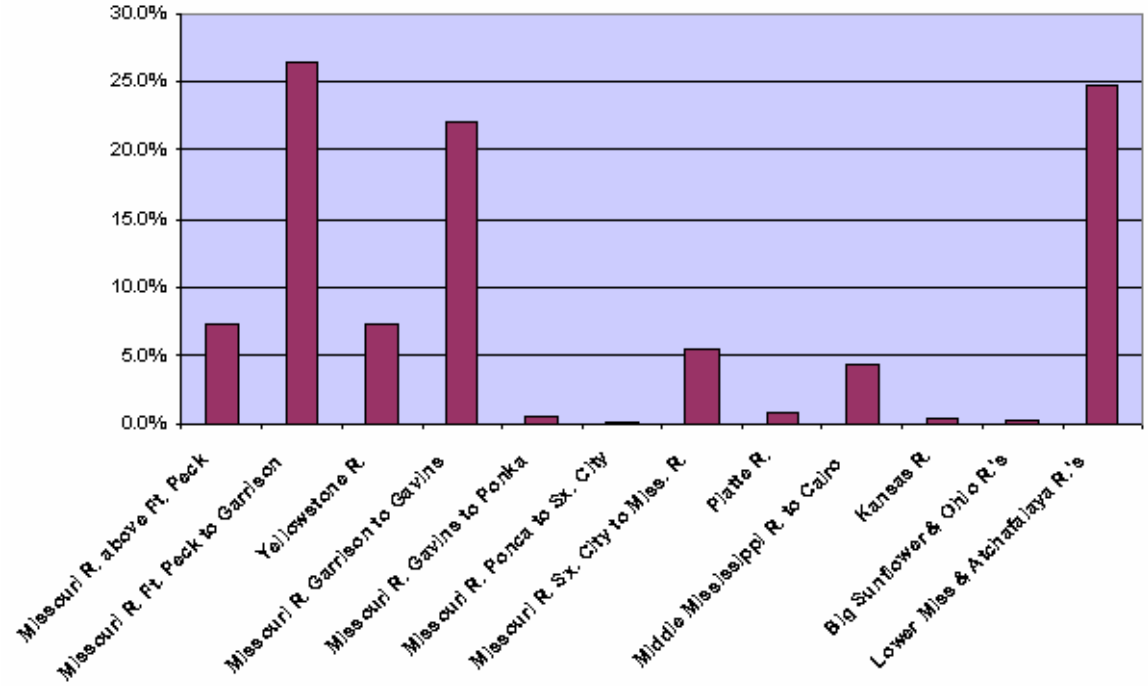
environmental baseline is based on surveys, studies and other information obtained since 2000. Environmental baseline information from the 2000 Biological Opinion is included to the extent that it will add clarity and context to this 2003 Amended Biological Opinion.

Distribution in the Action Area

The Action Area is entirely within the historic range of pallid sturgeon; however, catch records are scarce because pallid sturgeon are at low population levels. Unlike birds, such as least terns and piping plovers, fish must be captured before they can be counted. All pallid sturgeon catch records, including those gleaned from the literature, are catalogued in a Service database maintained in Bismarck, North Dakota. The database contains 1,214 records of pallid sturgeon captured from 1920 to 2002, and includes individuals captured more than once. Figure 18 displays the general rangewide distribution of pallid sturgeon catch records for designated river reaches. The histogram represents the percent of the total number of reported catch records in the Service's pallid sturgeon database. Some river reaches are more easily sampled than others, and some have been sampled more heavily for brood stock collections, research, assessment and monitoring. This may account for the relatively few records (historic and present) in the Missouri River below Gavins Point Dam and the Middle Mississippi River.

According to the database, reports of the most frequent catches within the Action Area on the Missouri River occur from between Ft. Peck Dam in Montana and the headwaters of Lake Sakakawea in North Dakota and in the reservoir reaches between Garrison Dam and Gavins Point Dam. However, the majority of catches from between Oahe Dam and Gavins Point Dam occurred prior to 1970. Other frequent records occur between Sioux City, Iowa, and the confluence with the Mississippi River, and from the confluence with the Missouri River to Cairo, Illinois on the Mississippi River. Sturgeon upstream of Ft. Peck Reservoir and downstream from Cairo, Illinois, on the Mississippi River, are outside the Action Area.

Figure 18. Rangewide Distribution of Pallid Sturgeon Catch Records.



These data, combined with 2003 data not entered into the database, reveal a rangewide distribution of pallid sturgeon catch records to be 63 percent in the Missouri and Yellowstone River, and 30 percent in the Mississippi River and Atchafalaya River.

Population Status and Trends

Heritage pallid sturgeon populations throughout the Action Area are at historic low levels, declining, and are not self sustaining. Catch reports from the Upper Missouri River reflect a continuous and ongoing decline in the population of adult pallid sturgeon. This population is at or near the end of its reproductive capability. Two larval pallid sturgeon have been reported, but no juvenile life stages (Bratten and Fuller 2002).

In the Lower Missouri and Middle Mississippi rivers there is some evidence of reproduction with the occasional capture of larval stages and juveniles. However, the population structure is unknown. Additionally, for both the Lower Missouri River alone, as well as the Lower Missouri River and the Middle Mississippi River combined, there appears to be a shift in the relative abundance of pallid sturgeon to shovelnose and other river sturgeon. Data from Grady et al. (2001) and Herzog (2002) indicate that shovelnose sturgeon populations are either stable or declining, respectively. This indicates to the Service that there is a true reduction in the abundance of pallid sturgeon to reflect a lower ratio of pallid to other sturgeon species.

Increasingly, the total numbers of pallid sturgeon collected during sampling reflect higher numbers of released hatchery reared fish and hybrids. The collection of larval and juvenile pallid sturgeon is becoming more common, however, the low numbers of these age classes suggest to most sturgeon researchers that pallid sturgeon reproduction is a

rare event and that recruitment to reproduction is not occurring. However, it should be noted that the numbers of larval and juvenile pallid sturgeon collected may also be an artifact of sampling gear bias and/or a variable level of effort aimed at these size classes.

Upper Missouri River – In the 2000 Biological Opinion, Duffy et al. (1996) estimated (based on mark and recapture data) approximately 200 and 300 adult pallid sturgeon remain between Garrison Dam and Fort Peck Dam, which also includes the lower Yellowstone River (RPMA #2). Kapuscinski (2003) reports the population in RPMA #2 at 151 individuals with 95 percent confidence intervals of 89 to 236 individuals. This is down from Duffy's 1996 estimate of 200 - 300, and an estimated 166 individuals in 2002 and 178 individuals in 2001 by Kapuscinski (2003). Kapuscinski (2003) projects that the population of wild pallid sturgeon in RPMA #2 will go extinct during the year 2018. The Service uses the terminology "extirpation," not "extinction," in this context.

Middle Missouri River – According to Steve Krentz (pers. comm. 2003), sport fishers have reported up to five pallid sturgeon catches per year on the Missouri River between the headwaters of Oahe Reservoir in North Dakota and Garrison Dam; however no catches have been reported since 2002. Occasional catches were reported from the riverine reach above Gavins Point Dam to the Fort Randall Dam, suggesting that, perhaps, as many as 25 to 50 fish remain in each of these areas; however no catches of adults have been reported since 1992. A small population also existed between Oahe Dam and the Big Bend Dam on the Missouri River in South Dakota with perhaps 50 to 100 fish remaining in the upper few miles of riverine section above the headwaters of Lake Sharpe; however no catches have been reported since 2001.

Lower Missouri River and Middle Mississippi River – The current status of pallid sturgeon in the Lower Missouri River below Gavins Point Dam and the Middle Mississippi River is largely unknown. As reported in the rangewide status section on pallid sturgeon, during a MICRA study from 1996 to 2000 (Grady et al. 2001), 21 pallid sturgeon were collected in the Lower Missouri River and Middle Mississippi River. Of the 9 pallid sturgeon collected in the Lower Missouri River, 7 were presumed to be of wild origin, while 2 were hatchery stocked fish. Of the 12 pallid sturgeon collected in the Middle Mississippi River, 1 was considered a wild origin fish and 11 were considered hatchery stocked fish. In 2001, the Service's CMFRO began work on the Lower Missouri River Pallid Sturgeon Monitoring and Population Assessment Project. Sampling occurred in six reaches along 170 river miles and resulted in collection of 4,110 fish from 11 families with 77 trawl hauls and 12 net nights (Doyle et al., 2002). No pallid or hybrid sturgeon were collected, however, 198 shovelnose sturgeon and 2 lake sturgeon were collected.

In 2002, the CMFRO sampled six reaches along 200 river miles. Among the 27,903 fish collected were 12 pallid sturgeon, 12 pallid/shovelnose hybrids, 3,044 shovelnose sturgeon and 28 lake sturgeon (Doyle and Starostka 2003). Five of the pallid sturgeon were classified as juveniles. While four of these fish were from recent stocking of hatchery reared fish, one was presumed to be wild (Doyle and Starostka 2003).

In May of 2002, the Corps' St. Louis District initiated a three-year Pallid Sturgeon Habitat and Population Demographics study in the Middle Mississippi River. The study is being carried out by staff from the Corps' Waterways Experiment Station, the MoDOC, Open River Field Station and SIUC. By May 2003 a total of 41 pallid sturgeon and 3,636 shovelnose sturgeon had been collected from throughout the Middle Mississippi River (USACE 2003). The ratio of pallid sturgeon to shovelnose sturgeon (1:89) is much lower than in other parts of the pallid sturgeon's range. As of October 2003, a total of 47 pallid sturgeon have been collected in the Middle Mississippi River as part of this study (Jack Killgore, USACE, pers. comm.). It is conservatively estimated that approximately 60 percent of these fish are MoDOC hatchery-reared fish released in 1994 and 1997 (Dave Herzog, MoDOC, pers. comm.).

The ratio of wild pallid sturgeon to all river sturgeon (shovelnose, pallid, lake, and hybrids) in the Lower Missouri River (RPMA #4) and Middle Mississippi River (RPMA #5) dropped from 1 in 398 (0.25 percent) collected by Carlson et al (1985) to 1 in 647 (0.15 percent) (Grady et al. 2001). Doyle and Starostka (2003) reported the ratio of wild pallid sturgeon to all river sturgeon collected in combined 2002 samples was 1:387 (0.26 percent) (N=8:3099). Data collected from 1996-2000 within the same reaches showed a ratio of 1:311 (0.32 percent) (N=7:2177) (Grady et al. 2001). There are two possible explanations for a declining ratio of pallid sturgeon when compared to other sturgeon in the catch: 1) other river sturgeon numbers are increasing compared to equal or smaller rate increases in pallid sturgeon; 2) all sturgeon are declining with pallid sturgeon declining at a greater rate. Data on declining shovelnose sturgeon populations in the Middle Mississippi River would support the latter explanation. The MoDOC (Hrabik 2002) reports that catch per unit effort of shovelnose sturgeon during winter sampling using gill nets showed a dramatic decline from 1997 to 2002. From other studies, however, shovelnose sturgeon populations in the Lower Missouri River and Middle Mississippi River show no apparent excessive exploitation as would be evidenced by reduced numbers of large reproductive fish (Grady et al. 2001, Doyle and Starostka 2003).

From January 2000 through March 2001, the CMFRO collected information on seasonal fish abundance and species composition in the area of the Highway 19 bridge replacement at Hermann, Missouri. They collected over 3,000 fish including 3 pallid sturgeon, 14 hybrids and 1,990 shovelnose sturgeon (Milligan 2002).

Early life stages – The 2000 Biological Opinion concluded the low incidence of larval sturgeon within the range of pallid sturgeon is likely due to low reproductive success or the inability of standard sampling gear to capture young sturgeon. This could also be explained by the decline in spawning stock. Since 2000, researchers and managers have deployed numerous gear types and greatly increased effort to capture early life stages of sturgeon. Larval pallid sturgeon have been collected in the Upper and Lower Missouri River, Middle Mississippi River and Lower Mississippi River, which indicates some reproduction is occurring in the wild.

In 2002, two larval pallid sturgeons were collected on the Upper Missouri River in RPMA #2 (Braaten 2002). In 1998, one young-of-the-year pallid sturgeon was captured in the Mississippi River (RPMA #5) by personnel from the Long Term Resource Monitoring Station near Cape Girardeau, Missouri (Mike Peterson, MoDOC, pers. comm. 1999). During 1998 to 1999, three larval pallid sturgeon were captured in the Lower Missouri River (RPMA #4) below a restored side-channel area near Columbia, Missouri (Jim Milligan, USFWS, pers. comm. 1999). No larval pallid sturgeon have been collected at this location since control structures were constructed in 2000 (Milligan 2002). During 2002, one larval pallid sturgeon was also collected from within RPMA #4 near river mile 171 slightly upstream of the confluence of Perche Creek and the Missouri River (Kerry Reeve's, Univ. of Missouri, pers. comm. 2003).

In April and May of 2001, the MoDOC collected 40 larval sturgeon utilizing the Missouri benthic trawl (Hrabik 2002). In spring of 2003, the MoDOC collected an estimated 50 larval sturgeon in the MMR (Dave Herzog, MoDOC, pers. comm.). It is unclear at this time how many of these larval sturgeon are pallid sturgeon or hybrids. Hrabik (2002) collected larval sturgeon in the Missouri River in September of 2001. It is possible that spawning occurred twice in the Missouri River or that shovelnose sturgeon spawn more than once in a year (Hrabik 2002). From April to September 2002, the CMFRO collected 11 young-of-the-year sturgeon in Lisbon Bottoms on the Lower Missouri River. Five of these fish were identified as shovelnose sturgeon and 6 remain to be identified (Grady and Mauldin 2002).

Hybridization - The rate of hybridization between pallid sturgeon and shovelnose sturgeon is increasing rangewide and remains highest in the Lower Missouri River and Middle Mississippi River reaches of the Action Area.

The 2000 Biological Opinion reported field surveys of *Scaphirhynchus* stocks that suggest a relatively high incidence of hybridization between shovelnose sturgeon and pallid sturgeon in the Middle Mississippi River (Sheehan 1997a, 1997b, 1998). Sheehan et al. (1997b) and Carlson and Pflieger (1981) noted a 3:2 ratio of hybrid sturgeon to pallid sturgeon. Sheehan et al. (1997b) speculated that if this is representative of the sturgeon populations in the middle Mississippi River, hybridization may pose a significant threat to pallid sturgeon as the species continues to cross with shovelnose sturgeon. Keenlyne et al. (1994) reported that hybridization may be occurring in half of the river reaches within the range of pallid sturgeon and that hybrids may represent a high proportion of remaining sturgeon stocks.

Hybridization between pallid and shovelnose sturgeon was only recently reported in the Upper Missouri River (RPMA #2), when in 2000, Yerk and Baxter (2001) reported one individual with intermediate characteristics.

During the MICRA study from 1996 to 2000, seven pallid/shovelnose sturgeon hybrids were collected in the Middle Mississippi River and 15 were collected in the Lower Missouri River. The rate of hybridization increased from 1 in 365 (0.27 percent) river

sturgeons in the late 1970's (Carlson et al. 1985) to 1 in 235 (0.42 percent) in the 1990's (Grady et al. 2001).

Surveys conducted as part of the Highway 19 bridge replacement project near Hermann, Missouri, resulted in collection of 3 pallid sturgeon, 14 hybrids and 1,990 shovelnose sturgeon (Milligan 2002). In addition, as part of the Lower Missouri River Pallid Sturgeon Monitoring and Population Assessment Project, CMFRO collected 12 pallid sturgeon, 12 hybrids and 3022 shovelnose sturgeon (Doyle and Starostka 2003).

Restoration Stocking – The 2000 Biological Opinion reported that in response to obvious declines in pallid sturgeon numbers and the notable lack of recruitment, MoDOC began an augmentation effort by releasing fingerlings raised at Blind Pony State Fish Hatchery. Through this effort, approximately 7,000 fingerlings were released in the Missouri and Mississippi Rivers in 1994 and an additional 3,000 fingerlings were released in 1997 (Graham 1997, 1999). Since the release, approximately 127 tagged pallid sturgeon have been reported (Graham, pers. comm. 2000). Most of these fish are being reported below St. Louis likely due to higher numbers of commercial fisherman in the Mississippi River (Graham 1999).

Since 1994 when stocking of hatchery raised pallid sturgeon began, young-of-year fingerlings, and age one and two juveniles have been stocked in all Recovery Priority Management Areas. No stocking occurred in 2001 when concerns of disease in hatchery stocks postponed stocking for one year. In all, 16 stocking events have occurred rangewide; 13 within the Action Area Table 7. Since the 2000 Biological Opinion, 27,516 juveniles have been stocked in the Action Area. These efforts have temporarily boosted total population numbers.

The survival and condition factor of stocked pallid sturgeon juveniles is under investigation on the Upper Missouri River. Gardner (2003) reported 6-year old pallid sturgeon stocked in 1998 at average fork length of 11.5 inches, grew to average fork length of 20.7 inches in 2003. Average weight during that period increased from 0.18 pounds to 1.12 pounds. Gerrity et al. (2003) calculated change in condition factor for 41 pallid sturgeon stocked in the Upper Missouri River, age 1-6, and revealed a slight decline in condition from date of stocking, but observed most appeared healthy. The outcome of stocking as a tool to avoid extinction and to recover pallid sturgeon will not be known for some time. To be successful, stocked pallid sturgeon must mature to spawn in suitable habitat, recruit to the population, then spawn again.

Table 7. Pallid Sturgeon Stocked by Year in Each Recovery Priority Management Area from 1994 to 2003.

RPMA	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Subtotals
#1	0	0	0	0	690	0	0	0	2058	0	2748
#2	0	0	0	0	780	0	679	0	3061	4124	8644
#3	0	0	0	0	0	0	514	0	1025	601	2140
#4	2432	0	0	2015	0	0	0	0	7406	9241	21094
#5	4526	0	0	1666	0	0	0	0	0	0	6192
#6	0	0	0	0	35	0	0	0	0	0	35
Subtotal	6958	0	0	3681	1505	0	1193	0	13550	13966	
									TOTAL		**40,853**

Distribution and Abundance of Habitat in the Action Area

As mentioned in the section for pallid sturgeon labeled Rangewide Distribution and Abundance of Habitat, the distribution, abundance and quality of habitat has been severely altered throughout its range. In the Action Area, suitable habitat for the pallid sturgeon has been inundated by reservoirs, modified by dam operations that affect current/velocity, turbidity, water depth, substrate, temperature and hydrograph, and modified through stabilization of the bankline and narrowing on the river.

Upper Missouri River and Yellowstone River - The rise and fall of Fort Peck Lake will inundate and expose riverine habitat, and Fort Peck Lake precludes both upstream and downstream migration of pallid sturgeon. Otherwise this reach is largely outside the Action Area. The conditions in this reach remain unchanged from the 2000 Biological. In RPMA #2 on the Upper Missouri River, physical habitat conditions are present; however, dam operations affect water current, velocity, turbidity, temperature, depth and the hydrograph. On the Yellowstone River, habitat conditions are suitable and a semblance of the hydrograph exists; however, access to approximately 170 river miles of upstream habitat is largely blocked by the Intake Diversion Dam owned by the U.S. Bureau of Reclamation. Providing pallid sturgeon access to the reach of the Yellowstone River above the Intake Diversion Dam would have significant positive effects. This reach has a relatively low amount of bank stabilization activity in relation to other reaches. The transport and suspension of sediment that provides for turbidity and habitat development

and sustainability is also significantly impaired. The conditions in this reach remain unchanged from the 2000 Biological Opinion with some exceptions. On the Yellowstone River, water appropriations have continued to occur, which will affect the natural hydrograph as allocations are exercised. New bank stabilization and maintenance of existing banks continues in this reach.

Middle Missouri River - In RPMA #3 on the Middle Missouri River, physical habitat conditions for pallid sturgeon are generally suitable; however, Ft. Randall Dam and Lewis and Clark Lake block both upstream and downstream migration. New bank stabilization and maintenance of existing banks continues in this reach. The effects of dam operations alter water current/ velocity, turbidity, temperature, depth and the hydrograph.

Lower Missouri River - In RPMA #4 on the Lower Missouri River from Gavins Pt. Dam downstream approximately 76.1 miles to Sioux City, Iowa, suitable physical habitat conditions exist; however, dam operations affect current/velocity, turbidity, water depth, substrate, temperature and the hydrograph. From Sioux City downstream approximately 139.5 miles to the mouth of the Platte River, the physical habitat conditions are substantially reduced and the hydrograph is significantly altered. From the mouth of the Platte River, downstream approximately 595.5 miles to the Mississippi River, the physical habitat conditions improve and the alterations to the hydrograph are attenuated due to the influences of tributary inflow. The transport and suspension of sediment for turbidity and habitat development and sustainability is also significantly impaired.

Since 2000, bank stabilization and maintenance continues through out this river reach. The Corps has been implementing certain habitat development aspects of the 2000 Biological Opinion. These include land acquisition (1,100 acres) from Gavins Point Dam to Sioux City, Iowa to benefit piping plovers, least terns, and pallid sturgeon. However, restoration has not occurred. During 2001 through 2003, the Corps made modifications to the BSNP that resulted in the creation of 1,365 acres of shallow water habitat (SWH). Projects included: excavation of over 400 notches in dikes; construction of reverse dikes/notches at Marion and Plowboy Bends; side channel construction at Overton Bottoms, Tobacco Island and California Bend; buried dike excavation and notching at Overton Bottoms; chevron construction and dike lowering near Nebraska City; and modification of dike maintenance at selected locations from Sioux City to the mouth to encourage aquatic habitat development.

According to the 2000 Biological Opinion, approximately 77,000 acres (105 acres/mile) of shallow water, slow velocity habitat occurred in the predevelopment river below Sioux City, Iowa. It was estimated that approximately 2-5 percent or 2.1-5.25 acres/mile of the historical acreage remains between Sioux City and the Grand River confluence in the developed river. Since issuance of the 2000 Biological Opinion, the Corps conducted new modeling studies which estimate that approximately 18.0 acres/mile of shallow water habitat currently occurs below the Grand River in the Lower Missouri River (6,017 total acres). The 2000 Biological Opinion RPA specified that 20-30 acres of shallow

water habitat should be created in the Lower Missouri River. As such, an estimated 8,000 to 14,000 additional acres of shallow water habitat must be established.

Middle Mississippi River – In RPMA #5 on the Middle Mississippi River, physical habitat is becoming homogeneous. With construction of the 9-foot channel navigation project on the Upper Mississippi River, the river bank top width has been reduced, side channels, islands and ephemeral sand bars have been lost, and the physical process of channel meandering has been arrested. Sediment transport and availability for habitat development has been significantly impaired as a result of Corps' actions on both the Upper Mississippi River and the Missouri River. The result has been the loss of aquatic habitat diversity over time. This process is on-going. In April 2000, the Service issued a jeopardy Biological Opinion for pallid sturgeon to the Corps for continued operation and maintenance of the 9-foot channel navigation project on the Upper Mississippi River. The Corps has accepted the Reasonable and Prudent Alternative (RPA) and is in the process of implementing the RPA. The RPA called for: 1) conducting a pallid sturgeon habitat study in the Middle Mississippi River; 2) development of a pallid sturgeon conservation and restoration plan, which would include monitoring of pallid sturgeon and habitat; 3) implementation of a long-term aquatic habitat restoration program to restore habitat quantity, quality and diversity; and 4) implementation of short-term aquatic habitat restoration measures (e.g., pilot projects). The pallid sturgeon conservation and restoration plan is still under development; however, to date the Corps has completed a number of pilot projects that have improved habitat conditions on a local scale. These projects include rehabilitation of Santa Fe Chute side channel, placement of woody debris piles in various locations, incorporation of woody debris into dikes during maintenance, dike notching, and construction of a chevron dike to facilitate development of a mid-channel sand bar island and associated aquatic habitat. It is assumed the Corps will continue to implement the RPA as described, including the long-term aquatic habitat restoration program. Thus, overall habitat conditions on the Middle Mississippi River should improve over time.

Importance of the Missouri River and Yellowstone River Combined to Pallid Sturgeon

- Adult pallid sturgeon in RPMA #2 on the Upper Missouri River represent one of the last remaining heritage populations. Intermediate taxonomic characteristics that might represent hybridization have only been suspected in one captured sturgeon.
- Upper Missouri River pallid sturgeon populations are currently supplying the hatchery program with brood stock.
- Habitat conditions for pallid sturgeon in RPMA #2 and RPMA # 4 on the Lower Missouri River are largely intact. However, dam operations affect current/velocity, turbidity, water depth, substrate, temperature and the hydrograph in all or portions of these reaches. Habitat is being improved for pallid sturgeon on the Lower Missouri River.
- The length of the Missouri River in the Action Area represents more than one-half of the existing range of the pallid sturgeon.

- 85 percent of the 40,853 stocked pallid sturgeon have been stocked to the Missouri River.
- 63 percent of pallid sturgeon observations recorded in the pallid sturgeon catch record database maintained by the Service have come from the Missouri River and tributaries (S. Krentz, USFWS, pers. comm. 2003).
- The incidence of hybridization also is lower on the Upper Missouri River than on the Lower Missouri River and Mississippi River.

Importance of the Yellowstone River to Pallid Sturgeon –

- Pallid sturgeon in RPMA #2 move freely and frequently between the Missouri River and the lower Yellowstone River. The majority of pallid sturgeon monitored by radios in a telemetry study stayed within the first nine miles of the Yellowstone River.
- Anecdotal information indicates there is a high probability that pallid sturgeon are spawning in the lower Yellowstone River. A male and female pallid sturgeon in spawning condition were captured in the same vicinity in 1993.
- At its junction with the Missouri River, the Yellowstone River is the larger of the two by volume. It is 678 miles in length and has no large dams.
- The Yellowstone River contains some of the best remaining riverine habitats within the entire Missouri River basin and a semblance of the natural hydrograph exists.
- The Yellowstone River has a diverse gradient and contains suitable spawning substrate for pallid sturgeon.
- Access to upstream habitat is largely blocked by a low-head diversion dam operated to divert water for irrigation. The dam is located approximately 70 miles from the confluence and is under the authority of the U.S. Bureau of Reclamation.

Importance of the Kansas River to Pallid Sturgeon

The situation remains as stated in the 2000 Biological Opinion:

> "Historic catch records for pallid sturgeon are scarce for the Kansas River. Since 1950s, only five documented pallid sturgeon have been sampled from the lower 40 mi (65 km) of the Kansas River, all during late March and early April in 1952. Little sampling for pallid sturgeon has occurred on the Kansas River.
>
> In general, pallid sturgeon researchers assume at this time that tributaries are used primarily for foraging and/or spawning. Pallid sturgeon use of tributaries such as the Kansas, Platte, and Niobrara Rivers needs to be better evaluated to identify their role in pallid sturgeon recovery. They are undoubtedly important to the ecosystem, but the full extent of pallid sturgeon use of those habitats is unclear.
>
> Pallid sturgeon inhabit the main stem Missouri River, and have entered the lower Kansas River during floods, with the furthest upstream records from Douglas County (Cross and Collins 1995). It is highly unlikely that this

species currently occurs in the Kansas River due to habitat modifications and physical barriers (e.g., Johnson County Wier), except under conditions of high flows."

Importance of the Middle Mississippi River to Pallid Sturgeon

The Middle Mississippi River is important to the survival and recovery of pallid sturgeon for a number of reasons. This area represents a significant portion of one of six designated recovery priority management areas identified in the recovery plan (USFWS 1993). There is some evidence of natural reproduction in the Middle Mississippi River and it is believed to be an important juvenile rearing area. It is one of only four areas where we have evidence of reproduction in recent years. It is approximately 5 percent of the pallid sturgeon's total current range of approximately 3500 river miles. However, it represents approximately 10 percent of the range that is believed to have suitable habitat and some semblance of a natural hydrograph. Finally, the Middle Mississippi River represents an important genetic conduit between the Lower Missouri River and the Lower Mississippi River. Changes in the Lower Missouri River are likely to affect population viability in the Middle Mississippi River and the Lower Mississippi River.

Emergency Wetland Reserve Program and Wetland Reserve Program

The Service and States of Missouri, Kansas, Nebraska, and Iowa also are working with Natural Resources Conservation Service (NRCS) and the Agricultural Stabilization and Conservation Service to protect flood-created habitats and floodplain wetlands through the Emergency Wetland Reserve Program (EWRP) and the Wetland Reserve Program (WRP), which provide a one-time payment to landowners for a perpetual easement on these areas. As of 2002, about 25,462 acres of floodplain lands in Missouri, Kansas, Iowa, and Nebraska have been enrolled in the program.

Federal Levee Projects

The Missouri River Levee System (MRLS) is a continuing Federal Project for flood damage reduction and other purposes along the Missouri River. The MRLS was authorized by the Flood Control Act of 1944. A number of Federal levee projects are currently under construction or development. They include the Missouri River Levee Unit L385 project in Riverside, MO; the Kansas City, Missouri and Kansas City, Kansas Flood Protection Project; the Missouri River Levee Unit L142, across from Jefferson City, Missouri; and the L15 levee near the confluence of the Missouri and Mississippi Rivers, within St. Charles County, Missouri.

Although most of those projects are designed to provide 500-year flood protection to urban areas, several levee units are designed to protect what is now largely agricultural land. The proposed L142 levee is designed to protect against a 1,000-year flood. The Corps based that level of protection on the historic trend of rising river stages (up to 5 ft [1.5 m]) for a given discharge. The Corps attributed much of that trend to sediment deposition on berms, channel cut-offs, and levee construction (USACE 1999c). The effects of levee building are many. Not only do levees reduce connectivity between the river and floodplain (e.g., reduce riverine recharge and fisheries access to floodplain wetlands and other habitats, reduce nutrient and organic material exchange, etc.), but they

also lead to additional levee projects to address higher river stages (upward spiraling effect of flood heights), and induce development in the adjacent floodplain. Levees and floodplain encroachment also reduce the Corps' flexibility to operate the river for flood control and limit habitat restoration opportunities to compensate for past and ongoing project-related effects to both federally listed species and native river species of special concern.

National Wildlife Refuge Projects

Big Muddy National Fish and Wildlife Refuge: The Big Muddy National Fish and Wildlife Refuge is authorized to acquire up to 60,000 acres (24,300 ha) of the Missouri River floodplain between Kansas City and St. Louis. To date, the Service has acquired 8,139 in 10 units and manages an additional 1,301 acres (527 ha) of Corps' mitigation lands. Acquisition of additional refuge lands is contingent on adequate funding and willing sellers, and may take 20 to 50 years to complete. The Corps has already initiated habitat restoration (reforestation through plant succession and planting, chutes, wet prairies, etc.). Adjacent to Jameson Island in central Missouri, the Service and the Corps have modified channel training structures to increase shallow-water and sandbar habitat. The Corps and the Service are also working to maintain a navigation grade control structure at a chute created at Lisbon Bottoms during the 1993 and 1995 floods. The Corps has modified repairs to a revetment to allow continued flow through the chute. Habitat improvements have already shown positive biological results as documented in the fish use of those areas. A wide variety of fish species, including several of special concern and the pallid sturgeon, have been documented in and around those habitats. Taking full advantage of the restoration opportunities of the Refuge is expected to take many years. The long-term benefits of those areas should be evaluated to better refine potential restoration work.

Desoto National Wildlife Refuge - Desoto National Wildlife Refuge (NWR) also manages the nearby Boyer Chute NWR near Blair, Nebraska. The refuge is a joint Federal and local conservation partnership to restore a portion of Missouri River habitat that flows through the 2.5-mi (4 km) chute paralleling the river. Currently, the refuge covers approximately 2,000 ac (810 ha). The Refuge is currently working with the Corps to construct new aquatic habitats on the refuge.

Middle Mississippi River National Wildlife Refuge - The Middle Mississippi River NWR was established following the flood of 1993 and is managed as part of the Mark Twain NWR Complex. To date approximately 4,000 acres of floodprone lands have been acquired. The primary management goal of the refuge is to restore habitats that have been lost or degraded as a result of modifications to the floodplain and river. The Service is currently working with the Corps to implement habitat restoration projects, including sidechannel and off-channel aquatic habitat restoration for the benefit of pallid sturgeon.

Endangered Species Private Land Acquisition Grant Program

In addition to the Refuge Land Acquisition program, additional lands along the Missouri River have been purchased since 2000 to allow for the conservation of listed species. Approximately 400 acres have been purchased at the confluence of the Yellowstone and

Missouri Rivers in North Dakota and approximately 1100 acres have been purchased directly adjacent to Ponca State Park in Nebraska. These properties have been acquired with funds from the Endangered Species Land Acquisition program. The Service is working with Nebraska Game Fish and Parks and North Dakota Game and Fish Departments to ensure management of these two sites benefits pallid sturgeon as well as least tern and piping plover.

Sand and Gravel Dredging

In 1998, the Corps' Waterways Experiment Station published a Technical Note that summarizes existing literature regarding potential impacts to aquatic organisms caused by entrainment during dredging and dredged material disposal operations (Reine and Clarke 1998). Entrainment in this case is defined as the direct uptake of aquatic organisms by the suction field generated at the draghead or cutterhead (Reine and Clarke 1998). Armstrong et al. (1982) reported entrainment rates that ranged from 0.001 to 0.135 fish/cy for both pipeline and hopper dredging activities. They found that both small and large fish were entrained in similar proportions, and therefore, concluded that large fish did not actively avoid the dredge any more than small fish. Armstrong et al. (1982) reported an initial mortality rate of 37.6 percent. Larson and Moehl (1990) reported entrainment rates ranging from <0.001 to 0.341 fish/cy during a 4-year study at the mouth of the Columbia River in Oregon. The majority of fish entrained were demersal with a few pelagic species also being collected (Larson and Moehl 1990).

Buell (1992) monitored entrainment by the hydraulic dredge *R.W. Lofgren* during dredging operations in the Columbia River. Buell reported an entrainment rate of 0.015 fish/cy for white sturgeon (*Acipenser transmontanus*). Substantial numbers of juvenile white sturgeon (300 to 500 mm) were entrained, which was largely attributed to dredging in an area referred to as the local "sturgeon hole". However, the overall entrainment rate reported by Buell (1992) is comparable to rates reported for other species of fish. To date, no studies have been completed in the Missouri or Mississippi Rivers to evaluate possible fish entrainment due to commercial sand and gravel dredging or navigation channel maintenance. The Corps has previously stated that entrainment of pallid sturgeon due to navigation channel maintenance dredging could not be ruled out (USACE 1999).

Title VI Projects - Cheyenne River Sioux Tribe, Lower Brule Sioux Tribe, and State of South Dakota Terrestrial Wildlife Habitat Restoration (Public Law 105-277, October 21, 1998) and the Water Resources Development Act (WRDA) (Public Law 106-53, August 17, 1999)

Title VI and WRDA will transfer much of the Corps' land and recreation areas in South Dakota to the State and to the Bureau of Indian Affairs. Two tribes have chosen to participate, the Cheyenne River and Lower Brule Sioux Tribes. The Crow Creek and Standing Rock Tribes chose not to participate. The Corps has completed the transfer of those lands. In accordance with the ESA, the Service has conducted a section 7 consultation with the Corps on those land transfers.

State of South Dakota Recreation Sites Lease Proposal
The Corps has processed a request by the State of South Dakota to lease 23 recreation sites along the Missouri River. That lease request also included plans for recreational facility enhancement and expansion. The Corps conducted a consultation with the Service on this action. In response, the Service has notified the Corps that expanded recreational facilities may exacerbate human disturbance of nesting Missouri River least terns and piping plovers. Additional lands along the Missouri River will be transferred from the Corps to the State of South Dakota once the trust fund established to manage these lands is fully capitalized (approximately 8 to 10 years).

Section 32/33 Bank Stabilization Program
Recently the National Park Service has taken a more active role in bank stabilization activities on the Missouri National Recreation River (sections 8, 9 and 10). Through participation in planning and maintenance activities of Section 32 projects, it has been determined that some past work completed under the guise of maintenance resulted in significant modifications to the demonstration projects' purpose and function. In 2003, the Corps delayed any maintenance or modification activities until agency coordination could be achieved.

The latest Corps' estimate of percent stabilization in the Recreation River (sections 8 and 9) is 22 percent while section 10 was 32 percent. Through a more detailed review of the data the National Park Service believed that many areas of the bank stabilization project were omitted from the Corps' estimates and the actual amount of stabilized bank may approach 40 percent.

Programmatic Bank Stabilization EIS
The Corps reinitiated coordination on the cumulative Bank Stabilization EIS for the Upper Missouri River in August 2001. The Corps now has a contactor working on the project and has enlisted the assistance of several cooperating agencies, including the National Park Service and the Fish and Wildlife Service. A preliminary draft Chapter 1 was released to cooperating agencies for review in August 2003. A Record of Decision is due in December 2004.

Invasive Species
Since issuance of the 2000 Biological Opinion, Asian carp populations have greatly increased in the Missouri River and Mississippi River systems. Bighead carp and silver carp have become the most abundant large fish in portions of the Lower Missouri River (Duane Chapman, USGS, pers. comm.). The abundance of these fish coupled with their ability to consume massive quantities of phytoplankton and zooplankton results in a great risk to the productivity of the Missouri River and Mississippi River aquatic food web. Bighead and silver carp have the potential to consume and retain large quantities of energy from lower trophic levels of the river's food web. This could occur to such a degree that pallid sturgeon and most other native fishes will be negatively impacted. In addition, pallid sturgeon larvae may be preyed upon by bighead and silver carp while they are part of the ichthyoplankton.

Bighead Carp - Bighead carp are known to school and occupy the upper to middle layers of the water column. They prefer large rivers and depend on velocity, a spring rise in the hydrograph and temperature regimes to spawn (Lin 1991). Five ontogenic shifts in feeding ecology of bighead carp were summarized by Lazareva et al. (1977) in fish less than one year of age. These included feeding on phytoplankton, then shifting to protococcaeceans, diatoms, bluegreen algae and *Rotaria* eggs, and finally to feeding on zooplankton exclusively. Bighead carp have a large suction volume, fast growth rates and voracious appetites enabling them to decimate concentrations of zooplankton quickly. Preliminary data from the Missouri River indicates that bighead carp can also feed on detritus, which gives them an alternate food source in periods when zooplankton concentrations are low (Duane Chapman, USGS, pers. comm.).

Laird and Page (1996) state that bighead carp have the potential to deplete zooplankton populations which could negatively impact the food availability for many larval fish, adult filter feeding fish and native mussels to a significant degree. Most species of fish in the Missouri and Mississippi Rivers have a larval stage in which the fish are part of the plankton, and thus can be vulnerable to Asian carp predation. Bighead carp host a number of disease causing agents, including 2 bacteria, 1 fungus, 22 protozoa, 6 trematoda, 3 cestoda and 3 copepoda species (Jennings 1988). The impact of these agents on native fish has not yet been assessed.

Silver Carp- Silver carp are known to school and occupy the upper to middle layers of the water column. Similar to bighead carp, silver carp feeding ecology shifts as the fish age. As adults, these fish feed primarily on phytoplankton with zooplankton as a secondary food source. Due to a modified gill structure, the fish filters food items at a ratio of 248:1. Silver carp also feed on organic detritus and associated bacteria, indicating opportunistic feeding behavior. In large numbers, the silver carp has the potential to cause enormous damage to native species because it feeds on plankton required by larval fish and native mussels (Laird and Page 1996) and has the potential to compete with adult native fish that rely on plankton for food (Pflieger 1997). Intraspecific competition through feeding between silver carp and endemic fishes in backwater habitats, lakes, pools, etc., appears to be the greatest threat. Silver carp may also displace native river fish from spawning habitats.

Grass Carp - Grass carp are herbivorous and depend on floodplain habitats for successful recruitment. In most rivers where grass carp reproduce successfully, floodplains provide a large volume of still, shallow, warm water containing vegetative cover. There are few macrophytes in the Missouri or Mississippi Rivers. However, ongoing efforts to reconnect the floodplain in these river systems, while essential to native species, will also likely benefit grass carp.

Other invasive aquatic species

There are other aquatic invasive species in the upper Mississippi River and in the Great Lakes that may eventually move up the Missouri, among them the rusty crayfish, the ruffe, and the round goby. There is little that can be done to limit expansion of these species through the open river system.

EFFECTS OF THE FEDERAL ACTION

The effects of the Corps' operation of the Missouri River Main Stem reservoirs were analyzed in the 2000 Biological Opinion (USFWS 2000; page 199). That effects analysis resulted in a conclusion that the Corps' actions would jeopardize the Interior least tern, Great Plains piping plover, and pallid sturgeon. The Service offered the Corps an RPA that we believed would alleviate the likelihood of their actions jeopardizing the three species.

In November 1993, the Corps provided the Service a Biological Assessment and requested reinitiation of consultation. The Corp described some 2000 RPA elements that they would delete (flow changes out of Gavins Point Dam and full implementation of flow changes from Fort Peck Dam) and some alternative elements that they believed would likely avoid jeopardizing the three species if done in conjunction with the other requirements of the 2000 Biological Opinion. The Service's task in this reinitiation is to review the Corps' proposed new elements of the RPA and determine whether the new elements, together with the other components required by the 2000 Biological Opinion, viewed in light of a new environmental baseline, will continue to avoid the likelihood of jeopardizing the species. To do this, after updating the status of the species and the environmental baseline, we analyzed the effects of the proposed new elements. Our analysis of these effects will be combined with our updated understanding of the status of the species rangewide and the environmental baseline, to make a conclusion as to whether the proposed new RPA (old RPA elements agreed to by the Corps plus the new RPA elements proposed by the Corps) avoids the likelihood of jeopardizing the interior least tern.

RISK ASSESSMENT FOR INTERIOR LEAST TERNS AND NORTHERN GREAT PLAINS PIPING PLOVERS

INTRODUCTION

As part of our jeopardy determination for both Interior least terns and Northern Great Plains piping plovers, we used a risk assessment process to investigate the consequences of a hypothetical question: if the Corps actions, or natural forces, resulted in the loss of significant reproductive output to riverine reaches of the Missouri River judged important to terns and plovers, what would the impact be on the listed entity? Based on the Corps' proposed actions and the requirements of the 2000 Biological Opinion, for Interior least terns, we found the adverse impacts to terns from Corps' actions would mainly be on the 125 mile stretch of riverine habitat below Fort Peck Dam and on the 59 miles of river below Gavins Point Dam.

Because the 2001 rangewide estimate of adult Northern Great Plains piping plovers was estimated to include nearly 3,000 adult plovers (compared to about 12,000 adult Interior least terns, we wanted to be even more conservative in our risk assessment for piping

plovers. Therefore, for plovers, we applied the same analysis to all riverine reaches on the Missouri River: 125 miles below Fort Peck Dam, 25 miles above Lake Sakakawea, 88 miles above Lake Oahe, 36 miles above Lewis and Clark Lake, and 59 miles below Gavins Point Dam. However, only the reaches above Lake Oahe and below Gavins Point Dam have significant number of nesting plovers.

We used data from rangewide censuses of both Interior least terns and Northern Great Plains piping plovers and data collected by the Corps for these species on the riverine reaches of the Missouri River. We then assessed the consequences of losing significant portions of the recruitment (survival of young to join the adult breeding population) to the listed species and used the results of these analyses to document part of the process we used in assessing whether results of the Corps' actions, or an unanticipated natural event, would result in unacceptable risk to the species.

RISK ASSESSMENT METHODS

We used a sequential risk assessment process to assist our decision making process. The purpose of the analysis was to test the population effects of the Corps' actions, or a natural event, on reproductive recruitment to the breeding populations of terns and plovers. An explanation of our process follows.

For both Interior least terns (ILT) and Northern Great Plains piping plovers (PP) we have estimates of total adults of the listed species (for ILTs, it is the subspecies) or the listed population (for PPs, it is the breeding population in the United States and Canada). For ILTs, the best estimate is the recent 2003 rangewide census and for PPs, the best estimate is the 2001 International piping plover census. For both species, the estimated total number of adult birds is an underestimate of unknown proportion.

N_{ILT} = Total Estimated Interior Least Tern Adult Population
N_{PP} = Total Estimated Northern Great Plains Piping Plover Population

For both ILTs and PPs , we considered the areas impacted by the Corps' ongoing and proposed actions to be subpopulations of N.

nb_{ILT1} = number of breeding pairs in the affected portion of ILT
nb_{PP1} = number of breeding pairs in the affected portion of PP

We considered the time period from eggs laid to when birds return to nest to be the period critical to species survival. Reproductive output (R) is a product of eggs laid, eggs that hatch, and hatchlings that survive to fledge (fledglings). The important product of reproduction is birds recruited to the adult population, that is, those juveniles that survive the year and return to nest. The following year's recruitment to the adult breeding population is a product of R and the first year survivorship.

For our RA, we made the following assumptions:

1. The Corps' ongoing and proposed actions have an adverse impact on R and this will be reflected in the observed fledge ratios.
2. R is also impacted by natural events, such as weather, so the difference in R between or among impacted areas and areas not impacted by the actions should be a measure of impacts of the Corps' actions on R, so long as all areas are similarly affected by climatic conditions or other natural forces (for example, disease or predation).
3. Both ILTs and PPs leave their northern breeding areas during the winter, so for the purposes of our assessment, over-wintering mortality to adults was a variable not affected by either the Corps' actions or natural forces on the breeding grounds.
4. Likewise, fledglings leave the breeding grounds and survivorship to first breeding year will be a constant.
5. There probably is a slight difference in reproductive life span depending on whether the adults nest in or outside of the action area. This is because some of the Corps' actions may result in increased predation on adult birds in the action area. However, based on the available data, we believe that the mortality to adult birds that might be attributed to the Corps' actions is low and will be encompassed within our hypothetical tests of lost R. However, natural forces, such as disease, could have a dramatic impact on reproductive life span but this impact would likely occur both within and outside the area impacted by the Corps' actions.

To summarize,

f_{ILT1} = fledge ratio for ILT in the affected area
f_{PP1} = fledge ratio for PP in the affected area

s_{ILT} = mean survival rate of first year ILT (0.30 (Thompson 1982), assumed to be the same within and outside of the affected area)
s_{PP} = mean survival rate of first year PP (0.318, assumed to be the same within and outside of the action area)

Effects of the Corps' Actions in Terms of Mortality Prior to First Breeding Season (P):

For the purposes of the RA, we investigated four hypothetical levels of effects to the R of ILTs and PPs in the action area. We compared birds surviving to first breeding season when $P_i$was set at:

i = 10,
i = 30,
i = 50, and
i = 100 percent.

and

P = probability

And

i = percent of hypothetical mortality to R not realized in the fledge ratios,

for RA equation of: $P_{100-i}\ (nb_a \cdot f_a \cdot s_a)\ :\ N$

where

P_{100-i}	percentage not lost, as described above,
nb	average number breeding pairs using the affected areas,
f	weighted fledge ratio over the affected areas,
s	survivorship to 1st breeding season, and
a	weighted over affected areas.

Adult survivorship after the 1st breeding season:

We realized that mortality to adults would continue through the years. In the literature, mean annual survival of adult ILTs has been estimated at 0.85 and for PPs the estimate is 0.737 (Larson et. al. 2000). However, these survivorship values apply to ILTs and PPs regardless of whether or not the adult birds are using the action area or are nesting outside the action area. Mortality on the wintering grounds is also included within these adult survivorship estimates. Therefore, mean annual survival of adult birds is a constant and was not used in the RA.

Calculation of fledgling ratios (f):

Within the affected area we calculated weighted fledgling ratios for both ILTs and PPs. For PPs, we used observed fledge ratios from birds using the four river reaches and calculated a weighted overall fledge ratio based on the proportion of birds using the reaches in the 1991, 1996, and 2001 census years divided by the numbers of pairs using the affected area overall all three census periods.

For ILTs, we used observed fledge ratios from terns nesting on the two river reaches and calculated a weighted overall fledge ratio based on numbers of fledgling divided by number of nesting pairs per year from 1993 through 2003, weighted by numbers of nesting pairs per year divided by total number of nesting pairs over all years (1993 – 2004).

Note: We used the method to calculate fledge ratios that has been used by researchers working for the Corps. That is, numbers of fledglings is known through observations of nests. However, number of pairs of breeding birds is calculated by dividing the number of adult birds in the area by two. This will likely over-estimate the number of breeding pairs to an unknown degree, which has the result of producing a conservative fledge ratio. The fledge ratio is calculated by dividing the number of fledglings by the number of breeding pairs.

RESULTS

The average number of Interior least terns nesting on the two river reaches was 131 breeding pairs. The weighted estimate of the fledge ratio for nests on these two river reaches was 0.92 fledglings per breeding pair of Interior least terns. Hypothetical losses to recruitment ranged from no terns lost to an upper estimate of 36 terns lost for any single year. These hypothetical losses were compared to a recent rangewide population estimate of over 12,000 Interior least terns.

The average number of Northern Great Plains piping plovers nesting on the four river reaches was estimated to be 140 breeding pairs. The weighted estimate of the fledge ratio for nests on these four river reaches was 1.10 fledglings per breeding pair of piping plovers. Hypothetical losses to recruitment ranged from no piping plovers lost to an upper estimate of 49 plovers lost for any single year. These hypothetical losses were compared to a recent rangewide population estimate of nearly 3,000 Northern Great Plains piping plovers.

ILTs

Hypothetical Post Fledging Recruitment Not Lost to Corps' Actions P_{100-i}	Average Breeding Pairs in the Affected Area	Hypothetical Recruitment to the Adult Population	ILTs Not Recruited to the Adult Population	2003 Estimated Adult ILTs in the Listed Entity
100%	131	36	0	12,035
90%	131	32	4	12,035
70%	131	25	11	12,035
50%	131	18	18	12,035
0%	131	0	36	12,035

PPs

Hypothetical Post Fledging Recruitment Not Lost to Corps' Actions P_{100-i}	Average Breeding Pairs in the Affected Area	Hypothetical Recruitment to the Adult Population	PPs Not Recruited to the Adult Population	2001 Estimated Adult PP in the Listed Entity
100%	140	49	0	2,953
90%	140	44	5	2,953
70%	140	34	15	2,953
50%	140	25	24	2,953
0%	140	0	49	2,953

CONCLUSIONS

We found that the loss to the Interior least tern from a single catastrophic event on two riverine reaches on the Missouri River could result in the loss of up to 36 first year terns, or about 0.003 of the 2003 estimated population. Likewise, for the Northern Great Plains piping plover, if an unexpected catastrophic event occurred that equally affected all four riverine reaches, then up to 49 first year piping plovers could be lost, or about 0.017 of the 2001 estimated population. An event, or combination of events, that resulted in the loss of all fledgling terns or plovers on the river stretches of the Missouri River has never been documented.

This risk assessment could be extrapolated beyond a single year. The annual mean adult survival rates for Interior least terns (0.85) and for piping plovers (0.737) would be applied to birds having survived their first year. In addition, the annual recruitment to the populations would be added. Our intent in calculating the risk assessment was to examine the consequences of a one-time event and we did not extrapolate beyond 2004. In addition, Interior least terns and Northern Great Plains piping plovers naturally exist on ephemeral habitats in the highly dynamic Great Plains Region. Therefore, extrapolating these data beyond the near future would result in unknown levels of reduced confidence.

These assessments considered the hypothetical cases of losing 10, 30, 50, and 100 percent of all annual recruitment from riverine stretches of the Missouri River to the Interior least tern and Northern Great Plains piping plover populations. We found that both species have populations of sufficient robustness to absorb a one time catastrophic event. If the event happened during the peak of nesting season, then results of the magnitude we predicted could happen. If the event happened before the nesting season, then the terns and plovers would likely go elsewhere to nest. Both species evolved on the Great Plains, an ecosystem known for greatly fluctuating weather patterns. Therefore, both species are adapted to compensate for a pattern of changing habitat availability. If an event of this type persisted over time, then the consequences could be more deleterious to the species.

LEAST TERN

We reviewed the effects of the Corps' proposed new elements in each of the segments of the action area where least terns occur. Four of those segments are more heavily used by least terns than the others: Garrison Dam to Lake Oahe, Lake Oahe, Fort Randall Dam through Lewis and Clark Lake, and Gavins Point Dam to Ponca State Park, Nebraska.

The new elements proposed by the Corps that were analyzed include: system unbalancing, drought conservation measures, Fort Peck tests, Fort Randall reach fall rise test, Gavins Point Dam summer releases, Gavins Point reach fall flow test, Gavins Point spring sandbar conditioning, acceleration of shallow water habitat creation, emergent sandbar habitat creation, research, monitoring and evaluation (including an interior least tern population assessment) and a three-year evaluation. We included emergent sandbar habitat creation in our list of proposed new elements to be analyzed even though it had been included in the original RPA from the 2000 Biological Opinion, because in the absence of flow changes, the Corps is proposing to create more of the needed habitat with mechanical means. In each riverine reach where emergent sandbar habitat goals were set in the 2000 Biological Opinion RPA, the Corps has proposed to meet those goals through whatever means necessary other than flows (e.g., mechanical creation of sandbars or restoration of existing sandbars through removal of vegetation.) Neither the program of research, monitoring and evaluation, nor the planned three-year evaluation, had a direct effect on interior least terns so they were not evaluated. We did not analyze segments 6 and 7 (Lake Sharpe and Lake Francis Case) or segments 11-15 (channelized portion downstream of Ponca State Park, Nebraska) because although terns have been recorded there historically they no longer occur in those areas.

Fort Peck Lake, Segment 1, RM 1882.7 - 1771.5

The element affecting interior least terns in this reach is the system unbalancing proposal that will affect the upper three reservoirs. Although system unbalancing was required by the 2000 Biological Opinion, it was analyzed because the Corps now proposes to clearly indicate in their Master Manual a commitment to this procedure. The effect of this element on Fort Peck lake is expected to be positive for both nesting and foraging tern habitat, although not a significant benefit since few terns use this reservoir on average. The positive effects are due to a potential increase in tern nesting habitat and foraging habitat (through improved habitat for small fish). We noted that no elements affecting this segment in the original RPA were omitted from the Corps' new proposal.

Fort Peck Dam to Lake Sakakawea Headwaters near Williston, ND, Segment 2, RM 1771.5 - 1568.0

Several elements affect least terns on this segment. The proposed drought conservation measures should have positive effects on both nesting and foraging habitat, although we recognize that the measures will only be implemented in drought years. By retaining more water in reservoirs, emergent sandbar habitat should increase, which has the potential to decrease predation rates on nests and chicks. The Corps' 2003 Biological Assessment concludes that if drought conditions continue for a long time, barren sandbar habitat will decrease through natural erosion processes and vegetation encroachment.

The proposed effects of the Fort Peck spring flow tests are generally positive to both nesting and foraging habitat. Although the tests may involve small amount of take during the actual test, overall effects would be positive (as described in the 2000 Biological Opinion) due to habitat restoration and warmer water effects which should provide a cue for spawning of forage species and improve their recruitment. However, we note that this element is considered a negative change from 2000 Biological Opinion because that RPA required full implementation of these flow changes after the mini- and full-tests were completed, yet the current Biological Assessment does not commit to full implementation. Therefore, the positive effects that may occur are limited to what may occur after the two tests, and the positive effcts are not continuing. No emergent sandbar creation in this riverine segment was required in the 2000 Biological Opinion RPA and none was proposed in the Corps' 2000 Biological Assessment.

Lake Sakakawea and Lake Audubon, Segment 3, RM 1568.0 - 1389.9

The element affecting interior least terns in this reach is the system unbalancing proposal that will affect the upper three reservoirs. Although system unbalancing was required by the 2000 Biological Opinion, it was analyzed because the Corps now proposes to clearly indicate in their master manual a commitment to this procedure. The effect of this element on Lake Sakakawea and Lake Audubon is expected to be positive for both nesting and foraging tern habitat, although not a significant benefit because, on average, only between 2 and 35 terns use this reservoir. The positive effects are due to a potential increase in tern nesting habitat and foraging habitat (through improved habitat for small fish). We considered whether the Fort Peck spring flow tests might affect terns in this reach because the tests will be occurring upstream, but we concluded that they are unlikely to result in impacts to nesting or foraging habitat on Lake Sakakawea.

Garrison Dam to Lake Oahe Headwaters near Bismarck, ND, Segment 4, RM 1389.9 - 1304.0

The proposed drought conservation measures should have positive effects on both nesting and foraging habitat in this segment, although we recognize that the measures will only be implemented in drought years. By retaining more water in reservoirs, available sandbar habitat should increase, which has the potential to decrease predation rates on nests and chicks. The Corps' 2003 Biological Assessment concludes that if drought conditions continue for a long time, barren sandbar habitat will decrease through natural erosion processes and vegetation encroachment.

The creation of emergent sandbar habitat through mechanical means was required in 2000 Biological Opinion RPA but in the 2003 Biological Assessment the Corps indicated that the proportion created through mechanical means will increase because no habitat will be created through a spring rise. The 2000 Biological Opinion RPA required that this segment contain 25 acres of emergent sandbar habitat by 2005 and 50 acres by 2015. The Corps' 2003 Biological Assessment indicated that these habitat goals would be met mechanically by creation of sandbars or by restoration of existing sandbars. This emergent sandbar habitat creation should also have a small positive effect by increasing available nesting habitat. Although somewhat uncertain, the effects of this mechanical

creation are most likely to be positive. The adaptive management approach should help avoid any unintended negative effects (i.e., if for some reason the created habitat is determined to be a sink, the Corps will destroy the habitat or otherwise prevent the birds from nesting there).

In summary, we consider that the net effect of these two proposed elements constitutes a benefit to the least tern.

Lake Oahe, Segment 5, RM 1304.0 - 1072.3
The element affecting interior least terns in this reach is the system unbalancing proposal that will affect the upper three reservoirs. Although system unbalancing was required by the 2000 Biological Opinion, it was analyzed because the Corps now proposes to clearly indicate in their Master Manual a commitment to this procedure. The effect of this element on Lake Oahe is expected to be positive for both nesting and foraging tern habitat, although not a significant benefit since few terns use this reservoir on average. The positive effects are due to a potential increase in tern nesting habitat and foraging habitat (through improved habitat for small fish). We noted that this does not constitute an overall negative change from the 2000 RPA because no elements affecting this segment in the original RPA were omitted from the Corps' new proposal.

Fort Randall Dam to Niobrara River, Segment 8, RM 880.0 - 845.0 and Niobrara River to Headwaters of Lewis and Clark Lake, part of Segment 9, RM 845.0 - 828.0
The proposed drought conservation measures should have positive effects on both nesting and foraging habitat in this segment, although we recognize that the measures will only be implemented in drought years. By retaining more water in reservoirs, available sandbar habitat should increase, which has the potential to decrease predation rates on nests and chicks. The Corps' 2003 Biological Assessment concludes that if drought conditions continue for a long time, barren sandbar habitat will decrease through natural erosion processes and vegetation encroachment.

The proposed Fort Randall fall test may have minor benefits to least tern nesting habitat by providing a one-time flush of sediment to create nesting habitat and information to facilitate future sediment transfer. The best time to provide the increased flows would be in the spring, not the fall, because the flows may accomplish other positive affects in the spring, such as providing spawning cues to forage fish. A potential short term negative effect of the tests is the possible flushing of forage fish through the system, and if this occurs, forage fish populations may take a year or two to rebound. We have noted that there appears to be considerable uncertainty regarding whether this test will occur. The test flows out of Fort Randall are dependent on the Gavins Point fall test which appears very uncertain to occur, due to several criteria which must first be met. We have analyzed the potential effects of this test, while noting the uncertainty.

Emergent sandbar habitat creation should also have a small positive effect through increasing nesting habitat. The creation of emergent sandbar habitat through mechanical means was required in 2000 Biological Opinion RPA but in the 2003 Biological Assessment the Corps indicated that proportion created through mechanical means will

change because no habitat will be created through a spring rise. The 2000 Biological Opinion RPA required that 50 acres per mile of emergent sandbar habitat in segments 8 and 9 exist by 2005 and 100 acres per mile by 2015. The Corps' 2003 Biological Assessment indicated that these habitat goals would be met mechanically by creation or restoration of existing sandbars. Although somewhat uncertain, the effects of this mechanical creation are most likely to be positive due to increased nesting habitat availability. The adaptive management approach should help avoid any unintended negative effects (i.e., if for some reason the created habitat is determined to be a sink, the Corps will destroy the habitat or otherwise prevent the birds from nesting there).

The net effect of these proposed elements is likely a minor benefit to least terns. We noted that the elements affecting this segment do not constitute an overall negative change from the 2000 RPA because no elements affecting this segment in the original RPA were omitted from the Corps' new proposal.

Gavins Point Dam to Ponca, NE, Segment 10, RM 811.1 - 753.0 We predict that several of the elements proposed by the Corps will have positive benefits to least terns: drought conservation measures, creation of emergent sandbar habitat, spring sandbar conditioning, and the Gavins Point fall flow test. As discussed above, drought conservation measures should have positive effects on both nesting and foraging habitat. Although somewhat uncertain, the effects of mechanical creation of sandbars are most likely to be positive due to increased nesting habitat availability. The 2000 Biological Opinion RPA required that 40 acres of emergent sandbar habitat exist per mile by 2005 and that 80 acres per mile would exist by 2015. The Corps' 2003 Biological Assessment indicated that these habitat goals would be met mechanically by creation or restoration of existing sandbars.

Spring sandbar conditioning refers to a two day test flow that would be conducted following the creation of new sandbar habitat the previous year. As releases from Gavins Point Dam are increased the following spring to meet the navigation service requirements, there will be additional releases in excess of those 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. We consider the true effect of these conditioning flows to be unknown, although unlikely to be negative.

The Gavins Point fall flow test would occur after refill of the system following the current drought, and would be conducted when evacuation of the system is necessary. The test would consist of a release of approximately 60 Kcfs for a period of approximately 60 days. The reach would be monitored for physical changes in sandbar distribution and characteristics. Representative island/bars would 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. The intended result is to increase the total amount of bare sandbar habitat in this reach and allow for a redistribution of the habitat,

which would have positive effects for nesting least terns. Because this is a one-time test, the positive effects would be short term. Because the test involves 60 Kcfs for such a long period of time, it may result in excessive flushing of sediment from this reach. The criteria given by the Corps for when this test would happen is stringent, leading us to believe that the certainty of the test occurring is low.

One of the elements proposed by the Corps in their 2003 Biological Assessment will have negative effects to nesting least terns in this segment: summer releases to meet navigation targets. Flow support for navigation and other downstream purposes would 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 navigation service support in August when tributary inflows have declined (steady-release); or by some combination of the two methods, as was implemented during the 2003 nesting season (steady-release – flow-to-target). The modeling done for the Missouri River Master Manual Review and Update process 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.

These summer releases have a negative effect due to nest flooding. Potential combination steady release/flow to target method may be an improvement over the current water control plan, but we are unable to determine with any certainty which method the Corps will use. The Corps has stated that adaptive management will be used to make decisions about the method to use during any given year and will be based on runoff, habitat availability, fledge ratios, and population conditions at that time.

We have appreciated the Corps' close coordination with the Service in recent years to choose a method that meets navigation needs but attempts to minimize incidental take of least terns. However, due to the uncertainty about which methods will be used in the future, we must consider a range of scenarios in analyzing the effects of these releases on least terns. The worst case scenario involving a steady release to meet full service navigation release (about 34.5 Kcfs was provided by the Corps in their November 2003 Biological Assessment) in high water years could submerge all available nesting habitat. Under a flow to target release, nesting habitat would initially be available (sandbars exposed) earlier in the season, but this type of release could flood nests and eggs (especially nests at lower elevations) when releases are needed for downstream targets.

A worst case scenario for the flow to target method would be low spring releases (allowing terns to nest at lower elevation) and maximum navigation releases (34 Kcfs) in summer due to low downstream tributary flow. This scenario could result in all low lying nests being flooded.

The third method provided by the Corps is a combination of the steady release and flow to target. This type of navigation release was conducted by the Corps' in 2003 in accordance with the 2003 Supplemental Biological Opinion. This method would start

with a steady release (26 Kcfs used in 2003) when the terns begin nesting in early to mid-May followed by a check to see if low-lying sandbars were inundated (to prevent use and later flooding of terns that may nest on these low areas). The initial steady release is intended to concentrate nesting terns at higher elevations to reduce flooding if higher flows are needed to meet downstream targets. The Corps can shift to flow to target releases target when needed later in the season to meet downstream navigation targets. The combination method is likely to result in lower loss of terns in most years.

The net effect of all the Corps' proposed elements that affect this segment may be approximately neutral. Some elements are predicted to benefit terns (drought conservation measures, creation of emergent sandbar habitat, spring sandbar conditioning, and the Gavins Point fall flow test) while summer releases will usually take some least terns in the form of eggs or chicks and reduce nesting habitat. We realize that these effects may vary year to year; drought conservation measures will not always be implemented and summer releases may take more or less terns depending upon a range of conditions.

We note that the major change in the new proposed RPA elements now under consideration that will affect this reach is the absence of spring rise and low summer flows. Therefore, while the overall effect of the Corps' new proposed elements may be neutral, the elements do constitute an overall negative change from the 2000 RPA because flow changes in the form of a spring rise and low summer flows out of the Gavins Point Dam were omitted from the Corps' new proposal. The 2000 RPA required that 40 acres per mile of emergent sandbar habitat would exist by 2005 and that 80 acres would exist by 2015. The Corps' November 2003 Biological Assessment indicated that goals would be met mechanically by creation or restoration of existing sandbars.

PIPING PLOVER

The Corps' proposed action is operation of the Missouri River Mainstem Reservoir System, operation of the Kansas River projects, and the operation of the Bank Stabilization and Navigation Project as modified by the reasonable and prudent alternative transmitted to the Corps in the Service's Missouri River Biological Opinion issued in November 2000. In addition, the Corps proposes to modify the Current Water Control Plan (CWCP) with a modified drought conservation plan and unbalancing of the upper three lakes. The Corps also proposes an alternative to the original RPA II.A. The purpose of this section is to determine the effects of this proposed action to the piping plover and whether these substitutions/modifications to the CWCP with the RPA from the 2000 Biological Opinion are sufficient to continue to preclude jeopardy to the piping plover.

Modified Drought Conservation Measures

The purpose of the modified drought conservation plan is to improve the storage in upper basin reservoirs during extended drought periods. The Corps will implement measures that result in a modification in navigation service (from full to intermediate to minimum

service) earlier than would occur under the CWCP. Under the proposed action, on March 15, navigation service would reduce from full to an intermediate level at 54.5 million acre feet (MAF) in the reservoirs and to minimum service at 49.0 MAF. The March 15 system storage level at which navigation would not be served for that year would change from the current 23.5 MAF to 31 MAF. Implementation of back-to-back non-navigation years would require approval from the Secretary of the Army.

Under the proposed action, on July 1, navigation service would reduce from full to an intermediate level at 57.0 MAF and to minimum service at 50.5 MAF. The system storage levels at which navigation season length would be shortened are as follows: at 51.5 MAF, the season would be prorated between 8 and 7 months; at 46.8 MAF, the season would be 7 months long; at 41.0 MAF, the season would be prorated between 7 and 6 months; and at 36.5 MAF, the season would become 6 months. Reductions in the navigation season would usually occur at end of the season (September to December).

The purpose of the drought conservation measures is to conserve water in the upper three reservoirs during drought periods. In general, implementation of the drought conservation measures will result in lower flows in summer and fall from Gavins Point Dam and Garrison Dam earlier in the drought cycle. These lower flows will result in more exposed habitat in the river reaches below the dams. However, as implementation of drought conservation measures continues over the long term, encroachment of vegetation will result in the degradation and loss of plover habitat and increased predation to the birds, until significant amounts of suitable nesting habitat are restored (e.g., by high flows).

Unbalancing of the Upper Three Lakes

Unbalancing consists of a set pattern of purposefully lowering one of the upper three lakes (Fort Peck, Garrison, Oahe) approximately three feet and then refilling the lake. The unbalancing would rotate among the three lakes on a three-year cycle.

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. To the extent possible, based on hydrologic conditions, a three-year cycle would be followed for lowering the water level about three feet below normal the first year, followed by a refill of the lake to about three feet above normal the second year and declining lake levels the third year. This three-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 declining.

As indicated above, the Service included system unbalancing as part of the RPA in the 2000 Biological Opinion. Unbalanced regulation of the reservoirs enhances both the creation and availability of nesting and foraging habitat for the piping plover in the reservoir reaches at Fort Peck, Lake Sakakawea, and Lake Oahe and the river reaches below Fort Peck Dam and Garrison Dam. In the first year of the unbalanced cycle, releases from the lake being drawn down must be higher than normal to ensure the drawdown. Additional shoreline and island habitat for nesting plovers becomes available

on the lake being drawn down. The higher releases enhance backwater areas and scour vegetation inundated on the sandbars increasing habitat and potentially forage for plovers. In the second year, when the same lake is being held at a constant lower level, the releases are somewhat lower than they were the previous year. Additional habitat for plovers becomes available on both the reservoir being held stable and the river reach below the dam. During the third year when the same lake is raised to inundate vegetation for spawning and nursery habitat for reservoir fish, the releases from the dam are even lower yet, thus exposing additional sandbars on the river reach below. Some vegetation encroachment on the previous year's sandbars is likely, but it is likely that habitat would still be available for the plovers.

System unbalancing would have the greatest positive effect on Lake Sakakawea, Garrison River, and Lake Oahe as, on average, these reaches support about 62 percent of the adult piping plovers on the Missouri River system and have produced 65 percent of the Missouri River fledglings in the years 1993 – 2003.

Gavins Point Summer Dam Releases

Flows for navigation and other downstream purposes would be provided by adjusting releases from the Gavins Point Dam to meet targets using either a steady release, a flow to target method, or a combination of the two. The evacuation of flood waters would be delayed until mid-September whenever possible. This represents a change in operation from the RPA in the 2000 Biological Opinion that called for a reduction in flows from the Gavins Point Dam beginning each year in mid-June and extending until September 1.

A steady release scenario calls for providing a steady, flat release during the plover and tern nesting season at the flow level estimated to provide the desired service support in August when tributary inflows have declined. A flow-to-target scenario requires adjusting releases as needed throughout the summer as tributary inflow varies. A combination of the two methods can also be used in which a lower flat release is used at the beginning of the nesting season and a flow-to-target scenario is adapted only if additional water is needed for navigation that cannot be provided by tributary inflows. The decision on which release 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. The Service and the Corps will coordinate to attain the most favorable conditions for plovers and terns as has occurred in the past.

A steady release scenario results in higher levels of flooded plover nesting habitat below Gavins Point Dam earlier in the year. While this results in a loss of nesting habitat, birds are able to react to consistent water levels and not nest low on sandbars where nests would be flooded out by increasing water levels after nesting has been initiated. In addition, as vegetation encroaches on existing sandbars below Gavins Point Dam, operating at a steady release scenario will further reduce habitat available to the plovers. In a worst case scenario, steady flows may create water levels high enough, that, coupled with vegetation encroachment, may preclude the availability of any nesting habitat below Gavins Point Dam.

A flow-to-target scenario results in more habitat being available to piping plovers early in the breeding season because water levels would be low. However, this scenario may require releases from Gavins Point Dam to increase over the summer to provide flows for downstream navigation. These higher flows may result in the loss of already established piping plover nests and eggs as water levels rise.

The river segment downstream of Gavins Point Dam supports, on average, the second largest number of adult birds among segments of the Missouri River and fledges approximately 26 percent of the young on the river (based on the 1993 – 2003 period). Loss of habitat in this area could greatly reduce nesting opportunities for a very productive stretch of river. Because this river reach supports large number of nesting plovers, increases in releases from the Gavins Point Dam after nest initiation results in the loss of nests, eggs, and chicks.

The Corps has committed to the following actions to minimize losses of piping plovers from summer releases downstream from Gavins Point Dam:

Conduct nest and adult census and weekly productivity monitoring of all known and potential piping plover nesting sites beginning the last week of April through the end of the breeding season;

Maintain its piping plover recovery program;

Continue to aggressively coordinate among the Service, the Water Management Division, dam operators, and the Omaha District's Endangered Species Section to evaluate and minimize losses due to water management;

Conduct outreach efforts;

Continue predator management efforts;

Restrict Garrison and Fort Randall Dam releases during piping plover nesting;

Move nests threatened by rising water on river and reservoir reaches to higher habitat, when possible;

Use the TESDMS during the nesting season;

Release water from the Kansas River projects when feasible (during periods when the downstream flow target is at Kansas City) to minimize plover losses;

Evaluate the location of tows before increasing releases from Gavins Point Dam to determine if release increases can be delayed until the end of the nesting season;

Delay increases until the end of the nesting season if the July 1 storage check shows an increase in service level for the remainder of the navigation season; and

Carry out law enforcement activities to reduce human disturbance.

Accelerated Actions to Benefit Species

The 2000 Biological Opinion RPA required the creation of sandbar habitat primarily through flow regulation. However, because the Corps' alternative elements of an RPA do not propose a spring rise or summer low flows at Gavins Point Dam, sandbar habitat will have to be mechanically created. At the present time, the Corps estimates that 6,255 acres of emergent sandbar habitat would be needed by 2005. They further estimate that about half of the 6,225 acres of habitat already exist. Of the remaining 3,127 acres of habitat to be created, half would be "created" by vegetation removal procedures on existing sandbars and islands and the other half would need to be physically/mechanically created.

In the 2000 Biological Opinion RPA, the Service recognized that sandbar habitat may have to be created if habitat goals were not met through flow regulation and if tern and/or plover fledge ratio goals were not met for the three year running average. However, creating habitat through flow regulation (natural means) was preferred.

Sandbar habitat is proposed to be created to ensure 40 acres per mile downstream from Gavins Point Dam, 40 acres per mile in Lewis and Clark Lake, 10 acres per mile downstream from Fort Randall Dam, and 25 acres per mile downstream from Garrison Dam. These reaches are important to piping plovers as about 54 percent of adult birds are found and nest in these reaches and they produce approximately 50 percent of the young in the river (based on the 1993 – 2003 period).

Concerns exist that mechanically-created habitat will not provide the habitat elements and biological components provided by habitat created by flows. Of particular concern, is that created habitat will not provide food resources for young birds. On habitat created on the Missouri River in the early 1990's, one starved fledgling was observed. (C. Kruse pers.comm.)

The Corps proposes to do the following to the habitat they propose to rehabilitate:

Increase the height of existing submerged sandbars;

Mechanically manipulate existing sandbars by pushing submerged sand to exposed elevations'

Contour existing sandbars to either minimize high dunes or to add minor topographical height variations;

Contour existing sandbars to provide depositional areas for organic material, wetted areas, and/or shallow ephemeral pools;

Investigate supplemental nitrification of sites with poor or insufficient forage production;

Set up and remove sand fences on existing habitat areas to add microhabitat features and/or create dunes to add topographical variations;

Armor (on a short term basis) productive nesting areas;

Remove vegetation by spraying with aquatically approved pre- or post-emergent herbicides, scraping, mowing, discing, chipping, or burning;

Create dynamic sandbar complexes by cutting shallow water channels through existing large sandbars;

Reduce localized predator impacts by removal of land bridges and perches;

Enhance terrestrialized linear habitats with livestock enclosures and exclosures and peninsula cutoffs and provide security through slope reductions and/or substrate modifications.

Research, Monitoring, and Evaluation

Gavins Point Reach Fall Test

The Corps proposes to conduct a fall flow test in the river reach downstream from Gavins Point Dam after refill of the system following the current drought, and this would be conducted when evacuation of the system is necessary. The test will consist of a release of approximately 60,000 cubic feet per second 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.

Following releases of 70,000 cubic feet per second for over five months from Gavins Point Dam during flood events of 1997, the Missouri River downstream of Gavins Point realized large increases in sandbar habitat that contributed to increased productivity of piping plovers in that reach. Although total habitat in this reach peaked in 1998 and has decreased in quantity every year since then, total productivity in this reach continued to rise in 2002 when 288 fledglings were produced (271 were produced in 2003). The Corps hypothesizes that a fall release of 60,000 cubic feet per second for 60 days would produce significant amounts of sandbar nesting habitat below Gavins Point.

A flow test of this magnitude could result in moving sediment too far down the system, resulting in a long term loss of sediment to the system for the purposes of creating sandbars. Desired results may be attainable with lower flows for the same or a shorter period of time (R. Jacobson, pers. comm., November 2003). The Service is concerned that these flows may harm pallid sturgeon. Therefore, the flows recommended in the 2003 Amended Biological Opinion are preferred.

However, this test with its concomitant creation of sandbar habitat is likely to be beneficial to piping plovers in the Gavins reach of the Missouri River. This reach is important to piping plovers. If sandbar habitat is successfully created by these flows, nesting habitat will likely be available for the birds for some years to come. The Corps has, however, only committed to a one time test of these flows.

Fort Randall Reach Rise

The Corps proposes to conduct a fall rise flow test out of Fort Randall Dam. A controlled rise in releases from Fort Randall Dam would be preceded by a lowering of the pool in Lewis and Clark Lake after Labor Day. The releases from Fort Randall Dam could be as high as 60,000 cubic feet per second and the pool at Lewis and Clark Lake could be as low as 1180 feet mean sea level. The length of the test would depend on the rate that the Lewis and Clark pool is refilled, which, in turn, is dependent on the release rate from Gavins Point Dam. The test could be conducted concurrently with the Gavins Point reach fall test or it could be done independently. If done with the Gavins Point test, the duration could be up to 60 days; if done independently, the estimated test length is five days. The exact magnitude and duration of the test will be determined through pre-test investigations and public input.

Following releases of 65,000 cubic feet per second for over five months from Fort Randall Dam during flood events of 1997, the Fort Randall Reach realized increases in sandbar habitat that resulted in increased productivity of piping plovers in that reach. Between 1993 and 1997, no fledglings were produced in this reach. From 1998 – 2003, however, an average of 20 fledglings has been produced per year and fledge ratios have averaged 1.06. The Corps hypothesizes that a fall release of 60,000 cubic feet per second for 60 days done in conjunction with the Gavins Point Fall Reach test could have similar results. This test could create additional piping plover nesting habitat in Lewis and Clark Lake by flushing sediment in the upper part of the lake.

This test, with its concomitant creation of sandbar habitat, is likely to be beneficial to piping plovers in the Fort Randall and Lewis and Clark Lake reaches. These reaches are moderately important to piping plovers. If sandbar habitat is successfully created by these flows, nesting habitat will likely be available for the birds for some years to come in these reaches. The Corps has, however, only committed to a one time test of these flows. The Service is concerned that these flows may harm pallid sturgeon. Therefore, the flows recommended in the 2003 Amended Biological Opinion are preferred.

Gavins Point Spring Sandbar Habitat Conditioning

The Corps proposes to condition mechanically-constructed sandbar habitat downstream of Gavins Point Dam. New sandbar habitat would be constructed prior to conducting this test. In the spring, as releases from Gavins Point Dam are increased to meet navigation service requirements, releases in excess of those needed to serve navigation would be released such that new sandbar habitat would be inundated for a day or two.

The purpose of this test is to consolidate the sandbar substrate and potentially mix organic material into the surface layer. It is hypothesized that this consolidation and mixing of the substrate could increase the productivity of the sandbars for the piping plovers that use them. However, conditioning may have no effect on the sandbar habitat and the plovers that use them. Conditioned and unconditioned mechanically-constructed habitat will be compared to determine if there is a difference in piping plover (and least tern) productivity between the two types of sandbar habitat.

Because this is a one year test designed to answer questions about the efficacy of conditioning created sandbars, there are likely to be few or no impacts to piping plovers. However, we may learn from this test if this type of conditioning flows provides conditions sufficient for productivity for piping plover forage.

Fort Peck Tests

The 2000 Biological Opinion RPA required a higher and warmer spring flow from Fort Peck Dam. The higher and warm-water releases are needed, on average, once every three years and were to be incorporated into the unbalancing strategy for the upper three reservoirs. A "mini-test" was to be conducted the first year to gain sufficient data on combinations of spillway and powerhouse discharges and water temperatures to develop a model for relationships. The year following implementation of the "mini-test," the Corps was to implement a "full test" of improved flows and warm-water releases out of Fort Peck Reservoir. Following the "full test," the Corps was to implement full flow enhancement releases out of Fort Peck approximately one year out of three. Now the Corps proposes to implement the "mini test" and the "full test." After assessing the results of these tests and through the adaptive management framework, the Corps may implement a Fort Peck Dam release change as a component of System operations. However, implementation of this release change would require revision of the Water Control Plan.

In the reach of the Missouri River below Fort Peck Dam, higher spring flows and warmer water temperatures will improve environmental conditions for the piping plover. The higher flows will restructure the channel and increase/improve available riverine habitat by redistributing sand, inundating side-channels, and connecting backwater areas to increase primary production which will, in turn, provide additional nutrients and macroinvertebrates used by piping plovers.

The 2000 Biological Opinion RPA required carrying out a Fort Peck "mini test" and "full test" to be followed by a spring rise from Fort Peck approximately one year out of three. In their modified action, the Corps now proposes only to conduct the "mini test" and the "full test." Following these tests and the accompanying evaluations, the Corps will decide whether to pursue regular implementation of the Fort Peck spring rise. Regular implementation will require modification of the Master Manual, compliance with the National Environmental Policy Act, and coordination with the public.

Implementation of the two Fort Peck "tests" will provide benefits to piping plovers. However, these benefits will be limited for two reasons. First, the river downstream from

Fort Peck does not support large numbers of piping plovers under any conditions and, second, there is no plan to incorporate a spring rise at Fort Peck into the operation of the Missouri River system, so long term benefits will not accrue.

Historical Piping Plover Mortality

In RPM 2 of the 2000 Biological Opinion, the Service requested the Corps compile and evaluate all previous information on impacts of plover take from release changes below dams, changes in releases due to maintenance or other isolated causes, and release changes to prevent downstream flood impacts.

The Corps has collected plover nest fate information since 1986. The nesting information was compiled in a database and the Corps evaluated those data to produce a report following the 2003 nesting season. That report included a summary of nest fates from 1988-2003; an analysis of flooded, collected, and destroyed unknown nest fates to determine nests lost from System operations; and a summary of take associated with implementation of the RPAs and RPMs from the 1990 and 2000 Biological Opinions.

According to the Corps' analysis, of 16,121 piping plover egg records contained in the Corps' database, 1,119 or 6.9 percent were lost due to Corps' operational activities on the Missouri River during the period 1988 – 2003 (USACE 2003).

A hatched nest is a nest hatching at least one egg. Hatched nests are identified by chicks in the nest bowl, chicks on site, hatched egg shells, pipping shell fragments, or chick droppings.

A destroyed nest is a nest that is lost before hatching. Causes of nest loss include flooding, weather, predation, sandbar erosion, livestock trampling, human disturbance, or unknown.

Sometimes the fate of a nest cannot be determined; a nest may be abandoned, or it may contain nonviable eggs. Eggs and chicks are sometimes collected and placed in the Corps' captive rearing facility. Eggs and chicks that are collected are usually in danger of flooding.

The Corps identified those nests that were flooded, destroyed for unknown reasons, and collected as they believe these are the fates that could potentially be impacted by operation of the Missouri River System. The nests that were lost due to flooding were further analyzed to determine if the flooding was caused by operational activities (e.g., releases from an upstream project, a rising reservoir pool) or a nonoperational cause (e.g., rain event). If there was no recorded rise in the water level observed during the time period the nest loss was recorded, then the nest loss was attributed to undetermined flooding. Nests assigned to the destroyed-unknown fate were analyzed in the same way. In addition, all eggs that were collected and taken to the captive rearing facility were considered nest failures and assigned to operational causes. Therefore, by the Corps' calculations, of a total loss of 2,653 piping plover eggs between 1988 and 2003, 1,118 eggs lost were attributable to Corps' operations.

Effects of mortality caused by Corps' Operations

The Corps analyzed the destruction of all nests monitored on the Missouri River system in the period 1988-2003 and found that its operations destroyed approximately 7.8 percent of all piping plover nests. (Note that as previously discussed, Kreil (in litt. 2003) analyzed the Corps' mortality data assuming that all disturbance and predation mortality was attributable to the Corps' operations but we have not agreed with that assumption.) The Corps also provided the Service with data regarding egg loss specifically for the period 1993-2003, but not for nest loss for this period. Although this figure is based on the period 1988-2003, we assume that the Corps' operations resulted in a similar percentage of nests destroyed in the period 1993-2003. (Based on the Corps' analysis, egg destruction due to its operations was 6.9 percent and 8.4 percent during the periods 1988-2003 and 1993-2003, respectively.) We assume that each destroyed nest would have fledged 1.3 chicks. We determined this by dividing the total number of fledglings in the years 1993-2003 by the total number of nests, minus the number of destroyed nests that the Corps' attributed to their operations.

If the Corps' operations resulted in the destruction of 7.8 percent of nests in the period 1993-2003 and each destroyed nest would have fledged 1.3 chicks, then the Corps' operations would have caused a loss of 388 fledglings during this period. The actual fledge ratio for the period 1993-2003 was 1.36. An additional 388 fledglings during this period would have increased the fledge ratio for the Missouri River to 1.47 during this period, based on this analysis. Based on the three years of the International Census, the Missouri River represented 19.7 percent of the entire Northern Great Plains population. Therefore, a 7.8 percent reduction in fledge ratios on the Missouri River might translate into a 1.5 percent reduction in production of fledglings during the period 1993-2003.

As explained in the Environmental Baseline (Nesting and Fledging Success in the Action Area), the Corps' analysis likely did not account for all nest destruction that is attributable to their operations. For example, the effects of the Corps' flow regulation on the Missouri River leads to an increase in the number of nests that are predated (see above). Because data are not available to quantify the total proportion of nest destruction that is attributable to the Corps, we can only say that it is greater than 7.8 percent, their conservative estimate. In addition, the Corps' operations likely results in the take of chicks and adults (e.g., by predation) that is not accounted for in their analysis of nest mortality.

Take of chicks that is due to the Corps' operations and that cannot be readily quantified is, however, reflected in observed fledge ratios. Data are available to calculate the fledge ratio for the period 1986-2003, but these data were not collected for the entire river until 1993. In addition, the Corps' standardized plover monitoring techniques in 1993. There are costs and benefits of using data for the entire period of record to evaluate the fledge ratio of piping plovers on the Missouri River. This period is longer and encompassed a greater amount of the highly variable environmental conditions that affect piping plovers on the Northern Great Plains. Data were not collected in a standardized manner before 1993, however, and not all reaches in which piping plover nest were monitored. To use

the larger data set without qualifications, we would have had to to assume that the differences in methodology were not significant and that the reaches that were monitored were representative of the unmonitored areas. Conversely, not using the 1986 through 1992 data results in a less comprehensive assessment of effects through time. This is a shorter period that encompassed a smaller subset of the environmental conditions on the Missouri River -- e.g., it missed the effects of the drought in the late 1980s and may overemphasize the effects of the extraordinary 1996-1997 floods that greatly affected plover abundance and fledge ratios.

Fledge ratio for the periods 1986-2003 and 1993-2003 were 1.18 and 1.36, respectively. These two fledge ratios cannot be compared without questions about the validity of the comparison due to the reasons summarized above. It may be reasonable to assume, however, that they bracket the fledge ratios that are likely to occur as a result of the proposed action.

Summary of Literature Discussing Fledge Ratios for Piping Plovers

Ryan, et al. (1993) whose fledge ratio was used in the 2000 Biological Opinion, determined that a 1.13 fledge ratio was needed to maintain a stable population size for the Great Plains Piping Plover Population. Melvin and Gibbs (1994) determined a fledge ratio of 1.245 was necessary to maintain Atlantic Plovers. Following those publications, Plissner and Haig 2000(a) determined that a mean fecundity (fledge ratio) of 1.25 was necessary for the Atlantic Coast Plover population to persist. They noted that numbers of individuals would ultimately decrease substantially without higher fecundity.

Plissner and Haig 2000(b)determined 1.25 was needed to stabilize Atlantic Coast Plovers. Based on their analysis, for the Missouri River/Coteau, a fledge ratio of 2.0 is necessary for a 99.8 percent probability for survival for 100 years. A fledge ratio of 1.7 is necessary for 90 percent probability for survival for 100 years. Plissner and Haig (2000(a)) noted that using their model and population estimates, they were unable to replicate Ryan et al.(1993) results, and noted a substantial decline in population size, following both panmictic and metapopulation model structures under such conditions.

Larson, et al. (2002) found that 1.44 fledglings per pair for plovers on alkaline wetlands, and 1.25 fledglings per pair for the entire great plains piping plover population would be required to stabilize the median population size.

Fledge ratios alone are an indicator of reproductive success, but do not set parameters for the recovery of populations. Plissner and Haig (2000(a) conclude that reproductive rates are apparently the most directly-manageable of factors influencing extinction risk. They suggest that other alternatives need to be explored. The authors state that mortality patterns are generally lacking and if survivorship rates are actually higher than the estimates currently used in the models, lower fecundity will be sufficient to meet viability goals.

PALLID STURGEON

The only effects that will be evaluated are those that result from the elements discussed in the 2003 proposed action section as implemented in the context of the CWCP and the 2000 Biological Opinion. For a full discussion of the effects of the CWCP on pallid sturgeon see the 2000 Biological Opinion, pages 162 - 196 and 210 - 214.

The Corps has proposed several actions as part of this consultation. The actions that the Corps are proposing that have effects to the pallid sturgeon include; Fort Peck flow tests (mini and full), pallid sturgeon propagation support improvements, drought conservation measures with unbalancing, the Fort Randall fall flow test, Gavins Point spring sandbar habitat conditioning flows, Gavins Point fall flow test, shallow water habitat improvement downstream of Gavin's Point Dam. Activities that the Corps has proposed that the Service has determined do not have any effects are: comprehensive pallid sturgeon research project to determine critical ecological factors for pallid sturgeon, pallid sturgeon population assessment, and the 3-Year Re-evaluation. Effects to the species only result if there will be active and aggressive pursuit of management actions, including operations, that benefit the species based on the results obtained from these programs.

The Service has evaluated the effects of the proposed action on the pallid sturgeon by river reach within the action area. Each reach has unique biological, physical, or hydrologic influences that may be particularly affected by elements of the proposed action. The reach above Fort Peck Lake of the Missouri River to the mouth of the Marias River was not evaluated for the purposes of this opinion. The reach below Fort Peck Lake to the headwaters of Lake Sakakawea is characterized as having good physical habitat elements but has an altered hydrograph and temperature regime. The reaches of the river between Garrison Dam and the headwaters of Lewis and Clark Lake were combined for the purposes of this analysis. These inter-reservoir reaches are characterized by short stretches of river between reservoirs with suitable habitat for the pallid sturgeon. The hydrograph in these reaches is highly altered but there are currently very few if any wild pallid sturgeon in the inter-reservoir reaches. The Lower Missouri River was divided into three reaches; Gavins Point Dam to Sioux City, Sioux City to the mouth of the Platte River, and the mouth of the Platte River to the confluence of the Missouri River with the Mississippi River. The Gavins to Sioux City reach is characterized by a highly altered hydrograph and sediment regime but currently retains a lot of suitable physical habitat for the pallid sturgeon. The reach from Sioux City to the mouth of the Platte River is characterized by a highly altered channel with little physical habitat. The hydrology and sediment regime in the Sioux City to the Platte River reach is influenced by project operations, however, these effects lessen downstream from Gavins Point Dam because of the addition of tributary inflows. The reach from the mouth of the Platte River to the Mississippi has a moderate amount of suitable physical habitat features and the high flow effects of project operation are substantially moderated by the tributary inflows from the Platte River, Kansas River, Grand River, Osage River and other tributaries. High flows through the summer as a result of project operations are not

moderated in the Missouri River below Gavins Point Dam. The last reach evaluated is the Middle Mississippi River from the mouth of the Missouri River down to Cairo, Illinois**.** The reach in the Middle Mississippi River is characterized as having a more normalized hydrograph and has a substantial amount of physical habitat available.

Upper Missouri River

The sub-population of pallid sturgeon in this reach including those in the Yellowstone River represents a significant and essential portion of the population as a whole. The Pallid Sturgeon Recovery Plan (USFWS, 1993) identifies this reach along with the Yellowstone River as RPMA#2. Several studies, including Tranah et. al. (2001) have identified genetic distinctions associated with this upstream sub-population indicating that there may have been some level of reproductive isolation of Upper Missouri River pallid sturgeon from the rest of the pallid sturgeon population. Additionally, Kapacinski (2003) has projected that the wild heritage population above Lake Sakakawea will likely be extirpated by 2018.

The habitat characteristics in this reach have been described as suitable, with physical habitat diversity present and adequate complexity of shallow water habitat and spawning substrate. This reach has a highly altered hydrograph which affects temperature, timing of flows, and the chemical constituents of the water. The timing and magnitude of affects associated with the operation of Fort Peck Dam are somewhat moderated downstream at the confluence of the Yellowstone River.

The Service has determined that the following elements of the Corps' proposed action will affect pallid sturgeon in this reach: drought conservation measures with unbalancing, the Fort Peck flow tests (mini and full), and pallid sturgeon propagation support improvements. It is the Service's opinion that the effects described in the 2000 Biological Opinion will continue to occur. In addition, the Service anticipates additional adverse impacts from the Corps' proposed action in this reach. The comprehensive pallid sturgeon research project to determine critical ecological factors for pallid sturgeon, pallid sturgeon population assessment, and the 3-Year Re-evaluation will generate information that may lead to subsequent actions.

The Service anticipates that the substantial delay in implementing the Fort Peck tests will have adverse effects on pallid sturgeon in this reach. As described in the Corps' November 2003 Biological Assessment, they accepted almost all of the 2000 Biological Opinion including the RPA's (except for RPA element II). RPA II.B.3 determined the Corps needed to implement full flow enhancements from Fort Peck, based on the criteria developed from the tests, in 2003 or the first year that criteria indicate it can be conducted, as one element to avoid the likelihood of jeopardy to the pallid sturgeon. The November 2003 Biological Assessment states that the CWCP would need to be revised to accommodate full implementation. This lack of action to date provides no assurance that the life history needs of the pallid sturgeon will be addressed in the near future (three to five years). The lack of a spawning cue, which includes suitable temperature, a rate of change in the flow, and a sufficient duration of flow will continue to adversely affect the ability of the species to spawn in this reach. Additionally, the pallid sturgeon not only

need flows of suitable temperature to spawn but warm water throughout the spawning and rearing period to provide for the production of food and to sustain the growth of the larval and juvenile fish throughout the summer. If warm water is only released from Fort Peck for spawning and then followed by releases at a much lower temperature this will likely suppress the growth of juvenile pallid sturgeon and likely adversely affect the production of prey items necessary to sustain post-yolk sac young fish. Along with prey production, lower temperature releases could result in mortality of larval sturgeon

Larval transport may be positively, negatively, or neutrally affected depending on the elevation of Lake Sakakawea under the drought conservation and unbalancing aspects of operations. When Lake Sakakawea is high, and flows from Fort Peck are high, the reach of river available to larval pallid sturgeon is reduced. This has the likely effect of transporting some portion of the juvenile pallid sturgeon into the lake where they would be lost to the population due to increased predation, access to prey, and lack of migratory cues due to lack of flows or velocities in lake environments. However, when Lake Sakakawea is low during drought, and flows from Fort Peck are low, production of prey may be enhanced due to increased shallow water habitat and longer river reaches which will be available for rearing fish during the summer. It is not anticipated that floodplain connectivity will be affected in this reach. There is a slight negative effect on the overall available habitat above Lake Sakakawea due to the long-term average increase in reservoir elevations resulting from implementation of the modified drought conservation measures.

Lack of sediment transport and availability is an ongoing negative effect of project operations and the lack of flow modifications from Fort Peck may exacerbate the sediment transport and availability problem. More importantly, the colder waters released from Fort Peck would likely suppress production of plankton and other invertebrate species in the river reach that contribute to the turbidity of the water. Clearer water adversely effects young pallid sturgeon by making them more vulnerable to sight-feeding predators and increasing competition for food by sight-adapted predators. In addition, adult fish may be adversely affected by the increased ability of prey to avoid capture in clearer water.

The Corps' proposal for population augmentation has positive effects in the near term. Stocking can also provide for an opportunity for monitoring and assessment of the life history and the habitat needs of the pallid sturgeon. Long-term reliance on artificial population augmentation may likely have substantial negative effects. The Service believes population augmentation in this reach is extraordinarily important as a stop gap measure. However, until adequate environmental conditions exist to accommodate the life history needs of the species for spawning and recruitment, the Service cannot rely on the stocking program as a means of sustaining the population. Because of the relative low rate of hybridization in this reach and the relative diversity of habitat compared to other reaches it is not anticipated that the Corps' proposal will affect hybridization.

In summary, there is reduced certainty associated with any modifications of flows from Fort Peck based on results from the Fort Peck test. This is because the 2000 Biological

Opinion RPA II.B determined that commitment to implement action based on the results of the test was necessary to avoid jeopardy, but the Corps' 2003 proposal provides only for conditional and partial implementation. There also remains a high degree of uncertainty as to when the test will be started based on the current drought conditions in the basin. These actions may increase the probability that the wild heritage sturgeon above Lake Sakakawea will be extirpated by or before 2018 in accordance with predictive models. There could be substantial new information from implementing the pallid sturgeon population assessment, augmentation program, as well as the research and monitoring elements proposed, but information must be coupled with changes to operations or the environment if species are to benefit. There is an expectation that there will be harm and harassment in this reach from ongoing operations of the project. This take results from temperature impacts, reduced larval drift through reservoir operations, reduced sediment for habitat development and maintenance and reduced turbidity that may indirectly lead to increased predation and reduced fitness leading to mortality.

Middle Missouri River

With the exception of the reach between Fort Randall and the headwaters of Lewis and Clark Lake, the sturgeon populations are extremely low. The number of heritage pallid sturgeon in this reach is presumed to be very low if not extirpated from some portions. The Pallid Sturgeon Recovery Plan (USFWS 1993) identifies some portions of this reach as RPMA #3. The pallid sturgeon in this reach is largely a reflection of stocking and they are isolated from the subpopulation in the Fort Peck reach and from reaches below Gavins Point Dam.

The physical habitat characteristics in this reach have been described as suitable, with diverse and complex shallow water habitat and areas with spawning substrate. There is a substantially altered hydrograph in this reach. The riverine reaches are too short for a river-run adapted fish. The stretch below Garrison Dam is approximately 86 miles long and the reach below Fort Randall Dam is approximately 35 miles long. The lengths of the stretches in this reach are affected by lake levels, and truncated due to intervening reservoirs and structures. This interruption in habitat continuity prevents upstream and downstream migration for any individuals that may reside in this reach.

The Service has determined that the following elements of the Corps' proposed action will affect pallid sturgeon in this reach; drought conservation measures with unbalancing, the Fort Randall fall flow test, and pallid sturgeon propagation support improvements. It is the Service's opinion that the effects described in the 2000 Biological Opinion continue to occur. In addition, the Service anticipates additional adverse impacts from the Corps' proposed action in this reach. As with the previous reach, there could be substantial new information from implementing the pallid sturgeon population assessment as well as the research and monitoring elements proposed. However, information must be coupled with changes to operations or the environment if species are to benefit.

It is expected that effects in sections above the Fort Randall reach (i.e. Garrison Dam to the headwaters of Lake Oahe) will be minimal and difficult to detect. Due to the length

of the reaches of the river below Garrison and Fort Randall it is the Service's opinion that the length of river reaches is a greater limiting factor than the lack of hydrologic cue for spawning. As with spawning cue, natural life history needs such as larval transport and sufficient development time have been affected by the length of available river reach through construction of the dams. Prey availability does not appear to be affected in these reaches by the proposed project. It is not anticipated that floodplain connectivity will be affected in these reaches. Due to the limited amount of riverine habitat available in these reach, there will probably not be significant effects of the proposed action. The proposed action will have limited or no effect on shallow water habitat in this sub-reach. There will be no effect due to habitat construction since none is proposed for this reach. Lack of sediment transport and availability as well as reduction in turbidity are ongoing negative effects of project operations. To the extent that there are pallid sturgeon in this reach, the effects from sediment are similar to those described above for the Fort Peck reach. There is potential concern for the transport of stocked juvenile pallid sturgeon from the riverine reach into the reservoir reach where they may be lost due to the Fort Randall fall flow test. This potential effect is dependant on the magnitude, duration, and timing of the test.

The Corps' proposal for support population augmentation has positive effects in the near term. Stocking can provide for an opportunity to monitor and assess the life history and habitat needs of the pallid sturgeon. Limited stocking for the purposes of assessing the life history needs of pallid sturgeon can be important in this reach because the riverine sections are short and can enhance the probability of detecting fish. However, long-term reliance on artificial population augmentation may likely have substantial negative effects. The Service cannot rely on the stocking program as a means of sustaining the population in this reach. Because of the relative low rate of hybridization in this reach, the low number of pallid sturgeon in the reach, and the relative diversity of habitat relative to other reaches, it is not anticipated that the Corps' proposal will affect hybridization.

In summary, it appears there is little difference between the proposed action and the 2000 Biological Opinion relative to this reach. There could be substantial new information from implementing the pallid sturgeon population assessment as well as the research and monitoring elements proposed if information is coupled with changes to operations or the environment to benefit the species based on the results obtained from these programs. There is an expectation that there will be harm and harassment in the Fort Randall reach from ongoing operations of the project from temperature impacts, reduced sediment for habitat development and maintenance and potential loss of individuals to Lewis and Clark Lake from the fall flow test.

Lower Missouri River from Gavins Point Dam to Sioux City

Pallid sturgeon adults have not been detected as in this sub-reach since the 2000 Biological Opinion was issued. There have been no detections of larval or juvenile pallid sturgeon in this reach despite the fact that there have been detections of larval and juvenile shovelnose sturgeon. The Pallid Sturgeon Recovery Plan (USFWS 1993)

identifies the entire Lower Missouri River reach, of which this sub-reach and the following two sub-reaches are a part, as RPMA#4.

The habitat characteristics in this reach have been described as suitable, with habitat diversity and complexity of shallow water habitat and spawning substrate. This sub-reach has a highly altered hydrograph which affects timing, magnitude and duration of flows, as well as the chemical constituents. Of the three sub-reaches in the Lower Missouri River this sub-reach has the best physical habitat but the most altered hydrograph.

The Service has determined that the following elements of the Corps' proposed action will affect pallid sturgeon in this reach; drought conservation measures with unbalancing, Gavins Point spring sandbar habitat conditioning flows, Gavins Point fall flow test, shallow water habitat improvement downstream of Gavin's Point Dam, and pallid sturgeon propagation support improvements. As with the previous reach, there could be substantial new information from implementing the pallid sturgeon population assessment, augmentation program, as well as the research and monitoring elements proposed. However, information must be coupled with changes to operations or the environment if species are to benefit.

There are numerous effects of the proposed action related to the hydrology of this reach. The CWCP and Master Manual do not currently allow for the restoration of a semblance of the normalized hydrograph or sediment influx through releases from Gavins Point Dam. The 2000 Biological Opinion RPA II.A determined that restoration of the hydrograph with pulses in the spring and summer habitat flows were necessary to avoid jeopardy of the pallid sturgeon. The Corps' November 2003 Biological Assessment Appendix B, page 6 specifically states that the environmental flow releases from Gavins Point Dam are not part of the proposed action. In lieu of the flow releases, the Corps is proposing, along with other elements, to accelerate shallow water habitat development. There are adverse effects associated with the lack of spring and summer flows. The Corps' proposed action does not provide for a sufficient change in the hydrograph.

The best available commercial and scientific information available when the 2000 Biological Opinion was prepared indicated that modification of the hydrograph in the Lower Missouri River was essential to stem the decline of species in the river. Homogeneity of flows as well as the reduced early flow peaks would interfere with the normal behavior/movement of the sturgeon to migrate upstream to utilize the habitat that is available in this reach. Operations of Gavins Point Dam result in a lack of cues to support spawning (timing, magnitude, and rate of change) and lack of low flows for rearing of young pallid sturgeon. The Corps stated that there is insufficient data to determine the timing, magnitude, or rate of change "essential" for pallid sturgeon survival. The Service agrees with the Corps that there is not a sufficient amount of information to precisely set a flow regime or to identify which element (temperature, turbidity, rate of change, magnitude of change, etc.) of the hydrograph is the most important factor (if there is only one). The concept of Adaptive Management is intended to address this kind of scientific uncertainty.

The altered hydrograph from Gavins Point Dam may not provide for scouring flows to keep spawning substrate suitable for spawning pallid sturgeon. The proposed fall flow test may identify the amount or extent of releases necessary to provide scouring flows for spawning substrate maintenance and shallow water habitat development. Should the Corps modify the proposed operation based on the data obtained from the test, the physical characteristics could be restored in this reach. However, the fall flow test is not provided at a time that is ecologically relevant to spawning pallid sturgeon. Additionally, because the Corps has characterized their ability to act subsequent to the test as conditional the Service has no certainty that subsequent actions will derive from the tests. As a result, the Service is not confident that any benefit to the pallid sturgeon will result from the test. It could be potentially detrimental due to biologically inappropriate timing. The altered hydrograph is likely precluding spawning and the subsequent production of larvae in this reach. Because of the operational influences in this sub-reach there is a lack of larval production so there are no effects related to larval drift or transport. Should young of the year (YOY) fish reside in this reach, the proposed increased fall flows combined with seasonally decreasing temperatures in the river makes YOY fish susceptible to increasing velocities and transport out of the reach to less suitable habitat conditions and may also impact feeding ability. This likely increases the probability of mortality for these YOY fish.

Prey availability is affected in a number of ways. The altered spring hydrograph is likely decreasing the production of juvenile fish and invertebrate prey at a time when YOY pallids require elevated prey production. Higher spring and summer flows do not provide the shallow water habitat to sufficiently provide for pallid sturgeon development. Additionally, the lack of a spring pulse and the absence of floodplain connectivity preclude the rich production of prey items that would normally occur on the floodplains and be available when larval and juvenile pallid sturgeon are present. System functioning and synchronized timing of prey production with pallid sturgeon needs are both disrupted. Fall flow releases may flush prey items out of this reach to areas where pallids may not be able to exploit them as food. The lack of summer habitat flows is diminishing the availability of shallow water habitat in this sub-reach. This will adversely affect fish development to the extent that fish are present in this sub-reach.

The Corps is proposing, in accordance with the 2000 Biological Opinion, to construct sandbar habitat in this reach. To the extent that there is ancillary shallow water habitat developed with sand bars, this will provide beneficial effects for any pallid sturgeon that may be present. The level of benefit will largely be determined by the design, location, and diversity of the habitat developed along with the overlying hydrograph. Timing, location, and the methods used for construction need to be carefully planned in order to avoid adverse effects from the mechanical activity.

Lack of sediment transport and availability is an ongoing negative effect of project operations. RPMA II.A was intended to, in part, provide for some sediment transport and redistribution. The Corps has presented data in the November 2003 Biological Assessment that the spring pulse will not construct all the shallow water habitat identified

in the 2000 Biological Opinion. The Corps has used this information as partial justification for not providing an immediate change in the flow releases from Gavins Point Dam. The Service agrees that the flows identified in RPA II.A will not create the entire habitat identified in the 2000 Biological Opinion. However, the Service believes that flows would be used in conjunction with physical habitat development to improve conditions to the point they would be suitable for pallid sturgeon. Lack of sediment availability and subsequent transport throughout this sub-reach adversely affects habitat development and maintenance. Lack of turbidly from the decrease of suspended sediments adversely affects pallids by increasing the potential for predation, increased competition from other fish species and increased ability of prey to avoid capture.

The Corps' proposal for population augmentation is a positive effect in the near term in this sub-reach. As habitat becomes more suitable (physical, hydrological, biological, and chemical features) in the sub-reach, there should be less need for stocking. Stocking allows for monitoring and assessment of the life history and the habitat needs of the pallid sturgeon in the near-term. However, stocking is not a substitute for ecological insights into wild populations. As with other reaches, long-term reliance on artificial population augmentation should not be relied on indefinitely. It is the Services position that long-term reliance on a stocking program to sustain a population in the wild is counter to the intent of the ESA. It is not known if the Corps' proposal will affect hybridization in this reach. There are hypotheses that habitat degradation in areas where pallid and shovelnose sturgeons are sympatric may contribute to hybridization.

As in other reaches, there could be substantial information generated from implementing the pallid sturgeon population assessment as well as conducting the research and monitoring elements if there are management actions, including changing operations, to benefit the species based on the results obtained from these programs. Additionally, the Corps is proposing to evaluate existing flow regimes to determine limitations to pallid sturgeon spawning and recruitment. It is the Service's position that it is unlikely that a sufficient monitoring program can be developed and implemented that yields results to a degree that will inform decision-making in three years. There is an expectation that there will continue to be harm and harassment in this reach from ongoing operations of the project. This results from reduced sediment for habitat development and maintenance and disruption from sandbar habitat construction activity and the altered hydrology.

In summary, there are several differences between the Corps' proposed action and the 2000 Biological Opinion. The Corps is not proposing to provide for the spring pulse or summer habitat flow from Gavins Point Dam as described in RPA II. As an alternative, the Corps is proposing to evaluate the release of water in the fall for the purposes of assessing the potential for habitat development and maintenance of existing and future habitat. The Corps is proposing to evaluate existing flow regimes to determine limitations to pallid sturgeon spawning and recruitment. Our evaluation of this change has determined that there will be adverse effects on pallid sturgeon similar to those identified for the proposed action in the 2000 Biological Opinion.

Sioux City to the Mouth of the Platte River

Very few pallid sturgeon have been collected in this sub-reach of the Lower Missouri River. Studies have not found larval or juvenile pallid sturgeon in this reach despite the increased effort and detections of shovelnose sturgeon. The Pallid Sturgeon Recovery Plan (USFWS, 1993) identifies the entire Lower Missouri River reach (of which this sub-reach is a part) as RPMA#4.

Sturgeon habitat characteristics in this reach are severely limited or non-existent. This reach has a highly altered hydrograph which affects timing, magnitude and duration of flows, as well as the water's chemical constituents. The effects of operations from Gavins Point Dam are somewhat ameliorated as distance from Gavins Point Dam increases through contributions of unregulated tributary inflows. The hydrology of this sub-reach is further modified by the physical structures in place that sustain high velocity water within a relatively narrow channel. This allows for the channel to maintain itself through a high degree of scour. The channel is incised and down cut due to these effects.

The Service has determined that the following elements of the Corps' proposed action will affect pallid sturgeon in this reach; drought conservation measures with unbalancing, Gavins Point spring sandbar habitat conditioning flows, Gavins Point fall flow test, shallow water habitat improvement downstream of Gavin's Point Dam, and pallid sturgeon propagation support improvements. It is the Service's opinion that the effects described in the 2000 Biological Opinion continue to occur. In addition, the Service anticipates additional adverse impacts from the Corps' proposed action in this reach.

The homogeneity of flows as well as the reduced early flow peaks affect the behavior/movement of the sturgeon. However, the increased inflows from the tributaries in this sub-reach begin to attenuate the altered hydrology resulting from Corps operations. Lack of cues for spawning, lower flows for rearing of pallids, and the scarcity of habitat available in this reach all substantially reduce the fish community as a whole. The lack of spawning cues throughout this reach may be inhibiting adult fish from migrating past the confluence of the Platte River through this sub-reach to the sub-reach above Sioux City.

There is insufficient data to know the amount or location of spawning substrate in this reach. High velocities that result from Gavins Point Dam releases and the extensive structures of the BSNP constructed in the river are present, and necessary to support a self-scouring navigation channel. This self-scouring design likely precludes the ability of pallid sturgeon to spawn in this sub-reach. Prey production and availability is limited throughout this sub-reach by a number of factors. These include: the lack of habitat diversity through either lack of floodplain habitat generally; floodplain connectivity to any floodplain habitat that is present; lack of shallow water habitat; lack of structure, diversity, and complexity of habitat coupled with the high velocities associated with this reach. The altered peak hydrograph and lack of habitat diversity is likely effecting the production of juvenile fish and invertebrate prey items at a time when YOY pallids require elevated prey production.

The Corps is not proposing to construct sandbar habitat in this sub-reach in the near term. However, this sub-reach has been identified as a high priority for shallow water habitat. There is very little data that the Service was able to obtain regarding habitat restoration and the efficacy of restored habitat for fish. Of the thousands of restoration projects across the United States less than 1 percent of those are evaluated for their intended benefits (Galat pers comm. 2003). The little evidence that was made available to us indicated that some restoration projects have resulted in a higher diversity and abundance of fish after the project was completed. It is the Service's opinion that, to the extent that habitat is developed in this reach or other reaches, the level of benefit will largely be determined based on the design location and diversity of the habitat developed coupled with a change in the hydrograph. It is not anticipated that effects will result from constructing habitat in the near term in this reach. The Corps is proposing to modify areas of this sub-reach to expand the top width of the channel (notching dikes and modifying navigation structures, restoring side channels and setting back levees). The Service anticipates, over the long-term, these activities will have a positive benefit to the species. The degree of benefit will be determined by the time required to develop the habitat, the design, location, and the overlying hydrograph and sediment regime needed to support the ecological processes necessary to sustain the habitat.

Lack of sediment transport and availability is an ongoing negative effect of project operations because they preclude habitat development and maintenance. Lack of turbidity from the reduction of suspended sediments adversely affects pallids by increasing the potential for predation, increasing competition from other fish species and increasing ability of prey to avoid capture. Lack of sediment in this reach is not only a result of ongoing operations of the dam but the continuous and ongoing maintenance of the banks through the BSNP which, by design, prevent bank erosion and channel migration.

The Corps' proposal for population augmentation is a positive effect in the near-term in this reach. As habitat becomes more suitable (physical, hydrological, biological, and chemical features) in the sub-reach, stocked fish may be able to utilize the habitat provided the assumptions concerning design identified earlier are accommodated. As this habitat becomes more suitable, stocking may become more appropriate to establish pallid stocks in this reach. Strategic planning on stocking this sub-reach in terms of time of year, the life stage stocked, location, and hydrology could yield an advantage to young larval fish to be transported downstream out of this reach to more suitable habitat in the next sub-reach down stream. As with other reaches, long-term reliance on artificial population augmentation fails to meet the objectives of the ESA. Due to lack of spawning, there is insufficient data to indicate hybridization is occurring in this reach in the near-term. As habitat and hydrology become more suitable, hybridization may become more prevalent in this reach.

Again, as in other reaches, there could be substantial positive information generated by implementing the pallid sturgeon population assessment, augmentation program, as well as the research and monitoring elements. This assumes that there will be active and

aggressive pursuit of management actions, including changing operations, that benefit the species based on the results obtained from these programs. Additionally, the Corps is proposing to evaluate existing flows regimes to determine limitations to pallid sturgeon spawning and recruitment. It is the Service's opinion that it will be difficult to implement a monitoring program that would yield results to a degree necessary to inform decision-making in three years. There will likely be harm and harassment in this reach from ongoing operations of the project. This take results from reduced sediment for habitat development and maintenance, and disruption from mechanically creating shallow water habitat.

In summary, there are several differences between the Corps' proposed action and the 2000 Biological Opinion. The Corps is not proposing to provide for the spring pulse or summer habitat flow from Gavins Point Dam as described in RPA II.A. As an alternative the Corps is proposing to evaluate the release of water in the fall for the purposes of assessing the potential for habitat development and maintenance of existing and future habitat. Such a fall pulse, as with a spring pulse, will not likely develop habitat in this reach in the near-term but providing the flow in the spring could form the basis of an experiment to identify pallid sturgeon life history needs in this sub-reach. In lieu of providing a specific spring pulse, the Corps is proposing to evaluate existing flows regimes to determine limitations to pallid sturgeon spawning and recruitment. Our evaluation of this change has determined that there will be adverse effects on pallid sturgeon similar to those identified for the proposed action evaluated in the 2000 Biological Opinion. The Service does not believe that the Corps has sufficiently addressed restoration of a normalized hydrograph essential to the survival of the pallid sturgeon.

Mouth of the Platte River to the Confluence with the Mississippi River
More pallid sturgeon have been collected in this sub-reach of the Lower Missouri River than anywhere else except the Middle Mississippi River. Larval, some YOY, and adults have been collected in this sub-reach (Nebraska Game and Parks Commission, 2001; Grady, 2001). There is, however, a gap in collections of what would be described as sub-adults in the intermediate size classes of pallid sturgeon, even though similar sized shovelnose sturgeon have been collected. Gear efficiency, the capability to collect fish in certain areas or types of habitat, reduced number of fish or other factors could be contributing to this lack of detection. The Pallid Sturgeon Recovery Plan (USFWS 1993) identifies the entire Lower Missouri River reach, of which this sub-reach and the preceding two sub-reaches are a part, as RPMA#4.

The habitat characteristics in this reach are better than the sub-reach above. There is a substantial amount of physical habitat present in this sub-reach, although it is not as substantial as the Gavins Point Dam to Sioux City sub-reach. Physical habitat is vastly improved over the sub-reach immediately above the Platte River. While the hydrograph in this sub-reach is altered by project operations in terms of the magnitude and frequency of peak flows, the distribution and relative rate of change of peak flows is reflective of a more normalized hydrograph. This attenuation of the effects of project operations through contributions of unregulated tributary inflow is largely caused by contributions from the

Platte, Kansas, Grand, and Osage rivers as well as other smaller tributaries. The semblance of the normalized hydrograph breaks down in the lower flow period (mid to late summer). Specifically, the late summer drought period flows are held artificially high to support other project purposes.

The Service has determined that the following elements of the Corps' proposed action will affect pallid sturgeon in this reach; drought conservation measures with unbalancing, Gavins Point spring sandbar habitat conditioning flows, Gavins Point fall flow test, shallow water habitat improvement downstream of Gavin's Point Dam, and pallid sturgeon propagation support improvements.

The Corps is proposing to accelerate development of shallow water habitat creation in this reach to offset the loss of the summer habitat flow regime and the habitat/ecological benefits that are derived from such a regime. Accelerated habitat development would likely have beneficial effects in this reach and those effects would be obtained sooner if implemented earlier. The degree of benefit will depend on the amount, location both within the sub-reach and elevation within the river, and the diversity and complexity of the habitat. Additionally, the timing, magnitude, and quality in these projects will vary with hydrograph alterations. There may be short-term, temporary adverse effects from the physical activity of constructing habitat features.

The Service is concerned whether shallow water habitat construction is actually being accelerated under the Corps' proposed action. The Corps' analysis indicates that there may be more shallow water habitat in this reach than was assumed in 2000. The extent to which habitat development will be accelerated is unclear. The RPA in the 2000 Biological Opinion identifies restoration of 20-30 acres per mile of shallow water habitat (USFWS 2000, at pages 243 - 244) and the implementation schedule of the RPA outlined restoration of 19,565 acres of shallow water habitat by 2020 and assumes an intermediate milestone of 5,870 acres by 2010. The Corps' November 2003 Biological Assessment is proposing to establish 5,870 acres by the year 2010 assuming that this is an acceleration over the lower target of 20 acres per mile. Targeting the upper end of the habitat range identified for creation of shallow water habitat by 2010 is questionable as a true acceleration of the habitat schedule. The Service believes that the habitat established will prove to be beneficial to the pallid sturgeon.

Lack of sediment transport and availability is an ongoing negative effect of project operations that adversely affects habitat development and maintenance. Lack of turbidly from the reduction of suspended sediments adversely increases the potential for predation, increased competition from other fish species and increased ability of prey to avoid capture. The Corps' proposal for population augmentation is a positive effect in the near term in this reach. As habitat becomes more suitable (physical, hydrological, biological, and chemical features) in the reach, the need for stocking may become reduced. Stocking provides an opportunity to monitor and assess the life history and the habitat needs of the pallids in the near-term. Long-term reliance on artificial population augmentation may likely have substantial negative effects.

It is not known if the Corps' proposal will affect hybridization in this reach. Hybridization is an ongoing concern in this reach. There are multiple factors that could be contributing to this increasing rate of hybridization. These factors include: higher numbers of shovelnose sturgeon, habitat degradation, loss of spawning niches for pallid sturgeon compared to shovelnose, and a modified hydrograph upstream affecting the migration of sturgeon past the Platte River artificially concentrating species in this reach with shovelnose sturgeon. The association between organochlorines impacts and pallid sturgeon reproduction is in the early stages of investigation. Additionally, harvest of female pallids from the population through commercial fishing (Williamson, 2003) may also be a factor.

In summary, the hydrologic effects of the Corps' proposed action relative to spring pulses is attenuated in this sub-reach due to tributary inflows. However, the summer flow regime is artificially high is this sub-reach and there will be benefits from the development of shallow water habitat. The Service cannot quantify further benefits of the proposed action through the acceleration of habitat development over that which was identified through the development of RPA IV.A in the 2000 Biological Opinion. There could be substantial information generated from implementing the pallid sturgeon population assessment, augmentation program, as well as the research and monitoring elements, assuming active and aggressive pursuit of management actions that benefit the species based on the results obtained from these programs. There is an expectation that there will continue to be harm and harassment in this reach from ongoing operations of the project from reduced sediment for habitat development and maintenance, and disruption from shallow water habitat construction activity.

Middle Mississippi River from the Confluence of the Missouri River to Cairo Illinois

The Middle Mississippi River is part of the action area for the purposes of this consultation and for the 2000 Biological Opinion. All life stages of pallid sturgeon have been collected in this sub-reach of the Mississippi River. The Pallid Sturgeon Recovery Plan (USFWS, 1993) identifies the entire Lower Mississippi River reach, of which this is a sub-reach as RPMA#5.

There are suitable habitat characteristics in this sub-reach for pallid sturgeon. The hydrograph in this sub-reach reflects a more normalized hydrograph on the Mississippi River. The Upper Mississippi River and the contribution from the Lower Missouri River provide for the hydrology of this reach along with tributary inflow.

The Service has determined that the following elements of the Corps' proposed action will affect pallid sturgeon in this reach: drought conservation measures with unbalancing, Gavins Point spring sandbar habitat conditioning flows, Gavins Point fall flow test, shallow water habitat improvement downstream of Gavin's Point Dam, and pallid sturgeon propagation support improvements. It is the Service's opinion that the effects described in the 2000 Biological Opinion continue to occur. The Service anticipates additional adverse impacts from the Corps' proposed action in this reach.

The Corps' proposal will reduce sediment availability. Lack of sediment availability and transport adversely affects habitat development and maintenance in the Middle Mississippi River. Lack of turbidity, from the reduction of suspended sediments, adversely affects pallid sturgeon by increasing the potential for predation, increasing competition from other fish species and increasing ability of prey to avoid capture.

The Corps' proposal for population augmentation is a positive effect in the near term in this reach. The extent to which stocked juvenile pallid sturgeon survive to reproductive stages is not known. It is not known if the Corps' proposal will affect hybridization in this reach. Increasing hybridization is an ongoing concern in this reach. These factors include: higher numbers of shovelnose sturgeon compared to pallid sturgeon, habitat degradation, loss of spawning niches for pallids, modified hydrograph upstream affecting the migration of sturgeon past the Platte River, artificially concentrating species in this reach with shovelnose sturgeon. The association between organochlorines impacts and pallid sturgeon reproduction is in the early stages of investigation. Additionally, harvest of female pallid sturgeon from the population through commercial fishing (Williamson, 2003) may also be a factor.

KANSAS RIVER EFFECTS

Least Tern, Piping Plover, and Pallid Sturgeon

The revised proposed action will not affect operation of the Kansas River System any differently than considered in the 2000 Biological Opinion.

INTERRELATED AND INTERDEPENDENT ACTIONS

Least Tern, Piping Plover, and Pallid Sturgeon

Missouri River Fish and Wildlife Mitigation Project

In the Water Resources Development Act of 1999, the Missouri River Fish and Wildlife Mitigation Project (MRFWMP) was reauthorized to include an additional 118,650 acres of land to be purchased from willing sellers on which to develop, restore or enhance fish and wildlife mitigation sites along the Missouri River. The total acres for the program now stand at 166,750. Due to the increase in acres, a Supplemental Environmental Impact Statement (SEIS) was completed prior to project implementation on the additional acres.

The Corps has completed the process for this effort including public comments on how the 118,650 acres will be acquired and developed for the project. On June 12, 2003, the Corps signed a Record of Decision. The Preferred Action includes the acquisition and habitat development of up to 118,650 acres of land, to be acquired from willing sellers or through easements to restore and enhance aquatic and terrestrial habitat on individual sites located along the Missouri River from Sioux City to St. Louis. The Preferred Action includes development of 7,000 to 20,000 acres of aquatic habitat. Much of this aquatic habitat will be acquired and managed for the benefit of endangered species.

Water Depletions

Water withdrawals continue to occur by state and local interests from the reservoirs and rivers. Water withdrawals and depletions place constraints on the water supply aspects of reservoir operations. These can incrementally reduce reservoir storage and instream flows. Theses effects in turn may affect the Corps' ability to maintain flows that are necessary for pallid sturgeon.

CUMULATIVE EFFECTS

Least Tern, Piping Plover, and Pallid Sturgeon

The Service has reviewed the cumulative effects from the 2000 Biological Opinion and considered if any new cumulative effects have been identified. The Service has determined that there are no effects of future State, tribal, local, or private actions that are reasonably certain to occur that were not previously identified in the 2000 Biological Opinion.

CONCLUSION

LEAST TERN

Our review of information that has become available since the 2000 Biological Opinion indicated that the status of the species rangewide continues to improve. Rangewide numbers have increased in the three years since the 2000 Biological Opinion and numbers counted have increased every year since 1997 (except for a slight decline in 2002). The estimated number of adult terns rangewide is approximately 12,000 which is 5,000 birds greater than the recovery criteria outlined in the recovery plan (although as we have noted, these 12,000 birds are not distributed geographically according to the recovery plan criteria nor have the numbers remained stable over a ten year period.) The lack of consistent annual abundance data will make it difficult in some cases to determine when abundance criteria have been met for ten years. Although some authors have expressed concern that interior least tern productivity (measured usually as fledglings/breeding pair) is not, on average, sufficient to sustain a rangewide increasing trend in abundance, a competing hypothesis has emerged. Whittier (2001) suggests that in some cases the longevity of least terns coupled with periodic peaks in productivity may result in a stable or increasing population even when average productivity is low.

We evaluated new information on the species and its habitat within the action area. Numbers of adults have continued to increase slowly since 2000 and fledglings/pair estimates remained above 1.0 until 2003. Interior least terns on the Missouri and Kansas Rivers may currently account for approximately 6 percent of the listed entity (779 in Missouri and Kansas Rivers/12,305 rangewide; Table 1). This proportion ranged between 6.5 percent in 2003 and 11.4 in 1992. We suspect that fledge ratios and numbers of nesting birds may decline as nesting habitat continues to decline post-1997 flood. However, the Corps' proposal to create habitat through mechanical means and clear existing habitat of vegetation, may somewhat ameliorate the ongoing decline in the habitat created in 1997. We recognized the uncertain success of this habitat creation, but we note that in other parts of their range least terns have successfully nested on constructed habitat, and we believe it must be accomplished within an adaptive management context. We also evaluated new information on mortality caused by the Corps' operations of the Missouri River system.

Over the Missouri River portion of the action area, our effects analysis indicates that the Corps' new proposed RPA elements are likely to be slightly beneficial to least terns. These new proposed elements do not affect the Kansas River system. Most of the proposed new elements may have a slight positive effect to least terns, with the exception of the summer releases out of Gavins Point Dam, which may have negative effects on least terns. The question the Service must answer in this reiniation of consultation is whether or not the proposed action (continuing RPA elements together with new proposed elements), when evaluated against the baseline of the species, will avoid the likelihood of jeopardizing the species.

To answer this question, we evaluated the effects of the new elements (which were generally positive) against the updated status of the species. We also contrasted the differences between the original 2000 RPA and the current proposed RPA. We noted that the major difference between the old RPA and the new proposed RPA is the omission of the spring rise out of Fort Peck and Gavins Point Dams and the low summer flows from Gavins Point Dam.

The reach below Gavins Point is one of the highest use areas for terns. The loss of these flow changes from Gavins Point and Fort Peck dams is not entirely balanced by the minor positive alternative RPA elements offered by the Corps. However, we note that the Fort Peck and Gavins Point segments (those most affected by the change in RPA elements) together represent approximately 3.4 percent of the current estimated interior least tern population which appears to be increasing. The negative effects on this reach will not result in a complete loss of 3.4 percent of the population. The negative effects will vary annually, and in the worst years the omission of flow changes may result in the loss of 100 percent of the annual production of the terns in that area.

We used a risk assessment to the Interior least terns from a single catastrophic event on two riverine reaches on the Missouri River. We found up to 36 first year terns, or about 0.003 of the 2003 estimated population, could be lost. While it is highly unlikely that such an event will occur, such an event would not imperil the survival and recovery of the species.

After reviewing the current status of the interior least tern, the updated environmental baseline for the action area, the effects of the Corps' new proposed RPA elements, and the cumulative effects, it is the Service's opinion that the 2000 Biological Opinion RPA, modified by the omission of flow changes and the addition of the proposed new RPA elements, will avoid jeopardizing the continued existence of the interior least tern.

PIPING PLOVER

In November 2000, the Service concluded that continued operation of the Missouri River Mainstem Reservoir System, operation of the Kansas River projects, and the operation and maintenance of the Bank Stabilization and Navigation Project would jeopardize the continued existence of the piping plover, pallid sturgeon, and least tern.

In November 2003, the Corps presented the Service with a biological assessment that evaluated the operation of the Missouri River Mainstem Reservoir System, operation of the Kansas River projects, and the operation of the Bank Stabilization and Navigation Project as modified by the reasonable and prudent alternative provided by the Service in our 2000 Biological Opinion. The Corps, in their Biological Assessment, also proposed to modify the Current Water Control Plan with a modified drought conservation plan and unbalancing of the upper three reservoirs. The Corps further proposed an alternative to the original RPA II.A, because they found the original RPA II.A was not reasonable and prudent, the spring high and summer low flows required from Gavins Point Dam did not

achieve the desired habitat effects. The modification to RPA II.A included Gavins Point Summer Dam Releases, emergent sandbar habitat creation, Gavins Point Reach Fall Test, Fort Randall Reach Fall Rise Test, Gavins Point Spring Sandbar Habitat Conditioning Flows, and Fort Peck Flow Tests.

Our evaluation of the changes proposed by the Corps in November 2003 does not alter the original jeopardy determination of the 2000 Biological Opinion. Our assignment was to look at whether removal of the spring rise and summer low flow and substitution of the alternative RPA elements proposed by the Corps continues to preclude jeopardy to the piping plover.

After evaluating the changes proposed by the Corps, we concluded that the effects of the modified drought conservation plan, unbalancing of the upper three reservoirs, emergent sandbar creation, Gavins Point Reach Fall Test, Fort Randall Reach Fall Rise Test, Gavins Point Spring Sandbar Habitat Conditioning Flows, and the Fort Peck Flow Tests would have positive effects to the piping plover. These project modifications would result in increased (albeit at times minor) habitat for the piping plover.

In particular, the Corps proposes to accelerate from the 2000 Biological Opinion RPA the physical creation of about 1,560 acres of emergent sandbar habitat and rejuvenate about another 1,560 acres of sandbar habitat (i.e., vegetation on existing sandbars and islands will be removed). This acceleration of habitat creation/rejuvenation is one piece of the Corps' proposed substitution for flow modifications. This emergent sandbar habitat will be created in areas that currently support plovers but where habitat quantity and quality is declining (i.e., downstream from Gavins Point Dam, Lewis and Clark Lake, downstream from Fort Randall Dam, downstream from Garrison Dam).

The creation of emergent sandbar habitat should benefit the piping plover by providing nesting and foraging habitat in areas where habitat is decreasing. Habitat reached high levels following the 1996 - 1997 floods and many acres (e.g., 3000 acres downstream of Gavins Point Dam) of sandbars were created. This habitat provided excellent nesting conditions for piping plovers. However, since those high flows, the amount of habitat has declined each year. Without higher flows to reduce vegetation encroachment, the overall amount of nesting habitat for piping plovers will continue to decline.

The rehabilitation of existing sandbar and island habitat should also benefit the piping plover. We believe that restoring habitat to a productive condition has a likelihood of success because we are beginning with some existing physical material. In addition, the Corps proposes to incorporate the measures identified in their Biological Assessment and again listed in the Effects Section of this document.

Because we are in the early stages of learning about habitat creation for this species, created habitat may not always provide the biological attributes needed by the birds. However, the Corps analyzed key physical features of plover habitat and will use these features to guide their habitat creation (C. Kruse, USACE, pers. comm., unpublished data).

The Corps also proposed to conduct fall flow tests from Gavins Point Dam and Fort Randall Dam. These tests will examine releases of up to 60,000 cfs for 60 days from the two dams. Such flows are approaching those that occurred during the 1996 -1997 floods and should create habitat similar to those created by flood conditions. If successful, these tests are likely to create habitat that could be used by plovers for a number of years. The Corps is proposing only a one time test that may take some time to implement because of current drought conditions and the need to coordinate with river interests.

Summer releases from Gavins Point will result in a reduction of plover nesting habitat if steady releases are used and will result in the take of nests, eggs, and chicks if a flow-to-target method is used. A combination release will likely reduce take if carefully managed, but some level of take will still occur in most years.

The overall status of the Great Plains piping plover has declined by about 15 percent throughout its range in the last ten years. It has declined about 2.5 percent in the United States. However, on the Missouri River, plover numbers have increased about 23 percent over the last 10 years and 460 percent in the last five years due to the 1996-1997 floods and more recent droughts.

While these numbers show overall rangewide decreases and local increases on the Missouri River, such fluctuations are not uncommon because piping plovers on the Northern Great Plains are influenced by changing habitat conditions, such as drought or flooding, and react to these conditions by being mobile. Population fluctuations are common in prairie habitat because drought or flooding can change habitats on an annual basis.

Numbers of piping plover nests, nest success, and fledge ratios have increased since the 1996 -1997 floods. Fledge ratios in most years since these floods have exceeded the 1.13 level required in the 2000 Biological Opinion. Recent literature (Larson et al. 2002) supports a 1.25 fledge ratio to maintain stable populations of piping plovers. This fledge ratio (1.25) was also exceeded in many years since the floods (see Figure 6).

Relative impacts of the Corps' alternative RPA on the Northern Great Plains piping plovers will be greatest in the reach of the Missouri River below Gavins Point Dam because of impacts from summer flow releases from Gavins Point Dam. The reach below Gavins Point Dam has supported, on average, 129 birds over the period 1993 – 2003 (with a range of 109 to 286 birds). This represents about 4.0 percent of the Northern Great Plains/Prairie Canada population piping plovers based on the 2001 International Census.

Habitat created by the floods of 1996-1997 peaked in 1998 and has been declining since. However, fledge ratios have remained high through 2003, presumably because sufficient habitat is still present. In addition, the area has since experienced the affects of a severe drought that has resulted in declining reservoir levels that have increased nesting habitat and nesting by piping plovers.

However, we recognize that the increases in absolute numbers of birds on the Missouri River and increases of fledge ratios may not be sustained through time if habitat continues to change. This will need to be carefully monitored.

In conducting our analysis, we considered if the positive and negative effects resulting from the Corps' implementation of the CWCP that incorporated the original 2000 Biological Opinion RPA, drought conservation measures, and system unbalancing and the modifications to RPA II.A. (i.e., Gavins Point Summer Dam Releases, emergent sandbar habitat creation, Gavins Point Reach Fall Test, Fort Randall Reach Rise, Gavins Point Spring Sandbar Habitat Conditioning, and Fort Peck Tests) when combined with the current species status/baseline continued to preclude jeopardy to the piping plover. Put another way, we evaluated if the piece of the 2000 Biological Opinion RPA that was removed by the Corps (i.e., a spring rise and summer low flows from Gavins Point Dam) was sufficiently replaced by the Corps' 2003 revised RPA elements when compared against the current status of and baseline of the species.

We used a risk assessment to the piping plovers from a single catastrophic event on two riverine reaches on the Missouri River. We found up to 49 first year plovers, or about 0.017 of the 2001 estimated population, could be lost. While it is highly unlikely that such an event will occur, such an event would not imperil the survival and recovery of the species.

After reviewing the current status of the Northern Great Plains population of piping plover, the updated environmental baseline for the action area, the effects of the Corps' new proposed RPA elements, and the cumulative effects, it is the Service's opinion that the 2000 Biological Opinion RPA, modified by the omission of flow changes and the addition of the proposed new RPA elements, will avoid jeopardizing the continued existence of the Northern Great Plains piping plover.

PALLID STURGEON

The Service has reviewed: 1) the current status of the pallid sturgeon; 2) the environmental baseline for the action area; 3) the effects of the current operations of the Missouri and Kansas Rivers under the CWCP with drought conservation measures and continued maintenance of the BSNP in concert with the RPA in the 2000 Biological Opinion; 4) the Corps' proposed alternative to implementation of specific elements of the RPA in the 2000 Biological Opinion; and 5) the cumulative effects of these actions. After reviewing this information it is the Service's Biological Opinion that the actions, as proposed, are likely to appreciably reduce the likelihood of both the survival and recovery of the pallid sturgeon in the wild by reducing the reproduction and distribution of that species, thus jeopardizing the continued existence of pallid sturgeon. No critical habitat has been designated for this species, therefore, none will be affected.

Destruction and alteration of big river ecological functions and habitat that was once provided by the Missouri and Mississippi Rivers is believed to be the primary cause of

declines in reproduction, growth, and survival of pallid sturgeon (USFWS 1993). The physical and chemical elements of channel morphology, flow regime, water temperature, sediment transport, turbidity and nutrient inputs that once functioned within this big river ecosystem have been dramatically altered by the construction and operation of mainstem and tributary dams, construction of navigation and bank stabilization projects (e.g., channelization) and the subsequent isolation of the floodplain through flood control projects.

As discussed in the status section of this Biological Opinion, pallid sturgeon populations are declining throughout their range. As shown by Table 5, generally the ratio of pallid sturgeon to all sturgeon is decreasing. In areas where the ratio of pallid sturgeon to shovelnose sturgeon is higher, this is likely the result of declining shovelnose sturgeon populations due to commercial fishing for sturgeon flesh and roe. Although spawning is known to occur, there is little evidence of successful reproduction as few juveniles are collected and there is no evidence of successful recruitment to reproduction. Pallid sturgeon in the Upper Missouri River are aging and isolated as a result of the Corps' operated dams. Hybridization appears to be increasing in the Lower Missouri River and Mississippi Rivers. The Atchafalaya River population has a diverse age structure, but is also hybridizing with the shovelnose sturgeon and is also reproductively isolated.

Implementation of the Corps' proposed action will continue to have ongoing, adverse impacts to the aquatic system utilized by the pallid sturgeon. In the Upper Missouri River, continued operation of Fort Peck Dam as proposed will continue to significantly impair the reproduction of pallid sturgeon in this reach. The altered hydrograph and altered temperature regime reduces the ability of pallid sturgeon to spawn. The survival of larval and juvenile pallid sturgeon in this reach is impaired by the artificially produced cold water temperatures that restrict the amount of riverine habitat available. In addition, these same factors affect the production of forage fish which are important to the overall survival of pallid sturgeon. The heritage population of pallid sturgeon in this reach is predicted to be extirpated by 2018 (Kapuscinski 2003). Pallid sturgeon in this reach are genetically different than pallid sturgeon located in the southern portions of their range. In addition, this reach represents one of the few areas where broodstock can be obtained for artificial propagation purposes. The Corps' proposal to initiate flow tests from Fort Peck Dam to evaluate the efficacy of improving the hydrograph and temperature regime to benefit pallid sturgeon is commendable. However, given the ongoing drought conditions in the basin, it may be 4 to 5 years before the flow test can be implemented and evaluated. There is no long term commitment on the part of the Corps to implement full-scale changes to benefit pallid sturgeon in this reach.

Pallid sturgeon populations located in the inter-reservoir reaches between Garrison Dam and Gavins Point Dam are reproductively isolated. Similar to the Ft. Peck reach, the heritage pallid sturgeon in these reaches are aging and few in number. Given the altered hydrograph, altered temperature regimes and the relatively short amount of riverine habitat located between the lakes, it is not likely that the heritage population of pallid sturgeon can reproduce in this reach. These inter-reservoir reaches generally represent refugia for these heritage fish and juvenile sturgeon being stocked as a result of

population augmentation efforts. The Corps' proposed actions are not likely to affect pallid sturgeon in these areas beyond what was described in the 2000 Biological Opinion.

The Lower Missouri River below Gavins Point Dam is an important reach for long-term survival and recovery of pallid sturgeon. The Lower Missouri River is the riverine conduit for maintaining the genetic connectivity and continuity of the species due to its connection with the Middle Mississippi River and the Lower Mississippi River. This connection is necessary to ensure that genetic material is dispersed throughout the population and genetic heterogeneity is maintained.

The Lower Missouri River is affected in different ways as a result of the Corps' operations. Overall, this entire reach is impacted by reduced sediment inputs that are important to creating and maintaining the diversity of habitats important for pallid sturgeon reproduction and survival. In addition, the reduction of turbidity has highly altered the river environment, impacting pallid sturgeon capability to forage successfully, increasing competition with other species and making the species more susceptible to predation by site-feeding predators. The reach of the Lower Missouri River from Gavins Point Dam to Ponca State Park has excellent habitat for pallid sturgeon. However, the hydrograph in this reach is significantly impacted by the Corps' operations. The lack of a bimodal spring rise in the hydrograph greatly reduces the possibility of pallid sturgeon spawning in this reach.

The reach of the Lower Missouri River from Ponca State Park to the Platte River is highly channelized with high velocities and minimal habitat diversity preventing usage of this area by all life stages of pallid sturgeon. The hydrograph in this reach is also significantly impaired due to the Corps' operations. The reach of the Lower Missouri River to the mouth is also channelized, however, habitat conditions are somewhat improved in this reach and the hydrograph is attenuated as the river progresses downstream due to tributary inflows.

Although the Corps proposes to implement an accelerated habitat restoration program in the Lower Missouri River, this action will have little benefit to the pallid sturgeon without a concurrent or subsequent change in operations to provide a more normalized hydrograph to provide spawning cues critical for pallid sturgeon reproduction and movement of larvae and juveniles to shallow water habitat. In particular, the reach below Gavins Point Dam is critical for providing pallid sturgeon reproduction. Without a change in the hydrograph, pallid sturgeon are restricted in the amount of area available for spawning in the Lower Missouri River.

Some natural reproduction is occurring in the reach of the Lower Missouri River below the mouth of the Platte River. However, larvae and juvenile pallid sturgeon are limited in the amount of shallow-water aquatic habitat available for rearing and refugia. This should be ameliorated over time with the development of shallow water habitat. However, a change in the hydrograph would provide immediate benefits by increasing the amount of shallow water habitat available to the species. Given the current status of the species, this could be very important for both survival and recovery.

The Middle Mississippi River represents an important riverine connection and genetic conduit for pallid sturgeon movement between the Lower Missouri River and the Lower Mississippi River. However, reduced sediment transport due to continued operation and maintenance of the Corps' projects on the Missouri River impair pallid sturgeon in this area due to reduced foraging capability, increased competition with other species and increased predation by site-feeding predators. The Corps' actions to evaluate the rerouting of sediment around Gavins Point Dam will benefit the species in this reach if implemented.

The Corps' proposed actions do not sufficiently normalize the hydrograph and the temperature regime critical to pallid sturgeon reproduction and reproductive success in the reaches below Fort Peck and Gavins Point Dams. For this reason, the Corps' actions continue to appreciably reduce the likelihood of both survival and recovery of the species, thus jeopardizing its continued existence in the wild.

REASONABLE AND PRUDENT ALTERNATIVE

LEAST TERN

RPA Elements applicable to multiple listed species in the ecosystem (elements continuing from the 2000 Biological Opinion)

Elements applicable to multiple listed species in the ecosystem must be implemented to avoid the likelihood of jeopardizing the three listed species, and also will provide incidental benefits to native candidate species and other non-listed species in the Missouri River System. Implementation of these "ecosystem" elements is necessary to offset jeopardy to the listed species and the ecosystem upon which the continued existence of these species depend, and may possibly help preclude the need to list other species. The portions of the multiple species RPA specific to the least tern follow.

I. Adaptive Management

Because the Corps has adopted this RPA element from the original 2000 RPA, and has indicated in their November 2003 BA that they will adopt an adaptive management approach, we repeat here the wording of the original RPA:

The Corps shall adopt adaptive management as one tool to preclude jeopardy to least terns, piping plovers, and pallid sturgeon. Adaptive management is a process that allows regular modification of management actions in response to new information and to changing environmental conditions. Adaptive management is based on the premise that managed ecosystems are complex and inherently unpredictable. The complexity of the Missouri River ecosystem and management for fish and wildlife underscores the need for such an approach to ensure the variability and flexibility necessary to manage multiple species and be consistent with project purposes.

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 under consultation. This is especially true with the aquatic species of concern, the pallid sturgeon. Whereas direct observations of species' behaviors often occur for terrestrial species, such as the least tern and piping plover, the ability to observe the behaviors of aquatic species is far more difficult. This difficulty is further compounded when dealing with a wide-ranging aquatic species with an exceedingly small population, as with the pallid sturgeon. Thus, adaptive management is an approach that can address various biological responses of threatened and endangered species, and other rare species to changes in the Corps' MR, BSNP, and KR Operation or habitat restoration projects.

The Service recognizes that because of the complexity of this large river system, various flow alterations may provide more immediate benefits to some listed species, while other alterations would benefit other listed species. Over the long-term, however, ensuring variable river flows and processes should provide the range of conditions necessary to support self-sustaining populations of all the species under consultation. Variability is essential to the integrity of the

river ecosystem (Richter et al. 1998, Galat and Lipkin 1999). Therefore, any river operation program followed by the Corps must be based on the need to maintain variability. Adaptive management is an important and effective way to insert variability and flexibility in river operations, taking maximum advantage of the inherent variability of precipitation and runoff within the river system.

The Corps and the Service agree that subsequent resource management actions in the Missouri River shall be pursued within an adaptive management framework that embraces the uncertainties of ecosystem responses and attempts to structure management actions to best address those uncertainties, recognizing that learning is a critical outcome. Halbert (1993) notes that "adaptive management treats all management actions as deliberate experiments ... to sort out system process." In that regard, adaptive management is viewed as a continuous process of actions based on testing, evaluating, informing, and improving. It will be the basis from which the Service can identify and evaluate performance.

This RPA will describe the framework for an adaptive management approach to the Corps' river operations and maintenance along the Kansas and Missouri rivers to avoid jeopardy to listed species and facilitate their eventual recovery. This approach will include a regular regime of discussion, information exchange, evaluation and reevaluation, and monitoring between the Corps and the Service. The general management actions identified in this opinion as part of the current project descriptions and as the RPA, likely will be conducted, modified and continually improved upon through adaptive management.

The Corps, in cooperation with the Service, shall identify and describe the specifics of implementing and modifying management actions needed at any given time. The specific methods of implementing the management actions may vary yearly and monthly as necessary to adapt to changing river conditions. Modifications to management actions shall be based on an evaluation of habitat, flow, climate, species response and other information that is available each year. The Corps shall address implementation of those actions through meetings held jointly with the Service at least twice a year, or more frequently if needed. Monitoring shall be used to document how management actions were implemented and their effects within the river and on listed species. Monitoring species responses shall be necessary to determine progress towards species survival. The agencies shall jointly determine what is sufficient progress within specific timeframes that will indicate that the Corps' actions are avoiding jeopardy.

Specific recommendations incorporating the adaptive management approach are included in the following elements of the Reasonable and Prudent Alternative.

A. Agency Coordination Team (ACT): An essential component of this RPA is establishment of an agency coordination team (ACT) that will serve to guide development and implementation of future river management measures to benefit listed species consistent with the Corps' statutory responsibilities. While some management actions will have more immediate benefits to listed species, all are important components of a comprehensive river operation program to prevent jeopardy and facilitate recovery. Those actions that contribute to flow variability, creation of dynamic sandbar and in-channel habitats, and those that provide triggers for reproductive response are the highest priorities,

although they may take several years to implement. Physical habitat restoration, another essential component to avoid jeopardizing the tern, plover and sturgeon, may be implemented more quickly.

Therefore, the Corps shall work with the Service to immediately establish an agency coordination team (ACT) to identify and implement the goals of this Biological Opinion. That team will be responsible for ensuring implementation of future conservation measures; tracking, evaluating, and documenting the results of those measures; and tracking and documenting sufficient progress in conserving listed species. The initial point of contact will be the Reservoir Control Center Chief for the Corps and the North Dakota Field Supervisor for the Service. The ACT should involve additional agencies or groups, as appropriate, with biologic and engineering expertise, such as the MRNRC, MRBA, and Tribes.

The ACT shall jointly develop targets against which they can evaluate whether the Corp is making sufficient progress toward avoiding jeopardy, increasing species status and/or habitat conditions, or implementing effective conservation actions. Progress toward each target shall be evaluated semi-annually. Species responses to management actions, however, are not likely to be immediately detectable. It may take many years to see a positive species response due to difficulties in monitoring the species, particularly the pallid sturgeon; the time necessary to recreate essential river processes and habitats; the biologic "lag time" between environmental stimulus and biologic response; and the variability in climatic conditions that may delay reproductive triggers, habitat restoration, or cause other temporary setbacks in reproductive success of listed species. Therefore, targets for evaluating success shall be based on a combination of short-term physical changes in river conditions plus longer-term changes in listed species survival and reproductive success.

Coordination Meetings: As discussed above, the ACT shall meet, at a minimum, twice each calendar year (March and October) to develop an action plan for the upcoming year; to evaluate the responses/effects of the previous year's actions; and to use this information to make necessary alterations in the upcoming years management actions. The action plan shall describe in detail the range and frequency of necessary management actions to avoid jeopardy. Those actions shall be subject to further evaluation and modification by both agencies as management "experiments" are undertaken in future years. Additional coordination (i.e., meetings, conference call, etc.) shall occur as needed to address issues requiring immediate attention.

At the March meeting, the ACT shall develop a river management plan for the upcoming months based on river conditions, climatological forecasts, and progress over the previous years. That plan shall identify situations/conditions that create opportunities for improving river conditions for the listed species and shall designate more specific recommendations for river operations that the Corps shall implement should those situations occur. For example, opportunities for increasing spring flows may be greatest during years with above normal water levels/project inflow in the reservoirs and low to moderate river flows and precipitation in the lower basin. [*Wording carried over from original RPA although the RPA for least terns now contains no flow requirement:* Alternatively, if specified spring flows have occurred during the past several years, there may be no need to discharge high flows the following spring, particularly if system inflow is low.]

The purpose of the October meeting is to evaluate information on river operations conducted that year and the species' responses, changes in habitat conditions, changes in timing and volume of flows, and changes in river use, etc. Those actions that create a positive species response or positive change in habitat conditions will be continued or changed for the upcoming year based on meeting specific biological goals. The ACT shall also determine whether actions were implemented as agreed to at the beginning of the year. They shall document improvements in listed species status or of specific river conditions, and whether sufficient progress has been made towards avoiding jeopardy. At the meeting, the Service and the Corps shall also identify potential operational changes or other management actions that likely will be needed in the upcoming year. The management plan shall then be revised as necessary in the March meeting of the following year.

B. Endangered Species and Habitat Monitoring Program

The Corps has the primary responsibility for, and shall monitor the biologic resources and responses of threatened and endangered species to changes in the Missouri and Kansas River operations, maintenance, or habitat restoration projects. Monitoring is needed to assess the biologic value of Corps management decisions. The Corps is to be commended for the comprehensive least tern and piping plover monitoring program it has implemented, providing state-of-the-art information on habitat and birds critical to river management decisions.

For many years, the Service has identified the need to collect comprehensive, long-term natural resource data on the river to guide management. This includes using long-term monitoring in conjunction with focused investigations to provide an adequate database to

evaluate the biologic effects of additional changes to flow management. Annual progress reports are an integral and required part of the monitoring program or restoration of riverine habitats.

Monitoring of least terns, piping plovers, and pallid sturgeon shall require the Corps to apply for authorization under section 10 of the ESA. The section 10 authorization will address potential take resulting from the monitoring program.

C. Annual Report

The Corps shall provide an Annual Report on threatened and endangered species conservation activities to document compliance with the provisions of the Biological Opinion. This report shall document results of monitoring for each species and their habitats and the progress in implementation of the elements of the reasonable and prudent alternative, terms and conditions for implementation of reasonable and prudent measures to minimize take, and conservation recommendations. This report is similar to reports completed under the 1990 Biological Opinion and ESA subpermitting requirements. Specific monitoring components to be included in this report are addressed in the appropriate RPAs and the RPMs. The report shall be due December 31 of each year. Additionally, this report will provide the Service, ACT, States, Tribes, Missouri River Natural Resources Committee, Missouri River Basin Association, and other parties information necessary to evaluate the effectiveness of the Corps' actions.

Prior to implementing tern and plover and pallid sturgeon management strategies for each operating year, the Corps shall demonstrate that the planned System operations and the management strategies will satisfy the elements of the reasonable and prudent alternative and reasonable and prudent measures. The Corps shall provide this information to, and/or meet with, the Service during development of the draft AOP in the fall and after March 1 when the runoff forecast is made. We anticipate that this will provide enough time to plan or implement operational scenarios that will be necessary for the new operating season.

II Flow Enhancement

C. Other Segments

Through adaptive management, the Corps shall investigate the applicability of flow enhancement at Garrison by 2005 and implement, if appropriate.

III Unbalanced Instrasystem Regulation

The Corps has adopted this RPA element from the original 2000 RPA, but has indicated in their November 2003 BA that the system unbalancing will be incorporated into the Master Manual revision, so this original RPA element will be reflected under the heading of

IV Habitat Restoration/Creation/Acquisition

Because the Corps has adopted this RPA element from the original 2000 RPA, and has indicated in their November 2003 BA that the habitat restoration/creation/acquisition will be accomplished, we repeat here the wording of the original RPA:

The Service's 1994 Draft Biological Opinion on the Master Manual documented actions to restore river functions and habitats, as well as target acreages, and provides the foundation for targets for the current consultation. Additional restoration actions have been documented in a Missouri River Natural Resources Committee document entitled "Restoration of Missouri River Ecosystem Functions and Habitats" adopted by the Missouri River Basin Association as part of their Missouri River Planning Document. The Service's current recommendations for habitat restoration follow.

The Corps' programs and authorities already exist to implement most, if not all the structural and non-structural modifications and changes in water management needed to restore Missouri River habitats. Those include, but are not limited to, the following: BSNP, BSNP Fish and Wildlife Mitigation Project, Section 1135, 206 and Section 33 Programs, Flood Control Act of 1938, Missouri National Recreation River, Master Manual, Annual Operating Plan, and section 7(a)(1) of ESA. The Corps shall pursue any additional authorizations, appropriations, or partnerships it believes are necessary to implement this portion of the RPA. Other programs, such as the Service's Big Muddy National Fish and Wildlife Refuge, and the NRCS' Wetland Reserve and Emergency Wetland Reserve Programs may also contribute to habitat restoration goals when the Corps works in concert with those programs to leverage its habitat restoration efforts.

Continued survival of listed species depends on restoration of riverine form and functions, as well as some semblance of the pre-development or natural hydrograph. Missouri River habitat restoration is, therefore, multi-faceted, and involves a combination of reservoir operational changes (e.g., hydrograph and temperature), structural modifications (e.g., chute restoration), and non-structural actions (e.g., floodplain acquisition or easements). The maximum benefits of physical habitat projects to listed species can only be realized when coupled with complementary hydrology. The following habitat elements of the reasonable and prudent alternative act together with the other elements as a functional unit to ensure the continued existence of the least tern, piping plover and pallid sturgeon.

Habitat management efforts will vary by species, habitat needs, opportunity, river segment, and year depending on water conditions. The health and status of listed populations and their habitats, and the opportunities to further their conservation are not uniform throughout the basin and, therefore, warrant varying levels of management effort and priority within each of the 16 designated river or reservoir segments. Thus, the Service developed a reasonable, flexible process to prioritize actions within a river segment.

Prioritization of habitat or other actions to benefit/preclude jeopardy to threatened and endangered species in each segment must consider the current status of the population of the species, condition and availability of habitat, needs associated with the species and habitats, and realistic management opportunities to improve the status and condition of the species and its habitats. Management direction provided by species' Recovery Plans also must be considered. Designation of a priority classification for species within each segment will provide flexibility and help focus management on those species where the need and opportunity most exists.

Therefore, to address these factors in the prioritization process, the Service and Corps developed a matrix to help provide direction within each segment of river, as well as an efficient, logical

framework for the implementation of management actions to benefit or help recover threatened and endangered species. Species/habitat needs (biology) and management opportunities for each species within a reach were respectively characterized as either high, moderate, or low and combined into a matrix to yield either a high, moderate, or low priority for management of the species in a particular segment (Table 8). In general, this designation means that implementation of positive actions to benefit a particular species either will be a "high, moderate, or low" priority in the river segment. However, low priority does not mean that a species is ignored, but that, in general, management opportunities for the species in that segment are meager and would provide little return to the resource. An obvious long-term goal would be to strive to elevate the low and moderate priorities to a higher status over time. Management actions in one segment may greatly influence other segments and therefore, add to the priority of that particular segment.

Although currently the lower Missouri River Segments 11-15, the Kansas River Segment 16, and the Missouri River Segment 2 have minimal habitat for nesting terns or plovers because of inundation, through adaptive management, the Corps and the Service may identify future opportunities to improve conditions in those areas to benefit the least tern and piping plover.

Table 8. Endangered species management action priorities for Missouri and Kansas River segments.

Missouri and Kansas Segments	Species Management Action Priorities			
	Least Tern	Piping Plover	Pallid Sturgeon	Bald Eagle
Segment1	Low	Low	Low	Low
Segment 2	Moderate	Low	High	Low
Segment 3	Moderate	High	Low	Low
Segment 4	High	High	Low	Moderate
Segment 5	Moderate	High	Low	Low
Segment 6	Low	Low	Moderate	High
Segment 7	Low	Low	Low	Low
Segment 8	High	High	High	Moderate
Segment 9	High	High	Low	Moderate
Segment 10	High	High	High	Moderate
Segment 11	Moderate/Low	Moderate/Low	High	Low
Segment 12	Moderate/Low	Moderate/Low	High	Low
Segment 13	Moderate/Low	Low	High	Moderate
Segment 14	Low	Low	High	Low
Segment 15	Low	Low	High	Low
Segment 16	Moderate/Low	Moderate/Low	Moderate	Low

The same can be said of currently developing deltas in the Missouri River reservoir segments 1, 6, and 7 .

As one element of the RPA, the Corps shall provide the quantity and quality of habitat on the Missouri and Kansas Rivers as described below.

Restoration of Submerged In-Channel Shallow Water Habitat in the Channelized River.

The distribution of shallow water habitat in today's channel is much different than the historical distribution. In the pre-development channel much of the shallow water habitat was associated with mid-channel sandbars (braided channels), large side channels, and chutes, and was generally available over a wide variety of flows. In today's channel, no shallow water habitat occurs in the middle of the channel, few chutes or side channels exist, and shallow water habitat is essentially confined to dike fields or the margins of point bars. For this reason, restoration of

shallow water areas will have to concentrate on increasing shallow water in channel habitats out of the thalweg and dike fields if the navigation function is to be maintained.

The Corps has made progress in achieving the shallow water habitat goals in the 2000 Biological Opinion. According to the Corps in their 2003 Biological Assessment, the most immediate goal is the development of 2,000 new shallow water habitat acres between 2000 and 2005. The second milestone is the creation of 5,870 acres of shallow water habitat by 2010. Service recommendations for providing the quality and quantity of shallow water habitat on the Missouri and Kansas rivers in the 2000 Biological Opinion have not changed.

Using August as the template for average acres of shallow water, slow velocity habitat in the lower river, the Gavins Point reach (Segment 10) is the only river reach where current habitat conditions under CWCP exceeds 50 percent of the historical acreage.

Protection shall be afforded for those areas that have existing habitat (i.e., River Segments 2 and 10) by maintaining existing habitat values. Coordination with the Service on existing projects in these areas will help insure habitat values are not lost.

Performance Standards as described in the 2000 Biological opinion are restated below:

- The Corps shall ensure no-net-loss of existing shallow water habitat from operations and maintenance activities in the lower Kansas River and channelized Missouri River.

- (2001) The Corps shall develop habitat restoration plans and strategies to restore shallow/slow-water sandbar/island habitats in river segments 10 through 16. The plan shall identify existing habitats and restoration activities throughout the priority river segments. As part of the adaptive management process, the Corps, in cooperation with the Service, shall provide to the Service implementation plans and strategies and schedule for implementation.

- (2002) The Corps shall implement habitat restoration plans and strategies to restore and protect shallow/slow-water habitats, and begin mapping of important pallid sturgeon habitats (i.e. shallow/slow-velocity, gravel areas).

- (2003) The Corps shall continue implementation of habitat restoration plans and strategies to restore and protect shallow/slow-velocity habitats; and the Corps shall finalize mapping of priority river segments for pallid sturgeon habitat.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 8 percent (1,700 ac [688 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 10 percent (2,000 ac [810 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- (2010) Based on habitat measurements between mid-July and mid-August, the Corps shall

have reached 30 percent (5,870 ac [2,377 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 60 percent (11,739 ac [4,754 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 100 percent (19,565 ac [7,924 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

The following elements were specific to the pallid sturgeon in the 2000 Biological Opinion and must be implemented as is or as modified by the Corps' proposed action as described in the November 2003 Biological Assessment.

Table 9. Mean acres of shallow water, slow velocity habitat for the month of August and habitat restoration goals/deficits by river segment below Gavins Point Dam.[1]

River Reach (Segment)	Segment Length (mi)	Mean Acreage of Shallow Water, Slow Velocity Habitat for August: Historical Ac/mi	Historical Acres	CWCP Ac/mi	CWCP Acres	Habitat Restoration Goal of 20-30 acres/mile: @ 20 Ac/mi	Deficit from CWCP Ac/mi	Deficit from CWCP Acres	@30 Ac/mi	Deficit from CWCP Ac/mi	Deficit from CWCP Acres
Unchannelized											
Gavins Point (Segment 10)	58	106.6	6,183	61.4	3,561	1,160	-	-	1,740	-	-
Channelized											
Sioux Cit (Segment 11)	18	107.0	1,926	2.0	36	36	18.0	324	540	28.0	504
Omaha (Segment 12)	140	107.0	4,980	1.8	252	2,800	18.2	2,548	4,200	28.2	3,948
Nebraska City/ St. Joseph (Segment 13)	228	101.9	23,233	4.6	1,049	4,560	15.4	3,511	6,840	25.4	5,791
Kansas City/ Boonville (Segment 14)[2]	237	101.9	24,150	4.6	1,090	4,740	15.4	3,650	7,110	25.4	6,020
Osage to Mouth (Segment 15)[2]	130	101.9	13,247	4.6	598	2,600	15.4	2,002	3,900	25.4	3,302
Totals	811	83,719			6,586	12,035					19,565

[1]Table computed from data provided by the Corps for Table 18, 2000 Biological Opinion (USACE, unpublished data, November 2000).

[2]As with Table 18, 2000 Biological Opinion, comparable data was not available for Segments 14 and 15. For analytical purposes, we assumed the historical and CWCP average acres/mile for August for Segments 14 and 15 were similar to Segment 13, and therefore, used these numbers. If data were available, the numbers likely would be higher.

To meet a shallow water habitat goal of 20-30 acres/mile in the channelized Missouri River, the Service believes that restoration of 12,035 ac (4,874 ha) to 19,565 ac (7,924 ha) is reasonable and prudent. Table 9 indicates that the range of desirable habitat is currently being met in the Gavins Point reach (Segment 10) under the CWCP. Restoration of shallow water habitats (30 acres/mile) should be distributed as follows:

Ponca, NE to Sioux City, IA (Segment 11)	504 total acres
Sioux City, IA to Platte River (Segment 12)	3,948 total acres
Platte River to Kansas City, MO (Segment 13)	5,791 total acres
Kansas City, MO to Osage River (Segment 14)	6,020 total acres
Osage River to the mouth of the Missouri River (Segment 15)	3,302 total acres

Restoration of this level of shallow (<5 ft/<2 fps aquatic habitat is almost equivalent to 20 percent of the estimated aquatic habitat loss (100,000 acres) attributed to the BSNP (USFWS 1980). Shallow-water habitat may be restored through flow management, increasing the top width of the channel (widening), restoring chutes and side channels, manipulation of summer flows, or combinations thereof. The habitat goal for the lover 170 mi (274 km) of the Kansas River also should be 20-30 acres/mile.

Protection shall be afforded for those areas that have existing habitat (i.e., River Segments 2 and 10) by maintaining existing habitat values. Coordination with the Service on existing projects in these areas will help insure habitat values are not lost.

Performance Standards

1. The Corps shall ensure no-net-loss of existing shallow water habitat from operations and maintenance activities in the lower Kansas River and channelized Missouri River.

2. (2001) The Corps shall develop habitat restoration plans and strategies to restore shallow/slow-water sandbar/island habitats in river segments 10 through 16. The plan shall identify existing habitats and restoration activities throughout the priority river segments. As part of the adaptive management process, the Corps, in cooperation with the Service, shall provide to the Service, implementation plans and strategies and schedule for implementation.

3. (2002) The Corps shall implement habitat restoration plans and strategies to restore and protect shallow/slow-water habitats, and begin mapping of important pallid sturgeon habitats (i.e. shallow/slow-velocity, gravel areas).

4. (2003) The Corps shall continue implementation of habitat restoration plans and strategies to restore and protect shallow/slow-velocity habitats; and the Corps shall finalize mapping of priority river segments for pallid sturgeon habitat.

5. (2004) Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 8 percent (1,700 ac [688 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

6. (2005) Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 10 percent (2,000 ac [810 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

7. (2010) Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 30 percent (5,870 ac [2,377 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

8. (2015) Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 60 percent (11,739 ac [4,754 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

9. (2020) Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 100 percent (19,565 ac [7,924 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

B. Restoration of Emergent Sandbar Habitat

Because the Corps has adopted this RPA element from the original 2000 RPA, and has indicated in their November 2003 RPA that the restoration of emergent sandbar habitat will be accomplished, we repeat here the wording of the original RPA:

B.1. Natural Habitat

Natural tern and plover nesting habitat shall be provided as a priority and other management actions implemented to create and maintain tern and plover habitat at levels seen on Segments 4, 8, 9, and 10 in 1998, and provide a diversity of shallow water habitats for refugia also beneficial to pallid sturgeon and other native fishes. Accordingly, the Corps shall, through flow regulation or other means provide for this sandbar habitat in complexes of various sizes in totals as noted below. The habitat should be available to nesting birds at a minimum of one out of three years. [*Wording carried over from original RPA although flow requirements no longer apply to least terns in this RPA:* The habitat goals on the Missouri River would be waived during years when the ACT, through the adaptive management process, recommends the Corps release high flows for habitat creation and/or other ecosystem/listed species benefits.)]

a. (2005) Minimum emergent interchannel sandbar habitat acres on average per river mile during the nesting season shall be as follows: Gavins Point - Segment 10 (40 ac [16.2 ha]), Garrison - Segment 4 (25 ac [10 ha]), Fort Randall - Segment 8 (10 ac [4 ha]), and Lewis and Clark Lake - Segment 9 (40 ac [16.2 ha]) to be measured in late July. This emergent sand shall be comprised of a minimum 60 percent dry sand.

b. (2015) Minimum emergent interchannel sandbar habitat acres on average per river mile during the nesting season shall be as follows: Gavins Point - Segment 10 (80 ac [32 ha]), Garrison - Segment 4 (50 ac [20 ha]), Fort Randall - Segment 8 (20 ac [8 ha]), and Lewis and Clark Lake - Segment 9 (80 ac [32 ha]) to be measured in late July. This emergent sand shall be comprised of a minimum 60 percent dry sand.

c. (2003) The Corps will complete 1998 baseline habitat evaluations on the Missouri River below Fort Peck - Segment 2 and by 2015 meet minimum baseline emergent sandbar acres. This habitat shall exist during the late July period. This emergent sand will be comprised of a minimum 60 percent dry sand.

Desirable Habitat Conditions: Optimum habitat has been described as a complex of side channels and sandbars with the proper mix of habitat characteristics required by the birds. Such sandbar complexes provide higher regularly scoured habitat for nesting and brood rearing and shallow pools and wetted perimeters for foraging. Single, large, unbraided monotypic sandbars with linear shorelines rarely provide these conditions because they often remain above the scour zone and the associated channels and chutes are often deep and provide little opportunity for foraging. Sandbar complexes suitable for least terns and piping plovers must provide two basic needs, food and security, during the nesting and brood rearing seasons. The Service recommends the following physical conditions for nesting habitat, brood rearing habitat, and foraging habitat.

Nesting Habitat:
Substrate – Nesting substrates consist of well draining particles ranging in size from fine sand to stones < 1 in. (2.5 cm) in diameter.

Size/Shape – Nesting areas should be a minimum of 1 ac (.4 ha), preferably 10 ac (4 ha); circular to oblong in shape, maximizing surface area; recommended slopes of 1:25 with maximum slopes not exceeding 1:10; surface height above water to exceed 18 in. (45.7 cm) at nest initiation.

Visibility – Smooth topography with < 10 percent early successional vegetation.

Brood Rearing Habitat:
Substrate – Same as nesting substrate but may contain fine silts, organic detritus, and other unconsolidated fine particulate matter.

Size/Shape – Brood-rearing areas should be 3-5 times larger than the nesting area; very irregular in shape, maximizing shoreline to water interface; recommended slopes of 1:25 with maximum slopes not exceeding 1:10.

Visibility – Vegetation can increase up to 25 percent ground coverage but should occur in a patchy pattern.

Connectivity – Brood rearing areas must occur connected to nesting areas or immediately

adjacent and separated only by shallow channels (< 1 in. [2.5 cm] deep) or mud flats.

Foraging Habitat
Substrate – Least terns require shallow, slow velocity water that provides habitat for schooling baitfish that are 0.5 – 3.0 in. (1.3-7.6 cm) in length. Piping plovers require wetted sand zones consisting of ephemeral ponds < 0.5 in. (1.3 cm) deep, nutrient enriched lagoons, swash areas, and braided shallow channels. Substrates range from large grained sand to heavy silts.

Size/Shape – Foraging habitat should comprise 40 percent of the brood rearing habitat for piping plovers.

Connectivity – Least tern foraging areas should not be greater than 438 yds. (400 m) from the brood rearing areas. Piping plover foraging areas must occur connected to nesting areas or immediately adjacent and separated only by shallow channels (< 1 in. [2.5 cm] deep) or mud flats.

B.2. Reservoir Habitat
Between 1986 and 2000, nearly 44 percent of piping plovers and 27 percent of least terns were recorded on reservoir habitats during the adult census (C. Kruse, USACE pers. comm. 2000). Productivity surveys have shown reservoir habitat significantly contribute to plover and tern recruitment, particularly during drought or low runoff years when reservoir elevations are lower and habitat is more abundant. In 2000, 223 piping plover chicks fledged from Lake Sakakawea (fledge ratio 1.61 chicks per pair) and 102 from Lake Oahe (fledge ratio 1.46 chicks per pair). A piping plover fledge ratio of 2.45 chicks per pair and a least tern fledge ratio of 2.33 chicks per pair were achieved on Lewis and Clark Lake in 1998 with 103 and 140 chicks fledging respectively (C. Kruse, pers. comm. 2000). Since listing the species, the Service has recognized the difficulty in managing water levels on both the reservoir and lotic segments of the river. Recently, through efforts of the Corps and with more intensive monitoring, data has shown that reservoir habitats provide a vital resource for the birds, especially during periods of substantial pool fluctuations as have occurred since the mid-1990s. Management opportunities being investigated by the Corps, including protection of peninsular habitat, overburden removal, island construction, and water control structures may provide long-term habitat to support least terns and piping plovers on the reservoirs.

Therefore, the Service believes the Corps should continue its investigations into the value of reservoir habitats and into opportunities to enhance these habitats for least terns and piping plovers. The Service recognizes that if opportunities can be developed, reservoir habitat may provide a significant level of the habitat necessary to meet the aforementioned recruitment rates and populations goals for terns and plovers on the Missouri River.

(2001) The Corps shall maintain reservoir habitats for least terns and piping plovers through intra-system regulation.

(2005) The Corps shall have identified all potential habitat enhancement on reservoir segments (Segments 1, 3, and 5).

(2010) The Corps shall have completed 25 percent of the reservoir projects identified in letter b above.

(2015) The Corps shall have completed 50 percent of the reservoir projects identified in letter b above.

(2020) The Corps shall have completed 100 percent of the reservoir projects identified in letter b above.

B.3. Artificially or Mechanically Created Habitat

This wording from the 2000 Biological Opinion is slightly modified to reflect the fact that flow modifications are no longer part of the least tern RPA, fledge ratios are now included in the Incidental Take Statement, and a separate RPA has been provided for the piping plover.

Other means (e.g., creation of habitat) will be necessary to meet goals for amount of emergent sandbar habitat specified in RPA 4.1. Created habitat shall be established to supplement natural habitat required by element B(1) above. The habitat shall be created following the desirable habitat parameters listed above in element B(1). Suggested management techniques for habitat creation include: (1) replenishment or nourishment of river sandbars and islands; (2) creation of suitable nesting habitat in reservoir depositional zones; (3) creation or enhancement of shallow and backwater areas, off-channel chutes, and flats as foraging habitat; (4) removal of early successional vegetation from nesting areas; (5) peninsular cutoffs or island creations in reservoir side bays; and (6) dike construction to dewater reservoir side bays for nesting and foraging habitat.

Initiation of Sediment Transport/Habitat Studies

The Corps shall initiate other studies as appropriate to research the long-term effects of riverbed changes/sediment transport and their impact to tern and plover nesting habitat, forage availability, and forage areas. The results of these studies shall be reported each year in the annual report and considered and included in operations as appropriate.

The Corps shall research and develop a way to restore the dynamic equilibrium of sediment transport and associated turbidity in river reaches downstream of Fort Peck (Segment 2), Garrison (Segment 4), Fort Randall (Segment 8), and Gavins Point Dams (Segment 10), and stop or reverse bed degradation of the river. Sediment input is necessary to restore instream habitats and turbid waters. Initially, the Corps should determine the sediment deficit from natural conditions and the functional quantities needed to restore instream sandbars, and implement a pilot project at one of the main stem dams.

Options to achieve sediment transport might include sediment bypass pipelines or physical deposition of sediments at the face of dams. Sediment bypass around large dams is feasible (Singh and Durgunoglu 1991). Bed degradation below dams and head cutting at the mouths of tributaries might be addressed with grade control structures. Weir notches at grade control structures would allow for fish passage to the tributaries. Because of the large

sediment deposition zone at the upper end of Lewis and Clark Lake and its proximity to Gavins Point Dam, Gavins Point may provide the best opportunity for a pilot study.

The Corps also should restore turbidity to functional levels downstream of Fort Peck, Fort Randall, and Gavins Point Dams. Turbidity will increase with actions taken to restore sediment transport; however, additional measures may be needed if reintroduced sediments are clean of small particulate matter that needs to be resuspended. Through the ACT, the Corps, in cooperation with the Service, shall develop a study plan by 2002 and initiate studies by 2003 with a completion by 2005.

D. Monitoring of Tern and Plover Nesting Habitat

The Corps shall monitor and map, on a periodic basis (at least every 3 years), all essential tern and plover nesting habitat on the Missouri River as identified. The mapping information, in conjunction with the Corps' Habitat Conservation and Recovery Project, will be used to determine tern and plover habitat available under different operating scenarios and to assist in establishing and implementing management. (*The wording of the preceding sentence has been modified to reflect that fledge ratios are no longer within the least tern RPA; refer to Incidental Take Statement for anticipated fledge ratios*). Mapping products or updates on data collection will be provided in the annual report (see Annual Report under Adaptive Management RPA).

Kansas River

The Kansas River (Segment 16) shall be operated to provide overall benefit to the conservation of least terns and piping plovers. Decisions concerning operations of the Kansas River for terns and plovers will occur through ACT. To facilitate decision making on Kansas River terns and plovers, the Corps shall collect and evaluate productivity, habitat, and other pertinent data to identify whether the Kansas River provides a source or sink for least terns and piping plovers. [*Wording carried over from original RPA although the date is now past:* A study plan shall be developed and agreed upon by the Service and Corps through ACT by 2002.] An evaluation to this effect will be made by the Corps by 2005.

The Service has determined that the issue of fledge ratios will be considered as anticipated incidental take in the Incidental Take Statement and therefore the discussion of Habitat/Fledge Ratio Goals that was previously included as RPA 5. B. is no longer included here.

New RPA Elements From the Corps' 2003 Biological Assessment

The following text is incorporated from the Corps' November 2003 Biological Assessment and constitutes the Corps' description of the elements they offered to the Service in lieu of the RPA II. A. (Flow Enhancement, Gavins Point):

Description of the Corps' Alternative to the Gavins Point RPA (Proposed Action).

a. **Drought Conservation Measures**. During extended drought periods, or those lasting more than 1 year, the duration and level of navigation service would be modified at

higher storage levels under the proposed action than under the CWCP. Additional details of this feature will be provided during consultation.

b. **Unbalancing of the Upper Three Lakes**. The Corps has the authority under the existing Master Manual and currently implements intrasystem unbalancing. Unbalancing of the lakes was also included as a feature of the 2000 Biological Opinion RPA. Unbalancing under this proposed action consists of a set pattern 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.

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. 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 10 describes the 3-year cycle of lake unbalancing.

Table 10. 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 a low lake elevation 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 be at a low elevation the following year as the cycle repeats.

c. **Gavins Point Dam Summer Releases**. Summer releases under the proposed action will be adjusted when the Corps determines that birds have begun nesting. Flow support for navigation and other downstream purposes would 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 navigation service support in August when tributary inflows have declined (steady-release); or by some combination of the two methods, as was implemented during the 2003 nesting season (steady-release – flow-to-target). The modeling done for the Missouri River Master Manual Review and Update process 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.

Adaptive management will be used to make decisions about the method to use during any given year and will 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.

The evacuation of floodwaters would be delayed until mid-September whenever possible to minimize the impacts to the young-of-year native river fish. 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. Additional measures to minimize losses of the two listed bird species are taken by the Corps. Further details regarding these measures can be found in Appendix B, page 6.

2. **Research, Monitoring, and Evaluation**. As indicated above, the Corps proposes to operate the System using adaptive management including a robust research, monitoring and evaluation (RM&E) program and a re-evaluation of the science on flow modifications and other potential actions in three years.

    a. **Regional Population Assessments**

    1) **Interior Least Tern and Piping Plover.** In addition to the population assessment and monitoring efforts on the Missouri River being conducted in response to the 2000 Biological Opinion, the Corps will develop and support a regional coordination process for the Missouri River piping plovers and least tern subpopulations. 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. Further information regarding this proposed action can be found in Appendix B, page 23, 2000 Biological Opinion.

b. **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 to which additional habitat can be constructed with flows into Lewis and Clark Lake, 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.

1) **Gavins Point Reach Fall Test**. In the fall a flow test will be run in the river reach downstream from Gavins Point Dam after refill of the system following the current drought, and would be conducted 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. This test would also provide a greater understanding of the benefits/impacts associated with any alternative release scenario from Gavins Point Dam. Further discussion of this flow test can be found in Appendix B, page 10, 2000 Biological Opinion.

2) **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. This test would 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 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. The test 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. Further discussion of this flow test can be found in Appendix B, page 11, 2000 Biological Opinion.

3) **Gavins Point Spring 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, there will be additional releases in excess of those 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. Further discussion of this flow test can be found in Appendix B, page 12, 2000 Biological Opinion.

4) **Fort Peck Tests**. The 2000 Biological Opinion included release changes from Fort Peck Dam as a component of the RPA. Prior to full implementation of this release change, the RPA included two tests, the "mini test" and the "full test." The Corps' proposed action includes conducting these two tests. Preliminary biological data collection is essential to determine the responses and effects of the "mini" and "full tests" on pallid sturgeon and the target species that have been selected for this effort, and will provide science critical to recovering fish populations throughout the Missouri River Basin. After assessment of the results of these tests, and through the adaptive management framework, the Corps may implement a Fort Peck Dam release change as a component of System operations. However, this would require revision of the Water Control Plan. Additional information on the planned Fort Peck tests can be found in Appendix C, page 1, 2000 Biological Opinion.

3. **Accelerated Actions to Benefit the Species**.

a. **Shallow Water Habitat**. The Corps proposes to accelerate the construction of shallow water habitat surpassing the short-term goals recommended in the 2000 Biological Opinion. This action will be taken in the lower river from Ponca State Park to the mouth. Additional information on existing and planned habitat development can be found in Appendix B, page 18, 2000 Biological Opinion.

4. **Three-Year Re-evaluation**. Consistent with the adaptive management approach, the Corps proposes that the status of the species, the scientific findings of the proposed robust RM&E program, the progress and success of other implemented measures to date, and other relevant new information be re-evaluated within 3 years following the issuance of a new Biological Opinion. This re-evaluation will inform decisions concerning implementation of additional measures or modification of existing measures and strategies, including potential flow releases out of Gavins Point Dam. The "3 year check-in" would include input from The Missouri River Recovery

Implementation Committee (MRRIC) to promote conservation of listed species and the broader ecosystem values of the Missouri River.

REASONABLE AND PRUDENT ALTERNATIVE

PIPING PLOVERS

RPA Elements applicable to multiple listed species in the ecosystem (elements continuing from the 2000 Biological Opinion)

Elements applicable to multiple listed species in the ecosystem must be implemented to avoid the likelihood of jeopardizing the three listed species, and also will provide incidental benefits to native candidate species and other non-listed species in the Missouri River System. Implementation of these "ecosystem" elements is necessary to offset jeopardy to the listed species and the ecosystem upon which the continued existence of these species depend, and may possibly help preclude the need to list other species. The portions of the multiple species RPA specific to the piping plover follow.

I. **Adaptive Management**

The Corps shall adopt adaptive management as one tool to preclude jeopardy to piping plovers. Adaptive management is a process that allows regular modification of management actions in response to new information and to changing environmental conditions. Adaptive management is based on the premise that managed ecosystems are complex and inherently unpredictable. The complexity of the Missouri River ecosystem and management for fish and wildlife underscores the need for such an approach to ensure the variability and flexibility necessary to manage multiple species and be consistent with project purposes.

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 under consultation. This is especially true with the aquatic species of concern, the pallid sturgeon. Whereas direct observations of species' behaviors often occur for terrestrial species, such as the least tern and piping plover, the ability to observe the behaviors of aquatic species is far more difficult. This difficulty is further compounded when dealing with a wide-ranging aquatic species with an exceedingly small population, as with the pallid sturgeon. Thus, adaptive management is an approach that can address various biological responses of threatened and endangered species, and other rare species to changes in the Corps' MR, BSNP, and KR Operation or habitat restoration projects.

The Service recognizes that because of the complexity of this large river system, various flow alterations may provide more immediate benefits to some listed species, while other alterations would benefit other listed species. Over the long-term, however, ensuring variable river flows and processes should provide the range of conditions necessary to support self-sustaining populations of all the species under consultation. Variability is essential to the integrity of the river ecosystem (Richter et al. 1998, Galat and Lipkin 1999). Therefore, any river operation

program followed by the Corps must be based on the need to maintain variability. Adaptive management is an important and effective way to insert variability and flexibility in river operations, taking maximum advantage of the inherent variability of precipitation and runoff within the river system.

The Corps and the Service agree that subsequent resource management actions in the Missouri River shall be pursued within an adaptive management framework that embraces the uncertainties of ecosystem responses and attempts to structure management actions to best address those uncertainties, recognizing that learning is a critical outcome. Halbert (1993) notes that "adaptive management treats all management actions as deliberate experiments ... to sort out system process." In that regard, adaptive management is viewed as a continuous process of actions based on testing, evaluating, informing, and improving. It will be the basis from which the Service can identify and evaluate performance.

This RPA will describe the framework for an adaptive management approach to the Corps' river operations and maintenance along the Kansas and Missouri rivers to avoid jeopardy to listed species and facilitate their eventual recovery. This approach will include a regular regime of discussion, information exchange, evaluation and reevaluation, and monitoring between the Corps and the Service. The general management actions identified in this opinion as part of the current project descriptions and as the RPA, likely will be conducted, modified and continually improved upon through adaptive management.

The Corps, in cooperation with the Service, shall identify and describe the specifics of implementing and modifying management actions needed at any given time. The specific methods of implementing the management actions may vary yearly and monthly as necessary to adapt to changing river conditions. Modifications to management actions shall be based on an evaluation of habitat, flow, climate, species response and other information that is available each year. The Corps shall address implementation of those actions through meetings held jointly with the Service at least twice a year, or more frequently if needed. Monitoring shall be used to document how management actions were implemented and their effects within the river and on listed species. Monitoring species responses shall be necessary to determine progress towards species survival. The agencies shall jointly determine what is sufficient progress within specific timeframes that will indicate that the Corps' actions are avoiding jeopardy. Specific recommendations incorporating the adaptive management approach are included in the following elements of the Reasonable and Prudent Alternative.

A. **Agency Coordination Team (ACT):** An essential component of this RPA is establishment of an agency coordination team (ACT) that will serve to guide development and implementation of future river management measures to benefit listed species consistent with the Corps' statutory responsibilities. While some management actions will have more immediate benefits to listed species, all are important components of a comprehensive river operation program to prevent jeopardy and facilitate recovery. Those actions that contribute to flow variability, creation of dynamic sandbar and in-channel habitats, and those that provide triggers for reproductive response are the highest priorities, although they may take several years to implement. Physical habitat restoration, another essential component to avoid jeopardizing the tern, plover and sturgeon, may be implemented more quickly.

Therefore, the Corps shall work with the Service to immediately establish an agency coordination team (ACT) to identify and implement the goals of this Biological Opinion. That team will be responsible for ensuring implementation of future conservation measures; tracking, evaluating, and documenting the results of those measures; and tracking and documenting sufficient progress in conserving listed species. The initial point of contact will be the Reservoir Control Center Chief for the Corps and the North Dakota Field Supervisor for the Service. The ACT should involve additional agencies or groups, as appropriate, with biologic and engineering expertise, such as the MRNRC, MRBA, and Tribes.

The ACT shall jointly develop targets against which they can evaluate whether the Corp is making sufficient progress toward avoiding jeopardy, increasing species status and/or habitat conditions, or implementing effective conservation actions. Progress toward each target shall be evaluated semi-annually. Species responses to management actions, however, are not likely to be immediately detectable. It may take many years to see a positive species response due to difficulties in monitoring the species, particularly the pallid sturgeon; the time necessary to recreate essential river processes and habitats; the biologic "lag time" between environmental stimulus and biologic response; and the variability in climatic conditions that may delay reproductive triggers, habitat restoration, or cause other temporary setbacks in reproductive success of listed species. Therefore, targets for evaluating success shall be based on a combination of short-term physical changes in river conditions plus longer-term changes in listed species survival and reproductive success.

Coordination Meetings: As discussed above, the ACT shall meet, at a minimum, twice each calendar year (March and October) to develop an action plan for the upcoming year; to evaluate the responses/effects of the previous year's actions; and to use this information to make necessary alterations in the upcoming year's management actions. The action plan shall describe in detail the range and frequency of necessary management actions to avoid jeopardy. Those actions shall be subject to further evaluation and modification by both agencies as management "experiments" are undertaken in future years. Additional coordination (e.g, meetings, conference call) shall occur as needed to address issues requiring immediate attention. Following coordination with the Service, the Corps should plan an organizational meeting of ACT for March 2001.

At the March meeting, the ACT shall develop a river management plan for the upcoming months based on river conditions, climatological forecasts, and progress over the previous years. That plan shall identify situations/conditions that create opportunities for improving river conditions for the listed species and shall designate more specific recommendations for river operations that the Corps shall implement should those situations occur. For example, opportunities for increasing spring flows may be greatest during years with above normal water levels/project inflow in the reservoirs and low to moderate river flows and precipitation in the lower basin. Alternatively, if specified spring flows have occurred during the past several years, there may be no need to discharge high flows the following spring, particularly if system inflow is low.

The purpose of the October meeting is to evaluate information on river operations conducted that year and the species' responses, changes in habitat conditions, changes in timing and volume of flows, and changes in river use, etc. Those actions that create a positive species response or positive change in habitat conditions will be continued or changed for the upcoming year based on meeting specific biological goals.

The ACT shall also determine whether actions were implemented as agreed to at the beginning of the year. They shall document improvements in listed species status or of specific river conditions, and whether sufficient progress has been made towards avoiding jeopardy. At the meeting, the Service and the Corps shall also identify potential operational changes or other management actions that likely will be needed in the upcoming year. The management plan shall then be revised as necessary in the March meeting of the following year.

B. **Endangered Species and Habitat Monitoring Program:** The Corps has the primary responsibility for, and shall monitor the biologic resources and responses of threatened and endangered species to changes in the Missouri and Kansas River operations, maintenance, or habitat restoration projects. Monitoring is needed to assess the biologic value of the Corps' management decisions. The Corps, in cooperation with the Service, shall develop a comprehensive threatened and endangered species monitoring plan within 1 year of the date of this opinion. The ACT shall serve as a forum to help accomplish this task. The Corps is to be commended for the comprehensive least tern and piping plover monitoring program it has implemented, providing state-of-the-art information on habitat and birds critical to river management decisions.

For many years, the Service has identified the need to collect comprehensive, long-term natural resource data on the river to guide management. This includes using long-term monitoring in conjunction with focused investigations to provide an adequate database to evaluate the biologic effects of additional changes to flow management. Annual progress reports are an integral and required part of the monitoring program or restoration of riverine habitats.

Monitoring of least terns, piping plovers, and pallid sturgeon shall require the Corps to apply for authorization under section 10 of the ESA. The section 10 authorization will address potential take resulting from the monitoring program.

C. **Annual Report:** The Corps shall provide an Annual Report on threatened and endangered species conservation activities to document compliance with the provisions of the Biological Opinion. This report shall document results of monitoring for each species and their habitats and the progress in implementation of the elements of the reasonable and prudent alternative, terms and conditions for implementation of reasonable and prudent measures to minimize take, and conservation recommendations. This report is similar to reports completed under the 1990 Biological Opinion and ESA subpermitting requirements. Specific monitoring components to be included in this report are addressed in the ecosystem RPAs for multiple listed species, RPAs for individual species, and the RPMs. The report shall be due December 31 of each year. Additionally, this report will provide the Service,

ACT, States, Tribes, Missouri River Natural Resources Committee, Missouri River Basin Association, and other parties information necessary to evaluate the effectiveness of the Corps' actions.

Prior to implementing plover management strategies for each operating year, the Corps shall demonstrate that the planned System operations and the management strategies will satisfy the elements of the reasonable and prudent alternative, reasonable and prudent measures, and meet fledge ratio goals. The Corps shall provide this information to, and/or meet with, the Service during development of the draft AOP in the fall and after March 1 when the runoff forecast is made. We anticipate that this will provide enough time to plan or implement operational scenarios that will be necessary for the new operating season.

II. Flow Enhancement

C. Other Segments

Through adaptive management, the Corps shall investigate the applicability of flow enhancement at Garrison by 2005 and implement, if appropriate.

III. Unbalanced Instrasystem Regulation

Currently, the Corps "balances" the amount of water in storage in the three largest Upper Missouri River main stem system lakes, i.e., Fort Peck Lake (Segment 1), Lake Sakakawea (Segment 3), and Lake Oahe (Segment 5). This does not mean that the amount of water in storage is always directly proportional to the total storage capacity in these three lakes. Instead, it means that the water is distributed to meet the authorized project purposes in an efficient manner. For example, extra water is retained in Fort Peck Lake and Lake Sakakawea going into the winter so that this water can be available for winter power generation needs. However, at some time during the year, the amount of water is approximately proportionally distributed among those three lakes.

In recent years, the Service has regularly supported unbalanced intrasystem regulation via its comments on the Annual Operating Plans to improve reservoir young-of-year fish production and survival, and increase habitat and productivity of threatened and endangered species. This unbalancing consists of lowering the storage in one lake by approximately 3 ft (.9 m), holding the level constantly low in the second lake (drawn down the year before), and raising the level in the third lake at least 3 ft (.9 m) to inundate the vegetation that grew around its rim the prior year (held at a constant lower elevation than normal the year before). This three-lake cycle would rotate among the upper three lakes on a 3-year cycle.

The Corps indicates that two factors, both related to the inflows to the main stem system, would "shut off" the purposeful unbalancing of the three lakes. First, high inflows associated with an Upper Quartile or Upper Decile year could result in one or more of the lakes rising into its/their exclusive flood control zones. When this happens, system operations would revert to the balanced mode to limit the duration and extent of filling of the exclusive flood control zone. Second, and in a contrasting situation, an extended drought often associated with lower quartile or lower decile years would also "shut off" the unbalancing. A threshold elevation in the upper part of each multiple use zone (that zone containing the water to be used to meet project purposes

during droughts) would be designated as the trigger below which the system would revert to the balanced mode. The unbalancing would restart the year after the system refilled to levels above the prescribed threshold elevations. The threshold elevations would be developed through coordination with ACT, the MRNRC, and specifically, the upper three basin states' game and fish departments.

The Service believes that unbalanced intrasystem regulation of the upper three reservoirs is an integral element of the reasonable and prudent alternative to avoid jeopardy to the least tern, piping plover, and pallid sturgeon. Unbalanced intrasystem regulation of the reservoirs enhances both the creation and availability of nesting and foraging habitats of the least tern and piping plover in the reservoir reaches (Segments 1, 3, and 5) and the river reaches below Fort Peck Dam (Segment 2) and below Garrison Dam (Segment 4). It also enhances conditions for the pallid sturgeon in Segment 2. In the first year of the unbalanced cycle, releases from the lake being drawn down must be higher than normal to ensure the drawdown. Additional shoreline and island habitat for nesting terns and plovers becomes available on the lake being drawn down. The higher releases provide some semblance of a natural hydrograph in the river reach, and, thus, provide spawning cues for native fish (e.g., pallid sturgeon in Segment 2), enhance backwater areas, and scour vegetation inundated on the sandbars. In the second year, when the same lake is being held at a constant lower level, the releases are somewhat lower than they were the previous year. Additional habitat for terns and plovers is available on both the reservoir being held stable and the river reach below the dam. During the third year when the same lake is raised to inundate vegetation for spawning and nursery habitat for reservoir fish, the releases from the dam are even lower yet, thus exposing additional barren sandbars on the river reach below. Some vegetation encroachment on the previous years sandbars is likely. Preliminary results of Corps' models for unbalanced intrasystem regulation for the Master Manual indicate that benefits to least terns and piping plovers will occur from increases in acres of suitable habitat on the upper three reservoirs and on river reaches below Fort Peck and Garrison Dams (R. McAllister, pers. comm. 2000).

As part of the RPA, the Corps shall implement unbalanced system regulation as described above on the upper three main stem reservoirs beginning in 2001 if system storage and runoff conditions are suitable. Implementation shall occur on annual basis dependent on the storage in those lakes and projected runoff conditions, and shall be coordinated with ACT, MRNRC, and the upper three basin states' game and fish departments to insure other appropriate issues (e.g., smelt spawning criteria) are considered. The goal shall be to unbalance one of the upper three reservoirs each year on a 3-year cycle.

IV. Habitat Restoration/Creation/Acquisition

The Service's 1994 Draft Biological Opinion on the Master Manual documented actions to restore river functions and habitats, as well as target acreages, and provides the foundation for targets for the current consultation. Additional restoration actions have been documented in a Missouri River Natural Resources Committee document entitled "Restoration of Missouri River Ecosystem Functions and Habitats" adopted by the Missouri River Basin Association as part of their Missouri River Planning Document. The Service's current recommendations for habitat restoration follow.

Corps' programs and authorities already exist to implement most, if not all the structural and non-structural modifications and changes in water management needed to restore Missouri River habitats. Those include, but are not limited to, the following: BSNP, BSNP Fish and Wildlife Mitigation Project, Section 1135, 206 and Section 33 Programs, Flood Control Act of 1938, Missouri National Recreation River, Master Manual, Annual Operating Plan, and section 7(a)(1) of ESA. The Corps shall pursue any additional authorizations, appropriations, or partnerships it believes are necessary to implement this portion of the RPA. Other programs, such as the Service's Big Muddy National Fish and Wildlife Refuge, and the NRCS' Wetland Reserve and Emergency Wetland Reserve Programs may also contribute to habitat restoration goals when the Corps works in concert with those programs to leverage its habitat restoration efforts.

Continued survival of listed species depends on restoration of riverine form and functions, as well as some semblance of the pre-development or natural hydrograph. Missouri River habitat restoration is, therefore, multi-faceted, and involves a combination of reservoir operational changes (e.g., hydrograph and temperature), structural modifications (e.g., chute restoration), and non-structural actions (e.g., floodplain acquisition or easements). The maximum benefits of physical habitat projects to listed species can only be realized when coupled with complementary hydrology. The following habitat elements of the reasonable and prudent alternative act together with the other elements as a functional unit to ensure the continued existence of the least tern, piping plover and pallid sturgeon.

Habitat management efforts will vary by species, habitat needs, opportunity, river segment, and year depending on water conditions. The health and status of listed populations and their habitats, and the opportunities to further their conservation are not uniform throughout the basin and, therefore, warrant varying levels of management effort and priority within each of the 16 designated river or reservoir segments. Thus, the Service developed a reasonable, flexible process to prioritize actions within a river segment.

Prioritization of habitat or other actions to benefit/preclude jeopardy to threatened and endangered species in each segment must consider the current status of the population of the species, condition and availability of habitat, needs associated with the species and habitats, and realistic management opportunities to improve the status and condition of the species and its habitats. Management direction provided by species' Recovery Plans also must be considered. Designation of a priority classification for species within each segment will provide flexibility and help focus management on those species where the need and opportunity most exists.

Therefore, to address these factors in the prioritization process, the Service and Corps developed a matrix to help provide direction within each segment of river, as well as an efficient, logical framework for the implementation of management actions to benefit or help recover threatened and endangered species. Species/habitat needs (biology) and management opportunities for each species within a reach were respectively characterized as either high, moderate, or low and combined into a matrix to yield either a high, moderate, or low priority for management of the species in a particular segment (Table 8). In general, this designation means that implementation of positive actions to benefit a particular species either will be a "high, moderate, or low" priority in the river segment. However, low priority does not mean that a species is ignored, but that, in general, management opportunities for the species in that segment are meager and would provide

little return to the resource. An obvious long-term goal would be to strive to elevate the low and moderate priorities to a higher status over time. Management actions in one segment may greatly influence other segments and therefore, add to the priority of that particular segment.

Although currently the lower Missouri River Segments 11-15, the Kansas River Segment 16, and the Missouri River Segment 2 have minimal habitat for nesting terns or plovers because of inundation, through adaptive management, the Corps and the Service may identify future opportunities to improve conditions in those areas to benefit the least tern and piping plover.

The same can be said of currently developing deltas in the Missouri River reservoir segments 1, 6, and 7 .

B. Restoration of Emergent Sandbar Habitat:

B.1 Natural Habitat: Natural tern and plover nesting habitat shall be provided as a priority and other management actions implemented to create and maintain tern and plover habitat at levels seen on Segments 4, 8, 9, and 10 in 1998, and provide a diversity of shallow water habitats for refugia also beneficial to pallid sturgeon and other native fishes. Accordingly, the Corps shall, through flow regulation or other means provide for this sandbar habitat in complexes of various sizes in totals as noted below. The habitat should be available to nesting birds at a minimum of one out of three years. (The habitat goals on the Missouri River would be waived during years when the ACT, through the adaptive management process, recommends the Corps release high flows for habitat creation and/or other ecosystem/listed species benefits.)

a) (2005) Minimum emergent interchannel sandbar habitat acres on average per river mile during the nesting season shall be as follows: Gavins Point - Segment 10 (40 ac [16.2 ha]), Garrison - Segment 4 (25 ac [10 ha]), Fort Randall - Segment 8 (10 ac [4 ha]), and Lewis and Clark Lake - Segment 9 (40 ac [16.2 ha]) to be measured in late July. This emergent sand shall be comprised of a minimum 60 percent dry sand.

b) (2015) Minimum emergent interchannel sandbar habitat acres on average per river mile during the nesting season shall be as follows: Gavins Point - Segment 10 (80 ac [32 ha]), Garrison - Segment 4 (50 ac [20 ha]), Fort Randall - Segment 8 (20 ac [8 ha]), and Lewis and Clark Lake - Segment 9 (80 ac [32 ha]) to be measured in late July. This emergent sand shall be comprised of a minimum 60 percent dry sand.

c) (2003) The Corps will complete 1998 baseline habitat evaluations on the Missouri River below Fort Peck - Segment 2 and by 2015 meet minimum baseline emergent sandbar acres. This habitat shall exist during the late July period. This emergent sand will be comprised of a minimum 60 percent dry sand.

Desirable Habitat Conditions: Optimum habitat has been described as a complex of side channels and sandbars with the proper mix of habitat characteristics required by the birds. Such sandbar complexes provide higher regularly scoured habitat for nesting and brood rearing and shallow pools and wetted perimeters for foraging. Single, large, unbraided monotypic sandbars with

linear shorelines rarely provide these conditions because they often remain above the scour zone and the associated channels and chutes are often deep and provide little opportunity for foraging. Sandbar complexes suitable for least terns and piping plovers must provide two basic needs, food and security, during the nesting and brood rearing seasons. The Service recommends the following physical conditions for nesting habitat, brood rearing habitat, and foraging habitat.

Nesting Habitat:
a) Substrate – Nesting substrates consist of well draining particles ranging in size from fine sand to stones < 1 in. (2.5 cm) in diameter.

b) Size/Shape – Nesting areas should be a minimum of 1 ac (.4 ha), preferably 10 ac (4 ha); circular to oblong in shape, maximizing surface area; recommended slopes of 1:25 with maximum slopes not exceeding 1:10; surface height above water to exceed 18 in. (45.7 cm) at nest initiation.

c) Visibility – Smooth topography with < 10 percent early successional vegetation.

Brood Rearing Habitat:
a) Substrate – Same as nesting substrate but may contain fine silts, organic detritus, and other unconsolidated fine particulate matter.

b) Size/Shape – Brood-rearing areas should be 3-5 times larger than the nesting area; very irregular in shape, maximizing shoreline to water interface; recommended slopes of 1:25 with maximum slopes not exceeding 1:10.

c) Visibility – Vegetation can increase up to 25 percent ground coverage but should occur in a patchy pattern.

d) Connectivity – Brood rearing areas must occur connected to nesting areas or immediately adjacent and separated only by shallow channels (< 1 in. [2.5 cm] deep) or mud flats.

Foraging Habitat:
a) Substrate – Least terns require shallow, slow velocity water that provides habitat for schooling baitfish that are 0.5 – 3.0 in. (1.3-7.6 cm) in length. Piping plovers require wetted sand zones consisting of ephemeral ponds < 0.5 in. (1.3 cm) deep, nutrient enriched lagoons, swash areas, and braided shallow channels. Substrates range from large grained sand to heavy silts.

b) Size/Shape – Foraging habitat should comprise 40 percent of the brood rearing habitat for piping plovers.

c) Connectivity – Least tern foraging areas should not be greater than 438 yds. (400 m) from the brood rearing areas. Piping plover foraging areas must occur connected to nesting areas or immediately adjacent and separated only by shallow channels (< 1 in. [2.5 cm] deep) or mud flats.

B.2. Reservoir Habitat:

Between 1986 and 2000, nearly 44 percent of piping plovers and 27 percent of least terns were recorded on reservoir habitats during the adult census (C. Kruse, pers. comm. 2000). Productivity surveys have shown reservoir habitat significantly contribute to plover and tern recruitment, particularly during drought or low runoff years when reservoir elevations are lower and habitat is more abundant. In 2000, 223 piping plover chicks fledged from Lake Sakakawea (fledge ratio 1.61 chicks per pair) and 102 from Lake Oahe (fledge ratio 1.46 chicks per pair). A piping plover fledge ratio of 2.45 chicks per pair and a least tern fledge ratio of 2.33 chicks per pair were achieved on Lewis and Clark Lake in 1998 with 103 and 140 chicks fledging respectively (C. Kruse, pers. comm. 2000). Since listing the species, the Service has recognized the difficulty in managing water levels on both the reservoir and lotic segments of the river. Recently, through efforts of the Corps and with more intensive monitoring, data has shown that reservoir habitats provide a vital resource for the birds, especially during periods of substantial pool fluctuations as have occurred since the mid-1990s. Management opportunities being investigated by the Corps, including protection of peninsular habitat, overburden removal, island construction, and water control structures may provide long-term habitat to support least terns and piping plovers on the reservoirs.

Therefore, the Service believes the Corps should continue its investigations into the value of reservoir habitats and into opportunities to enhance these habitats for least terns and piping plovers. The Service recognizes that if opportunities can be developed, reservoir habitat may provide a significant level of the habitat necessary to meet the aforementioned recruitment rates and populations goals for terns and plovers on the Missouri River.

a) (2001) The Corps shall maintain reservoir habitats for least terns and piping plovers through intra-system regulation.

b) (2005) The Corps shall have identified all potential habitat enhancement on reservoir segments (Segments 1, 3, and 5).

c) (2010) The Corps shall have completed 25 percent of the reservoir projects identified in letter b above.

d) (2015) The Corps shall have completed 50 percent of the reservoir projects identified in letter b above.

e) (2020) The Corps shall have completed 100 percent of the reservoir projects identified in letter b above.

B.3. Artificially or Mechanically Created Habitat: When habitat goals listed in IVB(1) are not met through flow regulation (i.e., 40 acres/mile on Gavins Point by 2005), and tern and/or plover fledge ratio goals have not been met for the 3-year running average, other means (e.g., creation of habitat) will be necessary to ensure the availability of habitat to meet fledge ratio goals. Created habitat shall be established to supplement natural habitat required by element B(1) above. The habitat shall be created following the desirable habitat parameters listed above in element B(1). Suggested management techniques for habitat creation include: (1) replenishment or nourishment of river sandbars and islands; (2) creation of suitable nesting habitat in reservoir depositional zones; (3) creation or enhancement of shallow and backwater areas, off-channel chutes, and flats as foraging habitat; (4) removal of early successional vegetation from nesting areas; (5) peninsular cutoffs or island creations in reservoir side bays; and (6) dike construction to dewater reservoir side bays for nesting and foraging habitat. Created habitat shall be monitored for available forage for piping plovers. If plover forage is inadequate, habitats shall be supplemented with acceptable forage.

Initiation of Sediment Transport/Habitat Studies: The Corps shall initiate other studies as appropriate to research the long-term effects of riverbed changes/sediment transport and their impact to tern and plover nesting habitat, forage availability, and forage areas. The results of these studies shall be reported each year in the annual report and considered and included in operations as appropriate.

The Corps shall research and develop a way to restore the dynamic equilibrium of sediment transport and associated turbidity in river reaches downstream of Fort Peck (Segment 2), Garrison (Segment 4), Fort Randall (Segment 8), and Gavins Point Dams (Segment 10), and stop or reverse bed degradation of the river. Sediment input is necessary to restore instream habitats and turbid waters. Initially, the Corps should determine the sediment deficit from natural conditions and the functional quantities needed to restore instream sandbars, and implement a pilot project at one of the main stem dams.

Options to achieve sediment transport might include sediment bypass pipelines or physical deposition of sediments at the face of dams. Sediment bypass around large dams is feasible (Singh and Durgunoglu 1991). Bed degradation below dams and head cutting at the mouths of tributaries might be addressed with grade control structures. Weir notches at grade control structures would allow for fish passage to the tributaries. Because of the large sediment deposition zone at the upper end of Lewis and Clark Lake and its proximity to Gavins Point Dam, Gavins Point may provide the best opportunity for a pilot study.

The Corps also should restore turbidity to functional levels downstream of Fort Peck, Fort Randall, and Gavins Point Dams. Turbidity will increase with actions taken to restore sediment transport; however, additional measures may be needed if reintroduced sediments are clean of small particulate matter that needs to be resuspended. Through the ACT, the Corps, in cooperation with the Service, shall develop a study plan by 2002 and initiate studies by 2003 with a completion by 2005.

D.**Monitoring of Tern and Plover Nesting Habitat:** The Corps shall monitor and map, on a periodic basis (at least every 3 years), all essential tern and plover nesting habitat on the Missouri River as identified. The mapping information, in conjunction with the Corps' Habitat Conservation and Recovery Project, will be used to determine tern and plover habitat available under different operating scenarios and to assist in establishing and implementing management actions to meet fledge ratio goals. Mapping products or updates on data collection will be provided in the annual report (see Annual Report under Adaptive Management RPA).

RPA ELEMENTS APPLICABLE TO SPECIFIC SPECIES

V. Piping Plover

In addition to the above "multi species" elements of the RPA, the following elements are necessary to provide successful reproduction and recruitment of the least tern and piping plover and offset jeopardy.

A. **Kansas River**: The Kansas River (Segment 16) shall be operated to provide overall benefit to the conservation of least terns and piping plovers. Decisions concerning operations of the Kansas River for terns and plovers will occur through ACT. To facilitate decision making on Kansas River terns and plovers, the Corps shall collect and evaluate productivity, habitat, and other pertinent data to identify whether the Kansas River provides a source or sink for least terns and piping plovers. A study plan shall be developed and agreed upon by the Service and Corps through ACT by 2002. An evaluation to this effect will be made by the Corps by 2005.

B. **Habitat/Fledge Ratio Goals:** Habitat shall be provided as a priority and other management actions implemented to meet or exceed fledgling per pair ratio goals of 0.70 for least terns and 1.13 for piping plovers. These are to be determined as the recent (past) 3-year running average (i.e., if the past 3-year least tern fledge ratios were 0.20, 1.90, and 0.00, tern fledge ratios would be met for those years). However, the Corps would have to take steps to ensure that a fledge ratio of at least 0.20 did occur in the following year to maintain the average. These fledge ratios have been superceded by those found in the incidental take statement of this document (amount or extent of take anticipated).

Piping Plover Foraging Ecology Study: The take associated with the loss of forage for piping plovers has never been addressed. Therefore, before the end of 2005, the Corps shall initiate and conduct a piping plover foraging ecology study on the Missouri River to document forage abundance and richness, and forage availability during the nesting season and impacts of operations on foraging. Subsequently through adaptive management, system operations can be modified to reduce impacts on plover forage and forage availability, and reduce take. The scope of the study shall be developed and agreed upon by the Service and the Corps through ACT by 2002. The results and management implications of the study shall be coordinated between the Service and the Corps through adaptive management.

New RPA Elements From the Corps' 2003 Biological Assessment

The following text is incorporated from the Corps' November 2003 Biological Assessment and constitutes the Corps' description of the elements they offered to the Service in lieu of the RPA II. A. (Flow Enhancement, Gavins Point):

Description of the Corps' Alternative to the Gavins Point RPA (Proposed Action).

a. **Drought Conservation Measures**. During extended drought periods, or those lasting more than 1 year, the duration and level of navigation service would be modified at higher storage levels under the proposed action than under the CWCP. Additional details of this feature will be provided during consultation.

b. **Unbalancing of the Upper Three Lakes**. The Corps has the authority under the existing Master Manual and currently implements intrasystem unbalancing. Unbalancing of the lakes was also included as a feature of the 2000 Biological Opinion RPA. Unbalancing under this proposed action consists of a set pattern 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.

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. 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 10 describes the 3-year cycle of lake unbalancing.

During the low year at a lake, the goal of the Corps would be to begin the runoff season on March 1 with a low lake elevation 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 be at a low elevation the following year as the cycle repeats.

c. **Gavins Point Dam Summer Releases**. Summer releases under the proposed action will be adjusted when the Corps determines that birds have begun nesting. Flow support for navigation and other downstream purposes would 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 navigation service support in August when tributary inflows have declined (steady-release); or by some combination of the two methods, as was implemented during the 2003 nesting season (steady-release – flow-to-target). The modeling done for the Missouri River Master Manual Review and Update process 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.

Adaptive management will be used to make decisions about the method to use during any given year and will 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.

The evacuation of floodwaters would be delayed until mid-September whenever possible to minimize the impacts to the young-of-year native river fish. 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. Additional measures to minimize losses of the two listed bird species are taken by the Corps. Further details regarding these measures can be found in Appendix B, page 6.

2. **Research, Monitoring, and Evaluation**. As indicated above, the Corps proposes to operate the System using adaptive management including a robust research, monitoring and evaluation (RM&E) program and a re-evaluation of the science on flow modifications and other potential actions in three years.

    a. **Regional Population Assessments**

1) **Interior Least Tern and Piping Plover.** In addition to the population assessment and monitoring efforts on the Missouri River being conducted in response to the 2000 Biological Opinion, the Corps will develop and support a regional coordination process for the Missouri River piping plovers and least tern subpopulations. 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. Further information regarding this proposed action can be found in Appendix B, page 23, 2000 Biological Opinion.

b. **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 to which additional habitat can be constructed with flows into Lewis and Clark Lake, 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.

1) **Gavins Point Reach Fall Test**. In the fall a flow test will be run in the river reach downstream from Gavins Point Dam after refill of the system following the current drought, and would be conducted 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. This test would also provide a greater understanding of the benefits/impacts associated with any alternative release scenario from Gavins Point Dam. Further discussion of this flow test can be found in Appendix B, page 10, 2000 Biological Opinion.

2) **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. This test would 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 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. The test 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. Further discussion of this flow test can be found in Appendix B, page 11, 2000 Biological Opinion.

3) **Gavins Point Spring 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, there will be additional releases in excess of those 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. Further discussion of this flow test can be found in Appendix B, page 12, 2000 Biological Opinion.

4) **Fort Peck Tests**. The 2000 Biological Opinion included release changes from Fort Peck Dam as a component of the RPA. Prior to full implementation of this release change, the RPA included two tests, the "mini test" and the "full test." The Corps' proposed action includes conducting these two tests. Preliminary biological data collection is essential to determine the responses and effects of the "mini" and "full tests" on pallid sturgeon and the target species that have been selected for this effort, and will provide science critical to recovering fish populations throughout the Missouri River Basin. After assessment of the results of these tests, and through the adaptive management framework, the Corps may implement a Fort Peck Dam release change as a component of System operations. However, this would require revision of the Water Control Plan. Additional information on the planned Fort Peck tests can be found in Appendix C, page 1, 2000 Biological Opinion.

3. **Accelerated Actions to Benefit the Species**.

a. **Shallow Water Habitat**. The Corps proposes to accelerate the construction of shallow water habitat surpassing the short-term goals recommended in the 2000 Biological Opinion. This action will be taken in the

lower river from Ponca State Park to the mouth. Additional information on existing and planned habitat development can be found in Appendix B, page 18, 2000 Biological Opinion.

5. **Three-Year Re-evaluation**. Consistent with the adaptive management approach, the Corps proposes that the status of the species, the scientific findings of the proposed robust RM&E program, the progress and success of other implemented measures to date, and other relevant new information be re-evaluated within 3 years following the issuance of a new Biological Opinion. This re-evaluation will inform decisions concerning implementation of additional measures or modification of existing measures and strategies, including potential flow releases out of Gavins Point Dam. The "3 year check-in" would include input from The Missouri River Recovery Implementation Committee (MRRIC) to promote conservation of listed species and the broader ecosystem values of the Missouri River.

REASONABLE AND PRUDENT ALTERNATIVE

PALLID STURGEON

The Service has determined that the Corps' proposed action, i.e. removal of the flow components of RPA element II.A of the 2000 Biological Opinion and the modification of RPA element II.B and the proposed substitute actions proposed in the 2003 Biological Assessment, and all other elements of the 2000 Biological Opinion that where applicable to pallid sturgeon will not reduce the likelihood of jeopardizing the pallid sturgeon in the wild. In order to be exempt from the prohibitions of take under section 9 of the ESA the Corps must implement the following elements of a new RPA, along with any new actions proposed in the 2003 Biological Assessment that are not modified here, and the remaining elements of the 2000 RPA that pertain to pallid sturgeon.

The Service provided the Corps with a reasonable and prudent alternative (RPA) in the 2000 Biological Opinion to alleviate the likelihood of their actions jeopardizing the pallid sturgeon. The Corps responded to the Service with a Biological Assessment in November of 2003 which described for the Service some 2000 RPA elements that they would delete (flow changes out of Gavins Point Dam and full implementation of flow changes from Fort Peck Dam) and some alternative elements that they believed would likely avoid jeopardizing the three species if done in conjunction with the other requirements of the 2000 Biological Opinion. As described in the preceding sections, the Service has analyzed those new proposed RPA elements in light of the ongoing elements of the 2000 Biological Opinion and the environmental baseline, and has determined that the proposed new RPA package (old RPA elements agreed to by the Corps plus the new RPA elements proposed by the Corps) does not avoid the likelihood of jeopardizing the pallid sturgeon. In this section, we summarize the applicable elements of the 2000 RPA package, the 2003 Amended elements that the Corps proposed and provide new

additional RPA elements. These additional RPA elements replace element II (Flow Enhancement) of the 2000 Biological Opinion and are described as elements VI-VIII.

Regulations (50 CFR §402.02) implementing section 7 of the Act define an RPA as an alternative action, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) is economically and technologically feasible; and (4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

The primary elements necessary to avoid jeopardy to listed species have not changed substantially since they were first outlined in the 1990 Biological Opinion, and later refined in the 2000 Biological Opinion. Information gained from experience during the last 13 years reinforces the need for immediate adoption of those elements.

The Service's 2000 Biological Opinion conclusion of jeopardy to the pallid sturgeon reflects degradation of the entire ecosystem. The intent of section 2(b) of the ESA is to focus attention on the conservation of the ecosystem upon which listed species depend. Such an approach is often not readily apparent in single species consultations for small or localized project areas, but is paramount in multiple-species consultations covering large regional areas. Research emphasizes the concept that recovery of endangered aquatic biota and biodiversity conservation must be pursued through an ecosystem approach (Blackstein 1992, Williams and Rinne 1992, Sparks 1995). This concept is particularly important given the wide-ranging nature of the species, geographic scope of this consultation, and the interrelatedness of the actions.

The reasonable and prudent alternative developed to avoid the likelihood of jeopardizing the continued existence of the tern, plover, and pallid sturgeon in the 2000 Biological Opinion included elements applicable to all three listed species in the ecosystem, as well as elements specific to each of the three species. In this section, we describe all the RPA elements applicable to pallid sturgeon. Under the terms and conditions implementing the incidental take statement, the Corps will be required to provide the Service an annual report which documents progress in the implementation of the reasonable and prudent alternative.

Because this Biological Opinion has found jeopardy to pallid sturgeon, the Corps is required to notify the Service of its final decision on the implementation of the actions of the reasonable and prudent alternative identified below. Additional clarifying language has been provide in the new elements discussed later concerning adaptive management.

I. Adaptive Management

Because the Corps has adopted this RPA element from the original 2000 RPA, and has indicated in their November 2003 Biological Assessment that they will adopt an adaptive management approach, below we modified the wording of the original RPA.

The Corps shall adopt adaptive management as one tool to preclude jeopardy to pallid sturgeon. Adaptive management is a process that allows regular modification of management actions in response to new information and to changing environmental conditions. Adaptive management is based on the premise that managed ecosystems are complex and inherently unpredictable. The complexity of the Missouri River ecosystem and management for fish and wildlife underscores the need for such an approach to ensure the variability and flexibility necessary to manage multiple species and be consistent with project purposes.

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 under consultation. This is especially true with the aquatic species of concern, the pallid sturgeon. Whereas direct observations of species' behaviors often occur for terrestrial species, such as the least tern and piping plover, the ability to observe the behaviors of aquatic species is far more difficult. This difficulty is further compounded when dealing with a wide-ranging aquatic species with an exceedingly small population, as with the pallid sturgeon. Thus, adaptive management is an approach that can address various biological responses of threatened and endangered species, and other rare species to changes in the Corps' MR, BSNP, and KR Operations or habitat restoration projects.

This RPA will describe the framework for an adaptive management approach to the Corps' river operations and maintenance along the Kansas and Missouri rivers to avoid jeopardy to listed species and facilitate their eventual recovery. This approach will include a regular regime of discussion, information exchange, evaluation and reevaluation, and monitoring between the Corps and the Service. The general management actions identified in this opinion as part of the current project descriptions and as the RPA, likely will be conducted, modified and continually improved upon through adaptive management.

The Corps, in cooperation with the Service, shall identify and describe the specifics of implementing and modifying management actions needed at any given time. The specific methods of implementing the management actions may vary yearly and monthly as necessary to adapt to changing river conditions. Modifications to management actions shall be based on an evaluation of habitat, flow, climate, species response and other information that is available each year. The Corps shall address implementation of those actions through meetings held jointly with the Service at least twice a year, or more frequently if needed. Monitoring shall be used to document how management actions were implemented and their effects within the river and on listed species. Monitoring species responses shall be necessary to determine progress towards species survival. The agencies shall jointly define sufficient progress within specific timeframes that will indicate that the Corps' actions are avoiding jeopardy.

Specific recommendations incorporating the adaptive management approach are included in the following elements of the Reasonable and Prudent Alternative.

a. Agency Coordination Team (ACT): An essential component of this RPA is establishment of an agency coordination team (ACT) that will serve to guide development and implementation of future river management measures to benefit listed species consistent with the Corps' statutory responsibilities. While some management actions will have more immediate benefits to pallid sturgeon, all are important components of a comprehensive river operation program to prevent jeopardy and facilitate recovery. Those actions that contribute to flow variability, creation of dynamic sandbar and in-channel habitats, and those that provide triggers for reproductive response are the highest priorities, although they may take several years to implement. Physical habitat restoration, another essential component to avoid jeopardizing the pallid sturgeon, may be implemented more quickly.

Therefore, the Corps shall work with the Service to immediately establish an agency coordination team (ACT) to identify and implement the goals of this Biological Opinion. That team will be responsible for ensuring implementation of future conservation measures; tracking, evaluating, and documenting the results of those measures; and tracking and documenting sufficient progress in conserving listed species. The initial point of contact will be the Reservoir Control Center Chief for the Corps and the North Dakota Field Supervisor for the Service. The ACT should involve additional agencies or groups, as appropriate, with biologic and engineering expertise, such as the MRNRC, MRBA, and Tribes.

The ACT shall jointly develop targets against which they can evaluate whether the Corp is making sufficient progress toward avoiding jeopardy, increasing pallid sturgeon status and/or habitat conditions, or implementing effective conservation actions. Progress toward each target shall be evaluated semi-annually. Pallid sturgeon responses to management actions, however, are not likely to be immediately detectable. It may take many years to see a positive species response due to difficulties in monitoring the pallid sturgeon; the time necessary to recreate essential river processes and habitats; the biological "lag time" between environmental stimulus and biological response; and the variability in climatic conditions that may delay reproductive triggers, habitat restoration, or cause other temporary setbacks in reproductive success of pallid sturgeon. Therefore, targets for evaluating success shall be based on a combination of short-term physical changes in river conditions plus longer-term changes in pallid sturgeon survival and reproductive success.

Coordination Meetings: As discussed above, the ACT shall meet, at a minimum, twice each calendar year (March and October) to develop an action plan for the upcoming year; to evaluate the responses/effects of the previous year's actions; and to use this information to make necessary alterations in the upcoming years management actions. The action plan shall describe in detail the range and frequency of necessary management actions to avoid jeopardy. Those actions shall be subject to further evaluation and modification by both agencies as management "experiments" are undertaken in future years. Additional coordination (i.e., meetings, conference call, etc.) shall occur as needed to address issues requiring immediate attention.

At the March meeting, the ACT shall develop a river management plan for the upcoming months based on river conditions, climatological forecasts, and progress over the previous years. That plan shall identify situations/conditions that create opportunities for improving river conditions for the pallid sturgeon and shall explore river operations that the Corps could implement should those situations occur. For example, opportunities for reducing flows from Gavins Point Dam for summer fish habitat may be greatest during drought years, and the sequence for reservoir unbalancing could target filling Fort Peck Reservoir first to expedite the Fort Peck test flows.

The purpose of the October meeting is to evaluate information on river operations conducted that year and the species' responses, changes in habitat conditions, changes in timing and volume of flows, and changes in river use, etc. Those actions that create a positive species response or positive change in habitat conditions will be continued or changed for the upcoming year based on meeting specific biological goals.

The ACT shall also determine whether actions were implemented as agreed to at the beginning of the year. They shall document improvements in pallid sturgeon status or of specific river conditions, and whether sufficient progress has been made towards avoiding jeopardy. At the meeting, the Service and the Corps shall also identify potential operational changes or other management actions that likely will be needed in the upcoming year. The management plan shall then be revised as necessary in the March meeting of the following year.

b. Endangered Species and Habitat Monitoring Program: The Corps has the primary responsibility for, and shall monitor the biological resources and responses of threatened and endangered species to changes in the Missouri and Kansas River operations, maintenance, or habitat restoration projects. Monitoring is needed to assess the biological value of Corps' management decisions. The Corps, in cooperation with the Service, shall develop a comprehensive pallid sturgeon monitoring plan within 1 year of the date of this opinion. The ACT shall serve as a forum to help accomplish this task.

For many years, the Service has identified the need to collect comprehensive, long-term natural resource data on the river to guide management. This includes using long-term monitoring in conjunction with focused investigations to provide an adequate database to evaluate the biologic effects of additional changes to flow management. Annual progress reports are an integral and required part of the monitoring program for restoration of riverine habitats.

c. Annual Report: The Corps shall provide an Annual Report to document compliance with the provisions of the Biological Opinion. This report shall document results of monitoring pallid sturgeon and the progress in implementation of the elements of the reasonable and prudent alternative, terms and conditions for implementation of reasonable and prudent measures to minimize take, and conservation recommendations. This report is similar to reports recommended under the 1990 and 2000 Biological Opinions and ESA subpermitting requirements. Specific monitoring components to be included in this report are addressed in the appropriate RPAs and the RPMs. The report

shall be due December 31 of each year. Additionally, this report will provide the Service, ACT, States, Tribes, Missouri River Natural Resources Committee, Missouri River Basin Association, and other parties information necessary to evaluate the effectiveness of the Corps' actions.

Prior to implementing pallid sturgeon management strategies for each operating year, the Corps shall demonstrate that the planned System operations and the management strategies will satisfy the elements of the reasonable and prudent alternative and reasonable and prudent measures. The Corps shall provide this information to, and/or meet with, the Service during development of the draft AOP in the fall and after March 1 when the runoff forecast is made. We anticipate that this will provide enough time to plan or implement operational scenarios that will be necessary for the new operating season.

II. Unbalanced Instrasystem Regulation

Because the Corps has adopted this RPA element from the original 2000 RPA, and has indicated in their November 2003 Biological Assessment that the system unbalancing will be incorporated into the Master Manual revision, below we modified the wording of the original RPA. Additional clarifying language has been incorporated in to the new elements discussed later relative to unbalanced regulation.

Currently, the Corps “balances” the amount of water in storage in the three largest Upper Missouri River main stem system lakes, i.e., Fort Peck Lake (Segment 1), Lake Sakakawea (Segment 3), and Lake Oahe (Segment 5). This does not mean that the amount of water in storage is always directly proportional to the total storage capacity in these three lakes. Instead, it means that the water is distributed to meet the authorized project purposes in an efficient manner. For example, extra water is retained in Fort Peck Lake and Lake Sakakawea going into the winter so that this water can be available for winter power generation needs. However, at some time during the year, the amount of water is approximately proportionally distributed among those three lakes.

In recent years, the Service has regularly supported unbalanced intrasystem regulation via its comments on the Annual Operating Plans to improve reservoir young-of-year fish production and survival, and increase habitat and productivity of threatened and endangered species. This unbalancing consists of lowering the storage in one lake by approximately 3 ft (.9 m), holding the level constantly low in the second lake (drawn down the year before), and raising the level in the third lake at least 3 ft (.9 m) to inundate the vegetation that grew around its rim the prior year (held at a constant lower elevation than normal the year before). This three-lake cycle would rotate among the upper three lakes on a 3-year cycle.

The Corps indicates that two factors, both related to the inflows to the main stem system, would “shut off” the purposeful unbalancing of the three lakes. First, high inflows associated with an Upper Quartile or Upper Decile year could result in one or more of the lakes rising into its/their exclusive flood control zones. When this happens, system operations would revert to the balanced mode to limit the duration and extent of filling of

the exclusive flood control zone. Second, and in a contrasting situation, an extended drought often associated with lower quartile or lower decile years would also "shut off" the unbalancing. A threshold elevation in the upper part of each multiple use zone (that zone containing the water to be used to meet project purposes during droughts) would be designated as the trigger below which the system would revert to the balanced mode. The unbalancing would restart the year after the system refilled to levels above the prescribed threshold elevations. The threshold elevations would be developed through coordination with ACT, the MRNRC, and specifically, the upper three basin states' game and fish departments.

The Service believes that unbalanced intrasystem regulation of the upper three reservoirs is an integral element of the reasonable and prudent alternative to avoid jeopardy to pallid sturgeon. Unbalancing enhances conditions for the pallid sturgeon in Segment 2. In the first year of the unbalanced cycle, releases from the lake being drawn down must be higher than normal to ensure the drawdown. The higher releases provide some semblance of a natural hydrograph in the river reach, and, thus, provide spawning cues for native fish (e.g., pallid sturgeon in Segment 2), enhance backwater areas, and scour vegetation inundated on the sandbars. In the second year, when the same lake is being held at a constant lower level, the releases are somewhat lower than they were the previous year. During the third year when the same lake is raised to inundate vegetation for spawning and nursery habitat for reservoir fish, the releases from the dam are even lower yet.

As part of the RPA, the Corps shall implement unbalanced system regulation as described above on the upper three main stem reservoirs beginning as soon as storage and runoff conditions are suitable. Implementation shall occur on annual basis dependent on the storage in those lakes and projected runoff conditions, and shall be coordinated with ACT, MRNRC, and the upper three basin states' game and fish departments to insure other appropriate issues (e.g., smelt spawning criteria) are considered. The goal shall be to unbalance one of the upper three reservoirs each year on a 3-year cycle.

III. Habitat Restoration/Creation/Acquisition

Because the Corps has adopted this RPA element from the original 2000 RPA, and has indicated in their November 2003 BA that the habitat restoration/creation/acquisition will be accomplished, below we modified the wording of the original RPA. Additional clarifying language has been incorporated into the new elements discussed later relative to habitat development.

The Service's 1994 Draft Biological Opinion on the Master Manual documented actions to restore river functions and habitats, as well as target acreages, and provides the foundation for targets for the current consultation. Additional restoration actions have been documented in a Missouri River Natural Resources Committee document entitled "Restoration of Missouri River Ecosystem Functions and Habitats" adopted by the Missouri River Basin Association as part of their Missouri River Planning Document. The Service's current recommendations for habitat restoration follow.

Corps' programs and authorities already exist to implement most, if not all the structural and non-structural modifications and changes in water management needed to restore Missouri River habitats. Other programs, such as the Service's Big Muddy National Fish and Wildlife Refuge, and the NRCS' Wetland Reserve and Emergency Wetland Reserve Programs may also contribute to habitat restoration goals when the Corps works in concert with those programs to leverage its habitat restoration efforts.

Continued survival of pallid sturgeon depends on restoration of riverine form and functions, as well as some semblance of the pre-development or natural hydrograph. Missouri River habitat restoration is, therefore, multi-faceted, and involves a combination of reservoir operational changes (e.g., hydrograph and temperature), structural modifications (e.g., chute restoration), and non-structural actions (e.g., floodplain acquisition or easements). The maximum benefits of physical habitat projects to listed species can only be realized when coupled with complementary hydrology.

Habitat management efforts will vary by life stage, habitat needs, opportunity, river segment, and year depending on water conditions. The health and status of pallid sturgeon and their habitats, and the opportunities to further their conservation are not uniform throughout the basin and, therefore, warrant varying levels of management effort and priority within each of the 16 designated river or reservoir segments. Thus, the Service developed a reasonable, flexible process to prioritize actions within a river segment.

To address the many factors of concern in the prioritization process, the Service and Corps developed a matrix to help provide direction within each segment of river, as well as an efficient, logical framework for the implementation of management actions to preclude jeopardy. Pallid sturgeon habitat needs and management opportunities within a reach were respectively characterized as either high, moderate, or low and combined into a matrix to yield either a high, moderate, or low priority for management in a particular segment. In general, this designation means that implementation of positive actions to benefit pallid sturgeon either will be a "high, moderate, or low" priority in the river segment. However, low priority does not mean that pallid sturgeon are ignored, but instead, management opportunities for the species in that segment are meager and would provide little return to the resource. An obvious long-term goal would be to strive to elevate the low and moderate priorities to a higher status over time. Management actions in one segment may greatly influence other segments and therefore, add to the priority of that particular segment.

As one element of the RPA, the Corps shall provide the quantity and quality of habitat on the Missouri and Kansas Rivers as described below.

a. Restoration of Submerged In-Channel Shallow Water Habitat in the Channelized River: The distribution of shallow water habitat in today's channel is much different than the historical distribution. In the pre-development channel much of the shallow water habitat was associated with mid-channel sandbars (braided channels), large side channels, and chutes, and was generally available over a wide variety of flows. In today's channel,

no shallow water habitat occurs in the middle of the channel, few chutes or side channels exist, and shallow water habitat is essentially confined to dike fields or the margins of point bars. For this reason, restoration of shallow water areas will have to concentrate on increasing shallow water in channel habitats out of the thalweg and dike fields if the navigation function is to be maintained.

The Corps has made progress in achieving the shallow water habitat goals in the 2000 Biological Opinion. According to the Corps in their 2003 Biological Assessment, the most immediate goal is the development of 2,000 new shallow water habitat acres between 2000 and 2005. The second milestone is the creation of 5,870 acres of shallow water habitat by 2010. Service recommendations for providing the quality and quantity of shallow water habitat on the Missouri and Kansas rivers in the 2000 Biological Opinion have not changed.

Using August as the template for average acres of shallow water, slow velocity habitat in the lower river, the Gavins Point reach (Segment 10) is the only river reach where current habitat conditions under CWCP exceeds 50 percent of the historical acreage.

Protection shall be afforded for those areas that have existing habitat (i.e., River Segments 2 and 10) by maintaining existing habitat values. Coordination with the Service on existing projects in these areas will help insure habitat values are not lost.

Performance Standards as described in the 2000 Biological opinion are restated below:

- The Corps shall ensure no-net-loss of existing shallow water habitat from operations and maintenance activities in the lower Kansas River and channelized Missouri River.

- (2001) The Corps shall develop habitat restoration plans and strategies to restore shallow/slow-water sandbar/island habitats in river segments 10 through 16. The plan shall identify existing habitats and restoration activities throughout the priority river segments. As part of the adaptive management process, the Corps, in cooperation with the Service, shall provide to the Service implementation plans and strategies and schedule for implementation.

- (2002) The Corps shall implement habitat restoration plans and strategies to restore and protect shallow/slow-water habitats, and begin mapping of important pallid sturgeon habitats (i.e. shallow/slow-velocity, gravel areas).

- (2003) The Corps shall continue implementation of habitat restoration plans and strategies to restore and protect shallow/slow-velocity habitats; and the Corps shall finalize mapping of priority river segments for pallid sturgeon habitat.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 8 percent (1,700 ac [688 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 10 percent (2,000 ac [810 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- (2010) Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 30 percent (5,870 ac [2,377 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 60 percent (11,739 ac [4,754 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

- Based on habitat measurements between mid-July and mid-August, the Corps shall have reached 100 percent (19,565 ac [7,924 ha]) of the shallow-water habitat goals identified in the Habitat Restoration/Creation/Acquisition element of the RPA.

The following elements were specific to the pallid sturgeon in the 2000 Biological Opinion and must be implemented as is or as modified by the Corps' proposed action as described in the November 2003 Biological Assessment.

IV. Pallid Sturgeon Propagation and Augmentation

Due to the lack of recruitment of pallid sturgeon into the wild population and the lack of fish for research purposes, the Service and the Pallid Sturgeon Recovery Team have developed and partially implemented propagation and augmentation plans for the pallid sturgeon populations to ensure the genetic integrity and prevent extinction of existing pallid sturgeon populations in the Missouri River. To partially offset jeopardy to the pallid sturgeon as a result of system operations, the Corps shall assist in pallid sturgeon propagation and augmentation efforts and subsequent monitoring of the stocked pallid sturgeon juveniles in those recovery priority areas in the Missouri River Basin that are identified in the Pallid Sturgeon Recovery Plan.

This program is being implemented and will be periodically evaluated. The Corps was tasked in the 2000 Biological Opinion with meeting the objectives, as stated below, with the cooperation, and under the supervision of the Service.

- The two agencies shall work cooperatively to capture, hold, and spawn at least nine female broodstock each year, with at least three females being used for propagation at each of the three designated pallid sturgeon propagation facilities (i.e., Blind Pony SFH, Gavins Point NFH, and Garrison Dam NFH), and subsequent release of the adult broodstock at the point of capture.

- The ultimate goal will be to produce a total of 4,700 juvenile to 1-year old pallid sturgeon (per year class) for subsequent stocking, which will include up to 50 juvenile representatives of nine family lots to maintain genetically diverse juveniles for future broodstock and refugia purposes (Table 23, 2000 Biological Opinion). The Corps' responsibility is the average annual shortfall of 2,973 fish. The annual details of the

stocking shall be developed and agreed upon by the Service, Pallid Sturgeon Recovery Team/Work Group, and the Corps through ACT during 2001.

- The two agencies shall work cooperatively on a day-to-day basis to increase the production, rearing, and release of pallid sturgeon juveniles into each priority area identified in the Pallid Sturgeon Recovery Plan to augment current efforts and achieve levels identified in stocking plans referenced above.

- The two agencies shall work cooperatively to monitor juvenile stocked pallid sturgeon to determine habitat use, distribution and movements, and survival, and guide future restoration/management efforts. The scope of the monitoring shall be developed and agreed upon by the Service and the Corps through ACT during 2001.

- The Corps and the Service shall meet annually through ACT where the Service will evaluate the level of success in meeting this RPA element.

V. Pallid Sturgeon Population Assessment

The endangered species and habitat monitoring program shall be designed to detect annual improvement in the ecosystem. This will be accomplished by documenting pallid sturgeon reproduction and recruitment, physical habitat improvements, improvements of the warm water benthic fishery (surrogate species), hydrograph improvements in form and function, improved water temperature regimes, and increased aquatic nutrient cycling, sediment transport, and in turbidity.

Pallid sturgeon population assessment shall include: (1) Total number of fish captured and tag number, (2) GPS coordinates of capture sights, distribution, recapture incidences and numbers, (3) channel and substrate mapping of the habitats used by the fish, (4) tributary use and concentrations by pallid sturgeon, (5) temperature, surface and bottom velocity, turbidity, and depth at capture locations, (6) length of fish frequency, (7) morphological measurements of fish and meristic counts, (8) species characterization utilizing morphological measurements, (9) genetic analysis of fish, and (10) productivity and recruitment. Additional information needs and priorities for the monitoring program should be developed through a cooperative effort between the Service, Corps, and Recovery Team. The population assessment information shall be included in the Annual Report referenced earlier under Adaptive Management.

To better direct management efforts at flow regulation and habitat restoration, the 2000 Biological Opinion tasked the Corps to the following, which still apply:

- Identify the causes for lack of reproduction, lack of recruitment, and hybridization and dependant on the limiting factor, initiate efforts to restore conditions that would restore reproduction, recruitment and minimize the occurrence of hybridization with shovelnose sturgeon. If and when appropriate data is gathered on pallid sturgeon populations and spawning habitat to warrant creation of spawning habitat, the Corps shall coordinate the initiation of these projects with the Service.

- Identify and map the location of gravel/cobble/rock substrates that may provide potential spawning habitat for sturgeon within the prioritized river segments. The habitat monitoring plan shall document locations and characteristics of known spawning habitat (i.e., physical substrate, depth, velocity, temperature, turbidity) and areas of potentially suitable spawning habitat. The Corps shall also determine if construction and maintenance activities would disturb or impact potential spawning areas and activities. By 2001, the Corps shall have implemented a study strategy, and by 2002 begun to map and delineate potential gravel/cobble/rock substrates.

- Incorporate modifications into channel training structure maintenance projects to maintain and improve aquatic habitat diversity (e.g, notching of wingdams, incorporating woody debris, etc.). Construction activities will continue to be coordinated with the Service and affected State resource management agencies.

- Participate with Service and partners to prioritize research needs and projects for the pallid sturgeon on an annual basis starting in 2000.

Implementation of the research monitoring and evaluation program for pallid sturgeon shall begin as described in the 2003 BA, in 2004 and the data collected will be reviewed by the Service, Pallid Sturgeon Recovery Team and Recovery Workgroups in order to develop priorities that would assist with research and recovery needs.

As part of the Annual Report due to the Service by December 31 of each year, the Corps shall describe progress made to avoid jeopardizing the pallid sturgeon and the results of research monitoring and evaluation.

New Reasonable and Prudent Elements of the 2003 Amended Biological Opinion

The following elements are a substitute for RPA II (Flow Enhancement) as well as additional elements that pertain to habitat development and adaptive management, Fort Peck temperature control, and must be implemented in concert with all other elements of the RPA as described in the 2000 Biological Opinion. Each of the elements described below are integral to each other and must be implemented in their entirety.

VI. Feasibility, Flow Development, and Adaptive Management

The intention of this element is to develop a flow regime that meets the needs of the species as described in element VII. Although the processes outlined below are described as individual steps it is intended that the pieces be developed in tandem and each individual piece together makes up the whole. The purpose of this element is to determine how flows can be provided that are essential for the survival of the pallid sturgeon not if the flows are necessary. It is the intent of this element to have information available and evaluated to implement element VII in March of 2006. Additionally it is intended that the adaptive management be a dynamic and ongoing process that results in action being implemented as data develops.

Biological Needs

The Service has recognized throughout this opinion that there is significant scientific uncertainty surrounding certain life history aspects of the pallid sturgeon. However, there is little debate that pallid sturgeon need a more normalized river, which includes the overlying hydrograph.

1. Feasibility and Flow Development

The following elements shall be completed within 2 years of issuance of this 2003 Amended Biological Opinion.

a) The Corps shall prepare and finalize a feasibility report which is comprised of several elements that address flow regimes, adaptive management, feasibility of various options, and impediments to implementation.

b) The Corps shall develop and complete studies to establish a long-term flow management plan for flow releases from Gavins Point Dam that will be implemented under the Master Manual. This study will establish, as minimum criteria, flows that provide sufficient magnitude, duration, frequency, and rate of change. The spring pulse shall be a bimodal release from Gavins Point Dam that provides for spawning cues and floodplain connectivity in the later spring and early summer. The flow plan shall also provide for a summer habitat flow that will optimize shallow water habitat, either naturally occurring or constructed. This flow plan shall be responsive to the hydrologic conditions in the basin based on system storage, winter precipitation, and the future projected precipitation based on probabilities from historical records.

c) The Corps shall evaluate the feasibility of the various alternatives for flow study outlined in element VI.1.a above. The purposes of this part will be to identify the methods that the Corps may use to provide flows necessary for the survival of the pallid sturgeon, determine impediments to implementing the flows necessary to ensure the survival of pallid sturgeon, and identify mitigation measures to address the impacts of removing impediments to implementation (e.g. floodplain easements, scouring easements, navigation off-sets).

d) The Corps shall establish an independent group of scientists that have expertise in the design, development, and implementation of adaptive management processes. This group will eventually be incorporated into the MRRIP to help guide that process. The Corps, shall collaborate with the Service and the USGS, in development of an adaptive management program that will: identify the scientific uncertainties surrounding the life history and conservation needs of pallid sturgeon, identify scientific experiments that can be implemented in the construction of the flow regimes that are to be developed above, design data collection and analysis methods and mechanisms to evaluate the experiments, identify the critical metrics against which decision-making can be made, the pathways to modify project

operations or additional experimentation if needed, depending on results. The adaptive management program developed shall be implemented in conjunction with the first flow modification from Gavins Point Dam in 2006, whether it is the one developed in the intervening 2 years or the one described below in element VII.1.a. This construct shall also apply to the Fort Peck flow enhancement program and the habitat development program.

e) The Corps shall modify operations based on the outcomes from the adaptive management program. The adaptive management program is an ongoing and dynamic process that results in change over time to improve the intended purposes of this RPA.

Justification
The Corps, in their proposed action, committed to a review of their action in three years based on information they collected and may possibly modify their action based on adaptive management. However, they were largely silent on how, when, what actions they might take, or the level of commitment to subsequent action depending on data and results. Due to some scientific uncertainty surrounding the pallid sturgeon and its critical population status in the wild, it is crucial to be able to respond to new information. In order to ensure the highest probability of success, experimentation and data collection must be collected in a structured, well thought out, and accurate manner. There is a need to develop information that will refine the Corps capability to manage flows for the needs of the pallid sturgeon. Prescriptive flows that are not flexible or responsive to the hydrology in the basin, both in terms of when hydrologic events may occur and the magnitude of the events, will not likely provide optimum conditions for the pallid sturgeon. A process to develop more refined criteria and remove the impediments that may exist for implementing certain aspects of flow modifications are critical to ensuring survival of the pallid sturgeon while minimizing impacts to other project purposes. Subsequent evaluation must be targeted to produce a management decision. Establishing an expert independent group of scientists to assist the Corps in developing an adaptive management program will help ensure the highest probability of success for implementation. This will help ensure the survival of the pallid sturgeon in the wild. It is important to realize that 3 years have passed since the 2000 Biological Opinion and RPAs were provided to the Corps. The Corps has not taken action in this area despite time available to develop an information base to act on.

VII. Flow Modification

Gavins Point downstream

Biological Needs
The Service has determined restoration of a normalized river hydrograph below Gavins Point Dam is still necessary to avoid jeopardizing the continued existence of the pallid sturgeon. Several biologically relevant features are needed in the reach. Flows to cue spawning that are sufficiently high for an adequate duration and flows that provide for

connection of low-lying lands adjacent to the channel. Inundation of low-lying lands is important processes for pallid sturgeon survival. This provides organic material and redistribution to produce forage for rearing fish at a time synchronized with the presence of larval and juvenile fish. Flows that are sufficiently low to provide for shallow water habitat as rearing refugia and foraging areas for larval, juvenile, and adult pallid sturgeon are also necessary.

1. Flows below Gavins Point Dam

To meet the biological needs for the pallid sturgeon, the Service finds that the Corps shall no later than the 2004 annual operation (which will begin in March, 2004):

a) ensure that the Final Environmental Impact Statement and subsequent Master Manual is changed to ensure the long term capability to provide a summer habitat flow of no greater than 25 Kcfs beginning no later than July 1, 2004 lasting for a minimum of 30 days at its lowest point. To subsequently raise flows from this target the Corps must demonstrate tangible impacts to other project purposes. The Corps shall ramp down to the habitat flow over a minimum of 7 days. Once the Corps begins to ramp up to meet new service levels, such ramping will be gradual over no less than 7 days. As shallow water habitat is developed, through re-engineering of the channel below Sioux City to St. Louis, the level of the habitat flow may be increased proportionally to optimize the habitat suitability, based on adaptive management and monitoring. This element may be subsequently modified or superceded by the flow options developed under other sections of elements I and II of this opinion.

b) in any year that the Drought Conservation Plan results in a shortening of the navigation season, the Corps shall ensure that the period of time that the navigation is suspended shall occur during the low summer flow period previously described for the pallid sturgeon. When approximately 1,200 acres of new shallow water habitat has been made available above that which currently exists between Sioux City and Omaha (approximately the amount that would be developed through flow management) the Corps, in consultation with the Service, may modify flows to take advantage of that habitat and more fully meet project purposes.

c) the Corps shall ensure that the Master Manual and the corresponding NEPA document provide the latitude for the eventual implementation of a spring rise and summer low flow of at least a magnitude identified in the Draft Environmental Impact Statement (USACE, 2001) as alternative GP2021. A variation that was not part of this alternative was the bimodal nature of the naturalized river hydrology that will need to be evaluated.

d) Within the first 2 years, as the information is available to establish an acceptable flow management plan identified in I.A.1.d, the Corps shall, if hydrologic conditions are suitable, initiate an experimental spring pulse to

assist and inform the process for establishing the long-term flow plan. Such a pulse shall be developed collaboratively, in collaboration with the Service and the USGS as well as with Tribes, States, and stakeholders

e) The Corps shall ensure that within 2 years, based on the results of the adaptive management and feasibility processes outlined below, a flow management plan will be implemented to provide a spring rise and summer low flow which will provide for the life history needs of the pallid sturgeon. This long-term flow regime must address, based on the best available information, spawning, rearing, maximization of floodplain connectivity, forage production and shallow water habitat. The long-term flow regime shall be reflective of the normalized river hydrology in order to be responsive to dry, intermediate, and wet conditions.

f) If the Corps, with the review and approval of the Service , is unable to determine a suitable flow management paln that incorporates the life history needs of the pallid sturgeon over all relevant flow frequencies within 2 years the Corps shall operate in the following manner in the operating year that begins on March 1, 2006. This initial starting point shall be subject to annual review and modification based on data collected and evaluated under the adaptive management program. This assumes a median hydroclimatic conditions in the basin based on system storage, past precipitation, and projections of future precipitation based on historical probabilities:

    i. During the winter release of 2006, the Corps shall minimize the releases from Gavins Point Dam to 16 Kcfs or less.

    ii. Beginning on or about March 15, 2006, the Corps shall provide for an early spring pulse of at least 31Kcfs which will last at least 7 days at the peak. Such a rise will have an ascending limb of approximately 7 days and a descending limb of approximately 7 days. After the pulse the Corps will reduce flows to the minimum amount possible while still maintaining project purposes.

    iii. Beginning on or about May 1, 2006 but not later than May 15, 2006 the Corps shall provide a second spring pulse release that will be no less than 16 Kcfs, added to the existing flow (i.e. if the flow on May 1 is 24 Kcfs the pulse would be 40 Kcfs). This pulse will last for a minimum of 14 days at its peak. The ascending limb of this pulse will not be less than 7 days but no longer than 10. The descending limb of this pulse will be no less than 7 days but may extend for longer as project purposes demand.

    iv. Beginning on or about June 15, 2006 but no later than July 1, 2006 the Corps shall begin reducing flows to provide a minimum 30 day summer low flow release of no greater than 25 Kcfs. Once the low

flow period has been achieved, the Corps may increase flows the minimum amount necessary to achieve project purposes by September 1, 2006.

v. If the operating year starting on March 1, 2006 is other than a median year, the Corps shall proportionally modify the flow regime either up or down depending on if runoff is projected to be in the upper quartile water year definition or the lower quartile, and within the bounds of health and human safety for the wetter period. Summer low flows must always be no greater 25 Kcfs and may extend for longer periods of time depending on hydrology.

vi. When the navigation season is shortened through implementing the drought conservation program, the Corps shall coordinate that period of non-navigation (with the summer habitat flow described in this section) to maximize benefits to pallid sturgeon.

Justification
Based on the effects described in the Effects of the Action it is the opinion of the Service that the flow regime elements described here will provide suitable spawning cues of enough frequency for pallid sturgeon to exploit the entire reach of the Missouri River from Gavins Point Dam to the confluence with the Mississippi River. By providing flows that are sufficiently high in the spring, connectivity to low-lying lands will be enhanced thereby providing additional production and input of nutrients and forage items for YOY fish at a time needed to enhance survival through the first year. Habitat flows will subsequently provide low velocity refugia habitat, enhanced in-channel productivity and provide for the spatial and temporal concentration of forage and prey items to areas where YOY and adult fish can exploit the prey base.

Fort Peck flow enhancements

Biological needs
The pallid sturgeon that occur in the reach of the river below Fort Peck Lake require a spawning cue of suitable magnitude, duration, timing and temperature to complete this life history element. Water temperature and flows are a controlling factor in this reach both for the spawning cue and over summer temperatures. Water temperature is an essential element of spawning cues for fish. Additionally, if the water temperatures dramatically drop after spawning it affects larval pallid sturgeon development as well as suppressing production and sustainability of forage throughout the summer. Low water temperatures may even induce mortality in young pallid sturgeon.

1. Flow Enhancement below Fort Peck Dam
To meet the biological needs for the pallid sturgeon the Serivce finds that the Corps shall no later than the 2004 annual operation, which will begin in March, 2004:

a) ensure that the Master Manual and the corresponding NEPA document sufficiently analyze and incorporate the capability to implement long-term flow enhancements in this reach upon completion of the Fort Peck tests (mini and full).

b) upon completion and evaluation of the Fort Peck tests (mini and full), assuming all technical issues have been addressed, implement flow enhancements to provide spawning cues and water temperature management at the first opportunity system storage and lake level allow.

c) the Corps shall, when implementing the system unbalancing, do so in a manner that starts with Fort Peck Lake at the highest elevation in the first year while achieving stable conditions in the second year.

d) to the extent that there are system-wide water savings from implementing the summer habitat flows below Gavins Point Dam, those savings shall be stored, to the maximum extent feasible, in Fort Peck Lake.

Justification
Implementing this RPA element will ensure that the institutional and legal mechanisms are in place to implement long-term flow enhancement in this reach. The Corps' proposed action specifically states that they were not going to revise the Master Manual at this time to facilitate long-term implementation of flow enhancements. By deferring the decision-making for this element, there would be a significant delay in implementing a critically important biological and ecological process necessary for the survival of wild pallid sturgeon in the Upper Missouri River. Without these actions, it is likely that the wild heritage population of pallid sturgeon will be extirpated from this reach in the next 15 years.

VIII. Fort Peck Temperature Control Device Feasibility

Biological Needs
Pallid sturgeon survival is dependant on water temperatures sufficient to support spawning cues and subsequent forage production and sustainability throughout the summer. The extent that the Fort Peck flow enhancements only occurs in years that the lake is full to the point of being able to utilize the spillway, this limits the effectiveness of the flow enhancement aspects in this reach.

1. Development of Fort Peck Dam Temperature Control Device Feasibility

a) The Corps shall with 3 years prepare a study that will evaluate the feasibility of constructing a temperature control device on the upstream face of the Fort Peck Dam. The study, once completed, will be subject to an outside engineering peer review for technical and economic feasibility. The peer review will be jointly established and overseen by the Corps and the Service. If the peer review determines that the project is feasible and can be built and is

a cost effective management action to provide water temperature management through the summer while continue to providing hydropower, the Corps shall implement the necessary steps to proceed with construction of the facility.

Justification
The Corps will have to bypass significant amounts of water that could be used for power production at Fort Peck Dam to implement the flow enhancement actions without a temperature control device. Additionally, the flow enhancement actions under current facility design can only be accommodated when the lake is essentially full and water can be released down the spillway. This action, if feasible, would likely contribute substantial flexibility to manage for multiple project purposes while maintaining biologically significant conditions in the river.

IX. Habitat Development, Shallow Water and Floodplain

Biological Need
Floodplain inundation and connectivity is essential in order to maximize the production of the forage base for pallid sturgeon. The forage base production must occur at a time that coincides with larval sturgeon becoming active, free swimming feeders. Floodplains are highly productive habitats in the late spring and early summer when warm, shallow water floods over the area and produces a bloom of forage that is of the appropriate size for larval fish to eat. Since larval and juvenile pallid sturgeon feed along the river margins, the productivity must be transported from the inundated low-lying lands to the river as flows recede. Additionally, low-lying are an extremely important source for other floodplain spawning fish which subsequently support the forage base for adult pallid sturgeon through the summer and fall. Highly productive floodplains are necessary on a frequent annual basis to provide necessary life requisites for pallid sturgeon survival.

1. Habitat Development

a) Shallow water and floodplain habitat

i. In order to maximize the potential of the flow regimes identified above in RPA elements VI.1 and VII.1., sufficient habitat must be developed in the Sioux City to the mouth of the Platte River sub-reaches as a first priority. The Corps shall, in coordination with the Service and USGS, identify the necessary habitat components (including but not limited to patch size, elevation, diversity, complexity, etc.) to maximize habitat potential under the range of flows that will be provided under the flow enhancement components of this opinion.

ii. Based on the information gathered and criteria established under element III.2.a. above, the Corps shall implement and concentrate shallow water habitat development in the Sioux City to the mouth of the Platte River sub-reach. Design and development of the shallow water habitat elements should consider, and be implemented with, a flexible and diverse flow regime in mind. This

element, if implemented expeditiously, may provide flexibility to increase summer habitat flows established under this RPA in some circumstances to take advantage of the new habitat and more fully meet other project purposes.

iii. The Corps shall, in designing and implementing sandbar and shallow water habitat restoration, how these features may contribute to the sediment deficit that exists in the lower river. For example, set back levees could be developed with erodable banks to allow for sediment input and redistribution. The Corps shall incorporate to the maximum extent, the relevant features to restoration projects to provide sediment to the lower river.

iv. The Corps shall design and implement floodplain connectivity to produce the intended ecological functions for production of nutrients and forage fish and plankton over a range of flow regimes developed under elements VI and VII above.

Justification

While the Corps has committed to evaluate flow modifications from Gavins Point Dam as a component of their proposal, they have not committed to modify operations or institutionalize the capability for change in operations of the system. The analysis for this Amended Biological Opinion has determined that pallid sturgeon need to be provided sufficient spawning cues such that they may exploit the entire reach of the Missouri River from the confluence of the Mississippi River to Gavins Point Dam. The flow regime that is to be developed with the spring rise will likely provide sufficient cues, in combination with tributary inflows, to stimulate pallid sturgeon to migrate past the mouth of the Platte River. This will provide access to additional and likely more suitable, spawning substrates and will provide access to longer reaches to the river for larval and juvenile rearing. This also provides for two opportunities for spawning in that the Platte River remains an important and viable spawning area for pallid sturgeon. In combination with the habitat construction and restoration proposed by the Corps, the flows regime will provide the ecological support to stimulate forage production from low-lying lands and refugia in shallow water habitat areas. This RPA ensures with certainty that such a flow regime will be implemented in a timely manner while recognizing there are scientific uncertainties in what precise attribute of flow (of which there may not be a single factor) are the limiting factor for pallid sturgeon reproduction and survival. The Service has determined that the pallid sturgeon can sustain itself during the additional 2 years, over and above the 3 years already past, when viewed in light of the current hydroclimatic conditions in the basin.

Summary Table Comparing 2000 Reasonable and Prudent Alternative with 2003 Reasonable and Prudent Alternative for Pallid Sturgeon

Pallid Sturgeon Issue / Risk / Hurdle	**Conclusions from 2003 Amendment ***	**Conclusions from 2000 Opinion including differences between opinions**
Flow tests at Fort Peck are precluded when reservoir is less than full. The issue is perceived delay in implementation.	Water savings resulting from low flows from Gavin's Point Dam in '04 and '05 should be transferred to Ft. Peck Reservoir to step-up the starting point. We identified Fort Peck Reservoir as the first to receive the benefits of system-unbalancing because we could potentially accelerate the first of the tests.	Recommended long-term flow changes at Fort Peck Dam. These changes were tied to reservoir storage without a timeline for starting.
Long-term water temperature management at Fort Peck Dam. New issue identified through our analysis in 2003.	We recommended that the Corps conduct a feasibility analysis and implement an alternative to address the issue.	Not addressed
Corps B.A. did not support long-term implementation of flow changes at Fort Peck Dam	We recommended that the Corps ensure implementation via long-term NEPA coverage and changes to the Master Manual.	Not as specific in the requirements to modify the Master Manual. The Services understanding was that the 2000 opinion would shape the ultimate selection of the preferred alternative for the Master Manual.
Lack of suitable habitat/flows between Lake Sakakawea and Fort Randall Dam	No recommendation to Corps for any substantial change in management in these reaches	No recommendation to Corps for any substantial change in management in these reaches
Propagation of Pallid Sturgeon. Issue is the perceived long-term reliance on this approach.	We believed that in 2004 and 2005, with the Corps current commitment, we will have an increased ability to meet our short-term needs for pallid stocking. We have expressed our concerns regarding long-term reliance on this option.	Recommended Corps increase commitment to propagation program. Over a ten year period.

Corps removed long-term flow changes from B.A.	Explicitly directs the Corps to modify regulatory underpinnings with Master Manual and subsequent NEPA process to include ability to change up to 20kcfs over full service navigation and as low as 21kcfs during summer months. Master Manual and NEPA must ensure implementation of flow change	Not as specific in the requirements to modify the Master Manual. The Services understanding was that the 2000 opinion would shape the ultimate selection of the preferred alternative for the Master Manual.
Uncertainty with starting point with spring pulse piece	Two step process: 1) Recognizing uncertainty, we provided the Corps the opportunity to work with us to shape the starting point and 2) Absent #1, we prescribed a starting point which included a bimodal rise. Our recommendation also tracks available basin hydrology not the 1 in 3 year pulse recommended in 2000	2000 opinion identified higher peak (51 kcfs), no bimodal rise recommendation, Rise targeted as once every 3 years on average based on available hydrology. Present system storage would preclude a spring rise in '04.
Starting point for summer habitat flow	25 kcfs no less than 30 days beginning as early as June 15th. Corps must document why flows must be increased following 30 days. Recommendation must occur in '04 and '05 or until 1,200 acres of habitat are developed between Sioux City and Omaha. (benefits are fish-focused). This should increase shallow water habitat by 25-30% over existing conditions. Corps ability to implement this flow was demonstrated by flows in '02 and '03.	Stair-stepped flows from 25 to 21 kcfs for 60 days. Annual recommendation. (benefits were bird-focused). Increase in shallow water habitat comparable based on information provided by Dr's Galat and Jacobson.
Risk associated with delayed timing	We recognized that there was extremely limited reproduction occurring. Greater potential for continuity from Missouri River and Mississippi River population.	2003 starting point for flow change **OR** when hydrologic conditions allowed. Change may prove to be inconsequential.

	We recognized that if conditions allowed in 2005, a test could proceed prior to completion of a final flow management plan.	
Habitat diversity and relationship to flows	Flows and habitat are coupled. The best available science indicates that larvae produced below Gavins Point Dam are adversely impacted by limited habitat between Sioux City and the mouth of the Platte River and associated flows. So Service recommended habitat restoration target Sioux City to Platte reach.	Habitat restoration recommended across the lower river without prioritization of where to restore it first.
Habitat Acres and Corps B.A. description of accelerated development.	Corps proposing to meet prescribed performance standard at the 30 acre figure from 2000 B.O. RPA and implementation schedule therefore no credit given for acceleration	20-30 acres per mile with performance standards identified at 30 acres per mile
Uncertainty associated with implementation of adaptive management as described in the Corps B.A.	Framework pieces of adaptive management developed. Specifically, we described how adaptive management should be framed and how the Corps must seek outside experts to help them transition from the starting point experiments to the eventual Missouri River Recovery Implementation Program process.	Generalized discussion of value of adaptive management. Only items mandated were formation of agency coordination team and collection of additional information.

* details are described in the RPA

INCIDENTAL TAKE AND REASONABLE AND PRUDENT MEASURES

LEAST TERN

Amount or Extent of Take Anticipated

The Service has developed the following incidental take statement based on the premise that the reasonable and prudent alternative for least terns described above will be implemented. Therefore, the proposed action includes changes to the 2000 RPA as proposed by the Corps in the 2003 Biological Assessment, and as modified by the RPA to the proposed action for pallid sturgeon. Incidental take of least terns is expected to occur in the following ways:

1. Take of eggs and chicks by flooding on the river and reservoir reaches that result from the Corps' operations of the water control system.

Raising reservoir levels and water releases from dams along the Missouri River during the summer can result in flooding of nests and mortality of eggs and chicks. Corps' records indicate that an average of 59.1 eggs have been taken annually over the past ten years. We therefore estimate that the Corp future actions may take up to 60 eggs each year. We realize, however, that the Missouri River system is highly variable and it is difficult to predict incidental take levels in any given year. Therefore, reinitiation of consultation will be required if the Corps' actions will result in take of more than 180 eggs in a 3-year consecutive period.

2. *Take of eggs, chicks, and adults by factors influenced by but not directly attributable to the Corps.*

Over the past 10 years, 858 nests have been lost due to predation, weather, livestock, erosion, and other factors that are influenced by, but not directly attributable to, Corps' activities. For example, we believe that the Corps' modification of the historical hydrograph reduces the number of scouring events that would limit vegetation encroachment on sandbars and beaches used for nesting by least terns. Encroachment of vegetation on sandbars used by least terns increases the potential for predation of eggs, chicks, and adults by predatory mammals and birds. It is also likely that the Corps' management of reservoir beaches has resulted in incidental take due to the disturbance of breeding birds and destruction of nests by recreationists. Other actions by the Corps that restrict the amount of nesting habitat available and force nest occupancy to less than optimal conditions (e.g., steady releases of summer flows) can make least terns more susceptible to harm or harassment by environmental factors, such as bank erosion, weather, and predation.

Fledge ratios provide an index of incidental take that is influenced by the Corps' activities but which cannot be quantitatively attributed to the Corps' actions. Data are not sufficient to accurately describe the proportion of predation attributable to the Corps' actions. We calculated an average fledge ratio of 0.94 using data from the past 10 years for the Missouri River system. The Corps should reinitiate consultation if the running 5 year average fledge ratio is less than 0.94. This incidental take statement is subject to automatic review and renewal before the 2009 breeding season.

Effect of Take
In the accompanying Biological Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the least tern when the reasonable and prudent alternative is implemented.

Reasonable and Prudent Measures to Minimize Take
The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take. These reasonable and prudent measures supercede the reasonable and prudent measures for the least tern in the 2000 Biological Opinion.

Reasonable and Prudent Measure 1 - Survey and Monitor Least Terns, Mortality, and Incidental Take
All least tern nesting sites on the Missouri and Kansas River reaches, including all reservoirs and the headwaters of Lewis and Clark Lake will be surveyed and monitored annually. Information on mortality and injury of least terns, including any incidental take resulting from Corps' operations, will be collected during these survey and monitoring efforts.

Reasonable and Prudent Measure 2 – Monitor, Evaluate, and Adjust Operations to Minimize Take of Least Terns
The Corps will monitor and evaluate the effects of its flow releases on the Missouri River and Kansas River and adjust operations to reduce the take of least terns. For its Annual Operating Plan (AOP), the Corps will select the Gavins Point Dam summer (navigation) release method that is expected to result in the least flooding of nests. The Corps will coordinate closely in a timely manner with the Service on all aspects of this RPM. The Corps will develop, in consultation with the Service, a process describing the steps to implement this RPM. This document will be incorporated in the new Master Manual after approval by the Service.

Reasonable and Prudent Measure 3 – Designing, Constructing, and Managing Created Sandbars as Required by RPA IV.B
The Corps will design, construct, and manage created sandbars in a manner that will provide for the biological and ecological needs of least terns.

Reasonable and Prudent Measure 4 – Monitor, Evaluate, and Modify Created and Rehabilitated Sandbars
The Corps will develop and implement a program to monitor and evaluate the effectiveness of created sandbars as nesting habitat for least terns. The Corps will also establish criteria and procedures to modify created sandbars to be more useful for terns based on information gained through monitoring and evaluation. The Corps will monitor and evaluate its actions relating to the rehabilitation of existing sandbars and determine the most effective and efficient means to restore and maintain existing sandbars for the conservation of least terns.

Reasonable and Prudent Measure 5 – Evaluate Effective Measures to Reduce Least Tern Predation

Predation has a major impact on the productivity of Missouri River least terns. Therefore, it is important to identify and implement the most effective methods to reduce predation levels and reduce the amount of predation that is influenced by Corps' activities. Because some control techniques (e.g., cages) may attract predators, resulting in increased predation, the Corps shall evaluate a variety of methods to be determined if effective measures exist. If they do, the Corps shall develop and implement a predator management plan, in coordination with the Service.

Reasonable and Prudent Measure 6 – Reduce Human Disturbance of Least Terns and Conduct Outreach and Education

Human disturbance, primarily through stepping on eggs and chicks and disruption of nesting adults, can impact least tern productivity. Informing the public about least terns and the effects of human disturbance, along with monitoring and management of human use on nesting sites, can reduce disturbance and increase productivity. The Corps will implement an Outreach and Education Program and other appropriate actions to reduce human disturbance.

Reasonable and Prudent Measure 7 – Revise Contingency Plan for Moving Eggs

The Corps shall collaborate with the Service, tern experts, and outside experts to review the practice of moving eggs to reduce take due to flooding prior to the 2004 season. After completion of the review, the Service and the Corps will determine future procedures. The Corps shall no longer move chicks.

Terms and Conditions for Implementation of the Reasonable and Prudent Measures

To be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting/monitoring requirements. These terms and conditions are non-discretionary.

The Fish and Wildlife Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. sec. 703 -712) if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

Terms and Conditions (RPM 1: Survey and Monitor Least Terns, Mortality, and Incidental Take):

1. The Corps will continue its annual least tern monitoring program at all nesting sites on the Missouri River and Kansas River reaches, including reservoirs and the headwaters of Lewis and Clark Lake). The current standard survey methods, timing, and information collected by the Corps will be continued. Information to be collected will include, but not be limited to, number of adult terns, breeding pairs, and number of nests, eggs, and chicks.

2. In conducting the annual least tern surveys, the Corps will continue to collect information on mortality, injury, and productivity. The number and type of mortality (in categories currently used by the Corps) will be recorded for adults, chicks, eggs, and nests along with any useful observations. The Corps will record mortality caused by its operations, any measures taken to reduce mortality, and the effectiveness of these measures to reduce take. The Corps will also collect information on annual productivity, including the number of fledglings per breeding pair.

3. In accordance with other annual reporting requirements in this Biological Opinion [RPA I.C, RPA IV.D], the Corps will provide to the Service by December 31 of each year the information collected as described by these Terms and Conditions along with analysis, conclusions, and recommendations.

Terms and Conditions (RPM 2: Monitor, Evaluate, and Adjust Operations to Minimize Take of Least Terns):

1. The Corps will monitor and evaluate the effect of flooding least terns by dam releases. Information collected under RPM 1, including elevation of sandbars and nests in relationship to water levels, plus any additional information necessary to assess flooding potential, will be used.

2. The Corps will utilize all of its authorities and operational flexibility in adjusting flows and other pertinent actions to reduce the flooding of least terns. The Corps will coordinate frequently and in a timely manner with the Service when it has determined that increased flow releases will flood terns. During this coordination, the Corps will provide the Service its recommendations to reduce flooding.

3. The Corps will assess the summer release method necessary to meet navigation targets while minimizing take of terns through flooding and incorporate into its Annual Operating Plan (AOP) the method (i.e., steady release, flow to target, or combination of the two) that is expected to result in the least flooding of nests. The Corps will coordinate with the Service at all stages of the AOP process (i.e., pre-draft, draft, and final).

4. By February 1, 2004, the Corps will describe the process to be used to determine the summer release method that will minimize take of terns. The Corps will coordinate the development of this document with the Service. This document, once approved by the Service, will be incorporated in the new Master Manual.

Terms and Conditions (RPM 3: Designing, Constructing, and Managing Created Sandbars as Required by RPA IV.B.1):

1. By April 1, 2004, the Corps will consult experts to determine the proper location, density, and juxtaposition of created sandbar habitats within the reaches specified in RPA IV.B.1. The Corps shall provide the results of the consultation to the Service.

Terms and Conditions (RPM 4: Monitor, Evaluate, and Modify Created and Rehabilitated Sandbars):

1. The Corps will monitor and evaluate the created sandbar habitat complexes annually to determine if physical and biological requirements of the least tern are being achieved. The Corps shall report the data for created or vegetation-managed sandbars separately from natural sandbars. If the sandbars are not providing habitat as anticipated, then the Corps will evaluate and implement methods to improve the habitat or discourage terns from using the habitat. The Corps will coordinate these actions with the Service and U.S. Geological Survey.

2. Following three years of creating, evaluating, and monitoring sandbar habitat, the Corps will report the results and conduct a peer review of habitat creation methods and outcomes. The Corps will provide a copy of its report and the results of the peer review to the Service and U.S. Geological Survey.

3. The Corps will monitor and evaluate its actions relating to the restoration and maintenance of existing sandbars and implement those methods that maximize the quality and quantity of tern nesting habitat. The Corps will seek outside assistance, including the Service if necessary, in formulating the most effective restoration and maintenance program.

Terms and Conditions (RPM 5: Evaluate Effective Measures to Reduce Least Tern Predation):

1. The Corps will design and implement a study to evaluate various measures to reduce least tern predation. This study shall be completed by December 1, 2005.

2. The Corps will prepare a report describing its findings of the predator control evaluation, along with its recommendations to reduce least tern predation. This report will be completed by April 1, 2006 and provided to the Service for review.

Terms and Conditions (RPM 6: Reduce Human Disturbance of Least Terns and Conduct Outreach and Education):

1. The Corps shall post signs at least tern nesting sites that it deems could be effected by human disturbance (e.g., large colonies, high human use, site used by ATV's or other ORV's, previous problems with human disturbance). The Corps will determine if a site should not be posted if the signs might attract additional human activities. The signs will be placed at strategic locations and densities to best deter human entry. The signs should clearly the potential for death and injury of least tern from entry, the penalties under the ESA for harming an endangered species, and general information on the life history and conservation of least terns. The Corps will coordinate with Service and State personnel on any nesting sites requiring surveillance and/or enforcement.

2. All personnel involved with surveying, studying, maintaining habitat, and related activities will be trained to use methods to avoid impacting terns.

3. At least tern nesting sites owned and managed by the Corps, monitor and manage recreation and other activities to minimize human disturbance.

4. The Corps' will conduct a public outreach and education program on the conservation of the least tern. In addition to using traditional outreach products and activities (e.g., brochures, videos, interpretative programs, posters), the Corps will conduct each year during the nesting season Public Service Announcements about least terns on the Missouri River. The Public Service Announcement should be available for public use and used in Corps' project offices.

Terms and Conditions (RPM 7: Moving Eggs to Reduce Flooding):

1. The Corps shall collaborate with the Service, tern experts, and outside experts to review the practice of moving eggs to reduce take due to flooding prior to the 2004 season. The Corps will complete the review by April 1, 2004. After completion of the review, the Service and the Corps will determine future procedures for use in the 2004 nesting season. The Corps shall no longer move chicks.

The Service believes that no more than 180 least terns eggs in a 3-year consecutive period will be incidentally taken by flooding as a result of the proposed action. Furthermore, the least tern will be incidentally taken by other indirect actions to such an extent that the fledge ratio may average 0.94 over a five year period. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, the Corps shall notify the Service to determine appropriate action.

PIPING PLOVER

Amount or Extent of Take Anticipated

The Service has developed the following incidental take statement based on the premise that the reasonable and prudent alternative will be implemented. Therefore, the proposed action includes the original action as proposed by the Corps and described in the attached supplemental Biological Opinion, as modified by the reasonable and prudent alternative. Incidental take is expected to occur in the following ways.

1. *Take (killing) of eggs and chicks by flooding on river and reservoir reaches that results from the Corps' operations of the water control system.* The Corps analyzed the destruction of all nests monitored on the Missouri River system in the period 1986-2003 and found that its operations destroyed approximately 8 percent of all piping plover nests. Before 1993, however, data were collected on only a subset of the piping plover nesting areas. In 1993, the Corps visited nests on a weekly basis

and standardized monitoring techniques. Therefore, we have concluded that the 1993-2003 data is most useful for anticipating the future extent of take that will be caused by the flooding of nests due to the proposed action. During the 11-year period 1993-2003, flooding due to the Corps' operations killed 8.4 percent of all eggs monitored. This includes the eggs that the Corps collected, but which would otherwise have been destroyed by flooding. We expect the proposed action to result in a similar level of take due to flooding as has occurred since 1993. The Corps will no longer collect nests. Therefore, nests that the Corps formerly collected would likely now be flooded. In summary, we expect that the Corps' operations will continue to take, by flooding, approximately 8.4 percent of eggs in the action area, expressed as a ten-year running weighted average. Due to the variation inherent in the distribution and abundance of piping plovers in the Northern Great Plains, we expect this to vary by as much as 10 percent over any ten-year period. Therefore, we anticipate that the 10-year weighted running average will range from 7.6 to 9.2 percent. In addition, assuming that this type of take will not exceed that observed since 1993 in any single year, we also do not expect take due to flooding caused by the Corps' operations to exceed either 42 percent or 126 of all eggs laid in the action area. (Note that the Terms and Conditions below contain specific requirements to use for determining the numbers of eggs destroyed.)

2. *Take (harm) of eggs, chicks, or adults by predation.* Due to the reduction in frequency of flows that are of sufficient magnitude to scour vegetation from existing sandbars and create new sandbar habitats, the Corps' action will indirectly increase the number of eggs, chicks, and adults that predators kill in the action area. The Corps' action will not be responsible for all predation, however, and data are not sufficient to accurately describe the proportion of predation attributable to the Corps' operations. Nest predation accounts for all mortality of eggs by predation and a portion of the mortality of adults due to predation (some incubating adults are killed during nest predation events), but does not relate directly predation of chicks. Nevertheless, the same factors that are likely to increase the frequency of nest predation (i.e., expansion of vegetation on existing sandbars and decreased frequency of new sandbar creation) are also likely to increase predation of adults, on and away from nests, and chicks. Therefore, we find that nest predation is a suitable surrogate for the take by predation of eggs, chicks, and adults that is attributable to the Corps' operations. Therefore, we will use overall nest predation as a surrogate measure of the take of chicks and adults that will be caused by the proposed action. In the eleven-year period 1993-2003, 4.0 percent of monitored nests were assigned a fate of predation. We expect the proposed action to continue to result in approximately this level of nest predation. Due to the variation inherent in the distribution and abundance of piping plovers in the Northern Great Plains, we expect this to vary by as much as 10 percent, from 3.6 to 4.4 percent expressed as a 10-year running weighted average expressed as a ten-year average.

3. *Take (harassment, killing) of chicks or adults by human disturbance.* A portion of the take caused by human disturbance is likely attributable to the Corps' action due to its general reduction in the number and size of open beach habitats on riverine

reaches. This increases the likelihood that humans who are seeking such open areas for recreation will directly or indirectly kill piping plovers or increase the frequency of nest abandonment. We do not think that the proposed action will cause this type of take on reservoir reaches due to the greater amount of open beach habitats for both plovers and human use. That is, although human disturbance is likely to continue to take some proportion of piping plover nests in the action area, we think that this take is only partially attributable to the proposed action and only on riverine reaches (i.e., the four Missouri River reaches below Ft. Peck, Garrison, Ft. Randall, and Gavins Point dams). As with predation, the proportion of take caused by human disturbance that is attributable to the Corps cannot be accurately quantified. In addition, only the take of nests caused by human disturbance can be accurately quantified. Therefore, we will use the measure of the proportion of nests destroyed due to human disturbance in riverine reaches as a surrogate for the take of chicks or adults by human disturbance that is due to the proposed action. We think that the proportion of nests destroyed due to human disturbance in the four riverine reaches will continue at levels observed in the eleven-year period 1993-2003. That is, the percentage of destroyed nests assigned a fate of "Human Disturbance" in the four riverine reaches will approximate 1.5 percent, based on a ten-year weighted running average. Due to the variation inherent in the distribution and abundance of piping plovers in the Northern Great Plains, we expect this weighted running average to vary by as much as 10 percent, from 1.4 to1.7 percent.

4. *Take (harm) of chicks as a result of insufficient forage in river reaches affected by hypolimnetic releases.* Continued operation of the system under CWCP with hypolimnetic hydropower releases at Fort Peck, Garrison, and Fort Randall Dams will continue to provide unsuitable water temperatures below main stem dams that will negatively impact production at all trophic levels and will take piping plover chicks. This take will occur in the three riverine reaches below these dams. The proportion of chick mortality that can be attributed to the proposed action cannot be quantified. Chick mortality does affect fledge ratios, the number of fledglings divided by the number of piping plover pairs. Numerous factors in addition to hypolimnetic releases affect fledge ratios. In addition to total counts of fledglings, however, they are the only measure of chick survival to fledging that will be available in the foreseeable future unless there is a significant change to the Corps' current sampling regime. Therefore, we anticipate that this form of take will be reflected in the fledge ratios for these three river reaches and that the fledge ratios observed during the eleven-year period, 1993-2003, are indicative of the fledge ratios that will result from the proposed action. That is, fledge ratios in the Missouri River reaches below Ft. Peck, Garrison, and Fort Randall Dams will approximate those observed in these reaches since 1993 (within 10 percent) 1.33 (1.20-1.46), 1.18 (1.06-1.30), and 0.92 (0.83-1.01), respectively. The reasonable and prudent alternative will lead to a gradual reduction in the hypolimnetic releases from Ft. Peck Dam. Therefore, this form of take is likely to decrease in the reach below this dam. Nevertheless, we will keep the anticipated level of take in reach below this dam at the level shown above.

5. *Take (harm) of eggs in nests assigned fates of destroyed-unknown, nest abandonment, sandbar erosion, and unknown fates.* The Corps is limited in its ability to determine what portions of certain forms of nest destruction are attributable to the proposed action. We described this uncertainty above in reference to predation, human disturbance, and effects of insufficient forage above. The Corps determines the fate of each unsuccessful nest in the action area, to the maximum extent possible given the available evidence. As with predation and, in riverine reaches, human disturbance, some nests whose fates cannot be clearly ascribed to the Corps' operations are likely destroyed as a direct or indirect result of these operations. This includes nests assigned the following fates: destroyed-unknown, abandoned, destroyed by sandbar erosion, and undetermined. As with predation and human disturbance, there will be no reasonable way in the foreseeable future to accurately determine the portion of the nests assigned these fates whose destruction is attributable to the proposed action. All of these types of take are reflected in fledge ratios – i.e., they reduce fledge ratios. Therefore, although the incremental decrease in fledge ratios due to the proposed action is unquantifiable, overall fledge ratios is an appropriate surrogate for this take. We anticipate that fledge ratios, when measured each year as a ten-year weighted running average, will be within 10 percent of the fledge ratio that has been observed during the period 1993-2003, 1.36 – i.e., 1.22-1.47.

6. *Take (harm) of chicks as a result of insufficient forage on created habitats*. At least one previous attempt to create habitat for piping plovers produced some evidence that these habitats may contain insufficient forage for the development and survival of chicks. Death of chicks that starve on created habitats cannot be quantified with accuracy because carcasses are likely to be scavenged before their discovery or be otherwise difficult to recover. Moreover, some starvation of chicks is likely to be attributable to causes other than the Corps' operations. Nevertheless, as with chick survival in the reaches with hypolimnetic water, chick starvation on created habitats would be expressed by the fledge ratios observed within these habitats. We anticipate that fledge ratios in these habitats will approximate that observed in the period 1993-2003, 1.36 fledglings per pair. Due to the variation inherent in the distribution and abundance of piping plovers in the Northern Great Plains, we expect this to vary by as much as 10 percent. Therefore, we anticipate that fledge ratios on created habitats, based on a ten-year running average will remain within the range 1.22-1.47.

Note that fledge ratios are used as a surrogate for three forms of take. The net effect, however, is that the Corps will be required to continue to count adults and fledglings and calculate fledge ratios every year for each of the eight Missouri River segments as has been done since 1993. An additional requirement is to collect the data necessary to calculate fledge ratios specifically for created habitats.

Reasonable and Prudent Measures to Minimize Take

The following reasonable and prudent measures (RPMs) with their implementing terms and conditions are necessary and appropriate to minimize take for the piping plover on the Missouri and Kansas rivers. The RPMs and implementing terms and conditions

found in this amended Biological Opinion supercede those found in the 2000 Biological Opinion.

Reasonable and Prudent Measure 1
The Corps shall survey and monitor all plover sites on the Missouri and Kansas rivers, in the headwaters of Lewis and Clark Lake, and on the reservoirs to reduce the take of piping plovers. Population surveys will be conducted and information collected annually. Data collected will include the total number of adult birds and breeding pairs, total numbers of eggs and chicks, total number of nests and nest fates, total number of fledged chicks per pair, the fate of chicks that do not fledge, the elevation of nests above the water level, and maps of nest site locations.

Reasonable and Prudent Measure 2
The Corps shall monitor and evaluate the effect of daily and hourly fluctuations in releases below Missouri River and Kansas River dams and changes in releases due to system maintenance or other reasons on nesting piping plovers. The purpose of monitoring and evaluation is to provide information to assist minimizing take and to document take of piping plovers that does occur.

Reasonable and Prudent Measure 3
The Corps shall coordinate system monitoring and evaluation with the Service to minimize take of piping plovers.

Reasonable and Prudent Measure 4
In the 2000 Biological Opinion, RPM 4 required the Corps to continue to follow the "Contingency Plan for Protection of Least Tern and Piping Plover Nests and Chicks" and the "Captive Rearing Program Protocol." The Service no longer supports use by the Corps of the captive rearing facility for piping plovers. Therefore, RPM 4 reads as follows:

The Corps shall collaborate with the Service, piping plover experts, and other outside experts to develop new criteria and procedures for the practice of moving eggs and chicks to reduce flooding as conducted in the "Contingency Plan for Protection of Least Tern and Piping Plover Nests and Chicks."

Reasonable and Prudent Measure 5
To reduce take, the Corps shall implement public information and education programs to increase pubic awareness to reduce take of nesting piping plovers.

Reasonable and Prudent Measure 6
The Corps shall evaluate and implement actions to reduce predation on piping plover nests, chicks, and adults.

Reasonable and Prudent Measure 7
The Corps shall design, construct, and manage created sandbar habitat in a manner that will be most beneficial for the biological and ecological needs of piping plovers.

Reasonable and Prudent Measure 8
The Corps shall develop and implement a program to monitor and evaluate the effectiveness of created sandbars as nesting habitat for piping plovers. This program will establish criteria and procedures to modify created sandbars in a manner most beneficial to the biological needs of piping plovers. The Corps will monitor and evaluate its actions relating to the rehabilitation of existing sandbars and determine the most effective and efficient means to restore and maintain existing sandbars for the conservation of piping plovers.

The following actions shall be taken to implement the reasonable and prudent measures

Terms and Conditions (RPM 1):

1. The Corps shall continue to monitor all piping plover sites on the Missouri and Kansas rivers and all reservoirs on the Missouri River (including the headwaters of Lewis and Clark Lake). Standard survey methodology shall continue. Data collected shall include: the total number of adult plovers, breeding pairs, and the total number of nests, eggs, and chicks.

2. Survival information shall also be collected. Data will include the number of chicks fledged per pair, chicks lost to predation, flooding, and other fates of chicks. Quantification of take, including loss of eggs, chicks, adults, and habitat that occurred during the year will be reported, along with the reasons or causes for take and any actions the Corps may have taken to avoid take. The Corps shall include an explanation of any operational efforts to avoid take and evaluate the actions for success in reducing the amount of take to piping plovers.

3. Methods of analysis that accurately stimate the number of eggs in destroyed nests at the time of their destruction shall be used. For example, a nest is visited during the laying period before a full modal clutch size of four (Haig 1992) has been laid. On the next visit, seven days later, the nest has been destroyed. The estimate should be b ased on the number of eggs observed plus an assumption that following eggs were laid at a rate of 1 egg per 1.5 days.

4. The Corps shall map the habitat (riverine and reservoir) used by piping plovers and include general location information, specific acreages, elevation of nests, and vegetation encroachment. Efforts taken to minimize take to piping plovers and an evaluation of the effectiveness of those actions will also be reported annually. Following this evaluation, the Corps, in coordination with the Service, shall invoke adaptive management techniques to improve the effectiveness of their efforts.

5. The Corps shall report all piping plover data annually by river segment and prepare an annual report detailing the data, statistical analyses, and conclusions

and recommendations. Productivity (fledge ratios) will be calculated and reported to the Service to track fledge ratios over time.

6. By 2005, in consultation with the Service, the Corps shall conduct a peer review of the historic piping plover database to help ascertain if the Missouri River piping plovers are a population source or a sink. If the Missouri River is determined to be a sink that persists over time, the Corps shall coordinate with the Service to develop strategies to reverse this condition.

7. In 2005, in cooperation with the Service and the U.S. Geological Survey, the Corps will host a workshop with piping plover experts in Canada and the U.S. to discuss and coordinate the 2006 International Piping Plover Census. This group will reconvene in 2007 to evaluate census methods, data, trends, and recommendations for recovery of the northern Great Plains population of piping plovers. By improving and standardizing census methodology, take can be minimized by prioritizing habitats and locations for rehabilitation or habitat creation.

Term and Condition (RPM 2):

1.) The Corps provided the Service with the comprehensive (1988-2003) Piping Plover Historical Mortality Report in November 2003. The Corps shall continue to collect detailed piping plover take data and operational information related to take (e.g., flooding of nests), and report this information to the Service on an annual basis. The Corps and the Service will coordinate to improve operations that lead to take.

2.) For purposes of necropsy, the Corps shall transmit chicks and adults found dead from unknown causes to the National Health Laboratory in Madison, Wisconsin. If disease, starvation, or other determination of death is possible, the Corps shall coordination with the Service to improve conditions for chicks and adults.

Term and Condition (RPM 3):

1.) The Corps shall coordinate regularly with the Service to ensure that operations minimize take to piping plovers to the maximum extent practicable. If take is unavoidable due to water conditions (i.e., inundation by raising reservoir levels versus passing water through the dams), the Corps shall coordinate with the Service to ensure that take is consistent with the incidental take statement. Coordination with the Service shall include weekly conference calls during summer operations to minimize take of piping plovers.

Term and Condition (RPM 4):

1.) The Corps will collaborate with the Service, piping plover experts, and other outside experts to develop new criteria and procedures for moving eggs to

high elevations to avoid flooding. The Corps will complete the new criteria and procedures by April 1, 2004 and implement then during the 2004 nesting season.

Terms and Conditions (RPM 5):

1.) The Corps shall produce and update Public Service Announcements (radio release and television video) informing the public of the need to conserve piping plovers on the river. The Public Service Announcements shall be distributed to radio and television stations within the States bordering the Missouri River with a request that they are used at least from May through August. The video shall be available for public use and used in the Corps' project office interpretive programs.

2.) The Corps' project offices shall engage in intensive public relations efforts for tern and plover conservation on lands managed by Corps. Public information may include displays, video productions, nature talks, information flyers or brochures, information placed in campground notices, and information posted at boat ramps.

3.) The Corps shall post all tern and plover nesting areas off limits to human disturbance. Each year, State and Service personnel will coordinate efforts with the Corps to determine adequate levels of enforcement.

4.) The Corps shall initiate appropriate studies that will address the cumulative impacts of increased recreational facility expansion on the Missouri River on piping plovers. The information may be used to devise appropriate management actions to lessen impacts to nesting species. The Corps shall consider appropriate public outreach.

Term and Condition (RPM 6):

1.) The Corps shall implement all appropriate predator management techniques to support plover productivity, including, but not limited to:

a.) nesting exclosures/electric fencing,
b.) trapping, and removal of predators,
c.) strobe light systems to disrupt predators,
d.) removal of land bridges to sandbars,

2.) The Corps shall determine if exclosure devices such are more effective at controlling piping plover predation than those currently in use.

3.) The Corps shall use appropriate techniques that minimize adult mortality, especially where predation of nesting adults by raptors is likely (e.g., areas with perch trees in close proximity of the nesting area).

Terms and Conditions (RPM 7)

1.) The Corps shall coordinate with the Service, U.S. Geological Survey, and other experts to gather the best available scientific information regarding means to create sandbar habitat in the Missouri River.

2.) The Corps shall complete a plan documenting the best techniques for creating sandbar habitat, identifying sandbar characteristics that are important to piping plovers, and identifying the best sites on the river for the creation of habitat.

3.) In the first year of sandbar creation (2004), create no more than three habitat complexes of a size recommended by the Corps' plan.

4.) The Corps shall collect data in a manner that will allow for the calculation of fledge ratios for each created or restored habitat area.

Terms and Conditions (RPM 8)

1.) Conduct a study comparing insect abundance on artificially created sandbars, sandbar habitat created by flows.

2.) In coordination with the Service and U.S. Geological Survey, monitor and evaluate the habitat complexes for two consecutive years to determine if they are meeting the physical and biological requirements of piping plovers. If the data documents that the sandbars are meeting the needs of the piping plovers, the rate of sandbar creation can accelerate. If the sandbars are not providing habitat as anticipated, evaluate, in coordination with the Service and U.S. Geological Survey, methods to improve the habitat or to discourage the birds from using the habitat.

3.) Following three years of creating and monitoring sandbar habitat, conduct a peer review, in coordination with the Service and U.S. Geological Survey, of habitat creation methodologies and outcomes.

Closing

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed actions. If, during the course of the actions, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need to modify the reasonable and prudent measures.

PALLID STURGEON

Amount or Extent of Incidental Take Anticipated

The Service has developed the following incidental take statement for the pallid sturgeon based on the premise that the Reasonable and Prudent Alternative (RPA) in the 2003 Biological Opinion will be implemented. This incidental take statement supercedes the incidental take statement in the 2000 Biological Opinion. The Service anticipates incidental take will occur from Corps' operations between the time the 2003 Biological Opinion is issued and complete implementation of the RPA (approximately 5-10 years). Following complete implementation of the RPA, incidental take will diminish but will likely continue to for the life of the project. This incidental take in the from of "harm" to pallid sturgeon will come about from significant alterations in the natural hydrograph during spawning periods when unnatural seasonal flows and changes in water constituents such as turbidity and temperature preclude spawning and/or cause mortalities to early life stages, and by significantly disrupting normal behavioral patterns, which include but are not limited to breeding, feeding, or sheltering, and which will occur over a large proportion of the species' range. Incidental take from injurious actions caused by collection of brood stock and artificial propagation, entrainment during habitat construction, and research will also occur, and will continue for the life of the project.

During the period immediately following implementation of the RPA, the extent and quality of pallid sturgeon habitat is likely to continue to decline as a result of continued Missouri River Operations and the processes that create and maintain such habitat will continue to be disrupted and altered. Although the Corps proposes to construct sandbar and shallow water habitat and focus construction on the channelized segments of the Missouri River from Ponca State Park to the mouth of the Platte River (River Segments 11 and 12 as described in the 2000 Biological Opinion), the full biological function and value of this created habitat will not be immediately realized.

In most instances it will be difficult to detect, monitor, and quantify the level of incidental take because: (1) pallid sturgeon are wide-ranging, (2) they occur in habitats and at low densities that make detection difficult and finding a dead or impaired specimen unlikely, and (3) changes to fitness parameters (e.g., decreased recruitment) are difficult to assess in small populations. Incidental take is more easily quantified and monitored when harm occurs during handling. The following describes "harm" from project operations and anticipated outcomes.

a. **Loss of spawning cue from significantly altered hydrograph, and reduced temperatures during spawning period.** Little to no spawning activity occurs on the Missouri River from Fort Peck Lake to the mouth of the Platte River (River Segments 1 to 12), which spans 1,176 river miles or one third of the species' total range. Until the hydrograph and temperatures are improved, loss of spawning opportunities will continue to prevent reproduction and recruitment for the pallid sturgeon. The recommended RPA will reduce, but not eliminate these threats. The loss to production is not quantifiable at this time, thus the level of incidental take cannot be determined.

b. **Mortalities of early life stages from reduced water temperatures, shortened river segments reducing larval drift distance, high velocities, and reduced forage.** Survival of early life stages is not occurring on the Missouri River from Fort Peck Lake to the mouth of the Platte River (River Segments 1 to 12), which spans 1,176 river miles or one third of the species' total range. Lack of suitable slow velocity and shallow water habitat limits larval and juvenile pallid sturgeon rearing areas, thereby reducing or eliminating recruitment into the pallid sturgeon population. Additionally, reservoir operations that reduce larval drift distances by shortening river reaches between reservoirs will result in mortalities as larval life stages drift into still reservation waters and perish. The recommended RPA will reduce, although not eliminate these threats. The mortalities to individuals are not quantifiable at this time, thus the level of incidental take cannot be determined.

c. **Loss of quantity and quality of spawning and nursery habitat because of significantly reduced sediment transport and deposition.** The processes of shallow water habitat creation and maintenance as brought about by sediment transport and deposition are reduced throughout the Action Area causing a continuous decline in shallow water habitat acreage. As well, lower hydrograph peaks will lessen the effects of scouring flows that clean fines from course substrates used for spawning. The recommended RPA will reduce, although not eliminate these threats. The loss of habitat and its effects to individuals is not quantifiable at this time, thus the level of incidental take cannot be determined.

d. **Loss of genetic purity and exchange due to hybridization caused by habitat loss.** Increasing rates of hybridization are observed in 595 river miles on the Missouri River between the mouth of the Platte River and the Mississippi River (River Segments 13 to 15), and in the 196 river miles of the Middle Mississippi River to Cairo, Illinois. The loss attributable to dilution of genetic purity is not quantifiable at this time, thus the level of incidental take cannot be determined.

e. **Mortalities of early life stages from entrainment due to sandbar habitat creation activities and sand and gravel dredging.** Creation of shallow water and sandbar habitat by various methods that include dredging will occur where appropriate below Gavins Point Dam on 811 miles of the Missouri River (River Segments 10 to 15). Pallid sturgeon may be entrained or otherwise impacted by these activities. These losses to individuals are not quantifiable at this time, thus the level of incidental take cannot be determined.

f. **Mortalities of adults from stress of capture and spawning for propagation program.** The Corps must obtain an ESA Section 10(a)(1)(A) permit for all research funded or conducted that may harm, harass, or take pallid sturgeon.

g. **Mortalities of all life stages from stress of capture and handling for research, monitoring and assessment programs, and from specimens retained for identification.** Incidental take for adults or juveniles due to the research,

monitoring and assessment is anticipated to be extremely low as supported by high rates of recapture. Researchers and managers follow a protocol on proper sampling and handling that was developed by the Pallid Sturgeon Recovery Team. The level of anticipated incidental take is one adult or one juvenile per year for the Upper Missouri River (River Segments 1 to 3), and one adult or one juvenile per year for the Middle Missouri River (River Segments 4 to 9), and two adults or two juveniles per year for the Lower Missouri River (River Segments 10 to 15). When larval stages are captured they must be preserved for identification in the laboratory. The level of allowable incidental take of larval sturgeon is ten per year from each the Upper, Middle and Lower Missouri River, and Middle Mississippi River (total of 40). Natural mortality of larval life stages is high in the wild, thus the loss of ten individuals per year is anticipated within each of the four river reaches.

Effect of the Take

In the accompanying Biological Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species when the Reasonable and Prudent Alternative is implemented. In other words, any incidental take that may occur would be largely offset by implementation of the Reasonable and Prudent Alternative, and Reasonable and Prudent Measures. The Service believes the following Reasonable and Prudent Measures are necessary and appropriate to minimize impacts of incidental take of pallid sturgeon.

Reasonable and Prudent Measures to Minimize Incidental Take

Although implementation of the elements described in the multi-species RPA section and the pallid sturgeon RPA section will, in part, minimize incidental take of pallid sturgeon, the Service believes the following Reasonable and Prudent Measures also are necessary and appropriate to minimize incidental take of pallid sturgeon:

Reasonable and Prudent Measure 1 (Incidental Take Outcomes a. through d.). The Corps shall minimize take associated with operation and maintenance activities through research, monitoring and evaluation.

Reasonable and Prudent Measure 2. (Incidental Take Outcome e.). The Corps shall minimize the effect of incidental take associated with dredging and construction of sandbars and shallow water habitat through entrainment of early life stages of pallid sturgeon.

Reasonable and Prudent Measure 3. (Incidental Take Outcome f. and g.). The Corps shall meet annually with the Service to match their funding capabilities with the Service's priorities to ensure strategic action on what, how and where mortality associated with propagation can be minimized.

Terms and Conditions for Implementation of Reasonable and Prudent Measures

To be exempt from the prohibitions of Section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the Reasonable and Prudent Measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. The Corps is responsible for the funding and means to carry out all Reasonable and Prudent Measures.

As part of the Annual Report, the Corps shall provide information on pallid sturgeon conservation activities similar to ESA sub permitting requirements and annual reports currently provided by the Corps' least tern and piping plover program. The report shall include progress and management actions, including elements of the reasonable and prudent alternative and reasonable, and prudent measures implemented during the operating year, habitat restoration actions, and anticipated actions for the upcoming year. The purpose of this report is to provide the Service, MRRIC, the Pallid Sturgeon Recovery Team and Recovery Workgroups the information necessary to evaluate the effectiveness of the Corps actions.

Terms and Conditions (RPM 1)
It is incumbent upon the Corps to vigorously support research and evaluation through funding and implementation of operational scenarios. The Corps should then actively and aggressively pursue and implement management and system operation actions that benefit the species based on results obtained from these evaluations, and the prescriptive approaches identified through the adaptive management strategy and Missouri River Recovery Implementation Committee (MRRIC).

The Corps shall evaluate means to avoid impacts to pallid sturgeon, quantify and track impacts, and provide recommendations to the Agency Coordination Team (ACT). The purpose of this review and evaluation is to identify and document specific operational measures taken or that can be taken now or in the future to avoid incidental take and institutionalize these measures in Annual Operating Plans and/or the Master Manual as appropriate. The Corps shall conduct this evaluation in coordination with the ACT. The initial report shall be completed by January 2005 and subsequent reports shall be part of the Annual Report to the Service and appropriately considered by the Corps in future Annual Operating Plans and/or the Master Manual revisions as appropriate. If the Corps develops new operational scenarios not considered during this consultation, the Corps shall reinitiate consultation with the Service for those new actions.

Terms and Conditions (RPM 2)
The Corps shall annually confer with the Service about location and timing of proposed dredging for sandbar and shallow water habitat construction activities. The Service will strive to minimize impacts of entrainment to early life stages of pallid sturgeon by recommending to the Corps' locations that are acceptable and unacceptable for dredging. The Corps shall evaluate means to avoid impacts to pallid sturgeon, quantify and track impacts, and provide recommendations to the Agency Coordination Team (ACT).

Terms and Conditions (RPM 3)
The Financial support to implement the propagation program is an RPA in the 2000 Biological Opinion. Developing brood stock and stocking to augment wild populations will continue to be very important in the near term. These mortalities will continue to occur because wild adults are old and in some cases unable to withstand the stress of artificial spawning.

Closing
Incidental take at a level which would not allow the pallid sturgeon to naturally reproduce, recruit and survive in the wild in the pallid sturgeon recovery priority areas is unacceptable. Because of the complexity of the issues surrounding incidental take as a result of continued or ongoing habitat degradation, and the need for adaptive management to effectively manage for all Federally listed species, we have proposed the following level or extent of incidental take. The Service believes that for those actions where incidental take can be quantified, no more than 4 adults or juveniles, and 40 larval life stages will be incidentally taken as a result of the proposed action and identified outcomes. All incidences of incidental take shall be documented and immediately reported to the Service's North Dakota Ecological Service Field Supervisor.

The Reasonable and Prudent Measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the Reasonable and Prudent Measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the Reasonable and Prudent Measures, or reinitiation of section 7 consultation.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out programs to conserve endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop biologic information. The Service provides the following recommendations to further the conservation of the bald eagle, least tern, piping plover, and pallid sturgeon on the Missouri River and lower Kansas River.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests the Corps notify us upon their implementation of any conservation recommendations.

LEAST TERN AND PIPING PLOVER

In addition to the reasonable and prudent alternative and measures listed above to preclude jeopardy and reduce anticipated incidental take, the following recommendations will further the conservation of the least tern and piping plover on the Missouri River.

A. The Corps should work with the Service and other partners to research intraspecific exchange (population dynamics/interactions) between Missouri River piping plovers and other plovers nesting in the Northern Great Plains particularly the Prairie Coteau region. Similar research should investigate movements of Interior least terns among subspecies. Such research may reveal information that would have implications to conservation of piping plovers and terns through adaptive management on the Missouri River.

B. The Corps should modify or eliminate development activities that adversely impact plover and tern reproductive success and lead to habitat destruction and modification.

C. The Corps should assess the feasibility of intensively managing a limited number of plover and tern breeding areas for high reproductive output.

D. The Corps should develop a population model for plovers and terns using the Missouri River to predict effects of river management on the survival and long-term trends and ensure levels of take on the Missouri River will not appreciably diminish the survival and recovery of listed plovers and terns.

E. The Corps should investigate Missouri River sandbar habitat complexes for migration, staging and pre-winter conditioning of piping plovers and terns.

F. The Corps should work with the Service and other partners to research the over-winter survival of plovers and terns.

G. The Corps should help fund to the Piping Plover Recovery Biologist position in North Dakota and Montana.

H. Establishing a clearinghouse for information/data/literature online or by other means for piping plover information.

PALLID STURGEON

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out programs to conserve endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop biological information. The Service provides the following recommendations to further the conservation of the pallid sturgeon on the Missouri and Mississippi Rivers.

1. The Intake Diversion Dam, operated by the Bureau of Reclamation, located on the Yellowstone River approximately 170 miles upstream of the confluence with the Missouri River has been identified as an impediment to migration of pallid sturgeon during the spawning season. As pallid sturgeon are forced to spawn in the lower reaches of the Yellowstone River, it is likely that larval sturgeon then drift into the lake environment of Lake Sakakawea and perish. Suitable spawning substrates and significant tributary inflows are present upstream of the barrier. Reconstruction of the Intake Diversion Dam to allow pallid sturgeon spawning migrations in the spring would be a significant benefit to this species. Such an action would make available approximately 170 river miles of highly suitable habitat for this species and should have a significant impact on reproduction and recruitment in this reach. We encourage the Department of the Army to work with the Department of the Interior to implement existing plans for reconstruction of this facility at the earliest possible date.

2. Sediment transport and availability for habitat development in the Lower Missouri River and Middle Mississippi River is identified as a significant factor contributing to the current status of pallid sturgeon and affecting recovery of the species in the wild. This reduction in sediment transport and availability is an ongoing effect of operation and maintenance of the Missouri River projects. The most significant benefit of increased sediment transport and availability would be expressed in the Lower Missouri River below Gavins Point Dam and in the Middle Mississippi River. However, these effects are carried through the

Mississippi River System to the Gulf of Mexico. Based on the Corps' 2002 Conceptual Analysis of Sedimentation Issues on the Niobrara and Missouri River, there appears to be a feasible alternative to manage reservoir sediment (e.g., reservoir flushing). We strongly encourage the Corps to heed the advice of the contractor that prepared the report and proceed to a Feasibility Study. We also encourage the Corps to implement any feasible alternative as determined in the Feasibility Study. The Service is willing to work closely with the Corps during this study to ensure all viable options are evaluated and that a full accounting of project benefits can be achieved.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests the Corps notify us upon their implementation of any conservation recommendations.

PIPING PLOVER CRITICAL HABITAT

Amendment to the Biological Opinion on the Operation of the Missouri River Mainstem Reservoir System, operation of the Kansas River Projects, and the operation and maintenance of the Bank Stabilization and Navigation Project: Possible effects to designated critical habitat for the threatened Northern Great Plains piping plover.

Introduction

In November 2003, the Corps transmitted the "Biological Assessment on the Operation of the Missouri River Mainstem Reservoir System, the Operation and Maintenance of the Bank Stabilization and Navigation Project, and the Operation of Kansas River Reservoir System" (hereafter, referred to as the November 2003 Biological Assessment) to the Service. The November 2003 Biological Assessment stated that "Reinitiation of formal consultation is also required because of the recent designation of critical habitat for the northern Great Plains population of the piping plover." In the "Anticipated Effects of Proposed Action and On-going Actions on Critical Habitat" section, the Corps stated "The biological effects on the piping plover designated critical habitat considered here, will include both the proposed action and those actions that are being implemented in response to the 2000 Biological Opinion." Because ongoing operations included in the Current Water Control Plan were considered in the Service's 2000 Biological Opinion, but the designated critical habitat on the Missouri River has not been a subject of section 7(a)(2) consultation, this consultation will review the Corps' ongoing Current Water Control Plan (CWCP) actions, the elements of the 2003 Biological Opinion RPA accepted by the Corps, and the new actions proposed in the Corps' November 2003 Biological Assessment.

Consultation History

The history of consultation on the Corps' action was detailed in the November 2000 Biological Opinion on the Operation of the Missouri River Mainstem Reservoir System, operation of the Kansas River Projects, and the operation and maintenance of the Bank Stabilization and Navigation Project. The consultation history from November 2000 to April 2003 can be found in the 2003 Supplemental Biological Opinion. The consultation history from April 2003 until the issuance of this amendment has been reported earlier in this amendment to the 2000 Biological Opinion.

Specific to designated critical habitat for the threatened Northern Great Plains piping plover, we are only aware of the "Supplemental Biological Opinion on the Annual Operating Plan for the Missouri River Main Stem Reservoir System During the Period May 1 – August 15, 2003 for the Endangered Pallid Sturgeon (*Scaphirhyncus albus*), Endangered Interior Least Tern (*Sterna antillarum*), Threatened Northern Great Plains Population of the Piping Plover (*Charadrius melodus*), Threatened Bald Eagle (*Haliaeetus leucocephalus*), and Designated Critical Habitat for the Piping Plover" (hereafter, referred to as the 2003 Supplemental Biological Opinion). However, the

action reviewed in that consultation was of short duration and to date, no consultation has reviewed the full scope of ongoing actions in the Corps' CWCP.

Description of the Proposed Action
The Corps' proposed action is operation of the Missouri River Mainstem Reservoir System, operation of the Kansas River projects, and the operation and maintenance of the Bank Stabilization and Navigation Project. The Corps described its proposed action in a Biological Assessment transmitted to the Service in November 2003.

In its operation of the Missouri Basin Projects, the Corps' proposed to continue implementing a majority of the actions recommended in the 2000 Biological Opinion. Additionally, the Corps' proposed action includes revised mainstem system operations, such as a modified drought conservation plan, the acceleration of shallow water habitat creation, implementation of a research, monitoring and evaluation program, flow tests, and expanded support for pallid sturgeon propagation efforts. The time frame analyzed for this consultation is presumed to be life of the Corps' Master Manual.

Current Water Control Plan
The following description of the CWCP paraphrases the description given in the 2000 Biological Opinion. Criteria for operations under the Master Manual's current water control plan (CWCP) include how reservoir storage is divided and how water is released from reservoirs during navigation and non-navigation seasons. The largest portion of the System storage capacity, 53 percent, is designated for carryover multiple uses during droughts (1-year and extended). Most of the carryover multiple use storage exists behind Fort Peck, Garrison, and Oahe Dams. Fort Randall Dam has a relatively small carryover multiple use zone, and Big Bend and Gavins Point Dams have no carryover multiple use zone. The water in the System carryover multiple use zone is designed to provide for all authorized purposes during drought periods. This zone is operated so that it remains full during periods of normal inflow, but is gradually drawn down during drought periods.

The Master Manual provides criteria for releases from the carryover multiple use zone for navigation service level, navigation season length, and non-navigation service level from the System. Each criterion relates to the amount of water in System storage. The criteria were designed so that, as the amount of water stored in the System is reduced during an extended drought, more stringent cutbacks in System releases are made to conserve water as the drought period lengthens. The criteria were designed so that the water in the carryover multiple use zone would be completely used if the drought of the 1930's duration and severity were repeated.

Support for navigation on the Missouri River below Sioux City is provided by the release of water from the Main Stem Reservoir System. At Sioux City, flows of 25 thousand cubic feet per second (Kcfs) to 31 Kcfs (minimum to full navigation service) result in channel depths of approximately 8 and 9 ft (2.4-2.7 m), respectively, in the navigation channel. Most of the water needed to maintain these flows is released from Gavins Point Dam, because the river receives little inflow between the dam and Sioux City. At Kansas City, 35 to 41 Kcfs is necessary to provide 8 to 9 ft, respectively, of navigation channel

depth; however, flow in the Missouri River at Kansas City is greatly influenced by the flow from major tributaries including the Platte and Kansas Rivers. Corresponding navigation target levels at Omaha and Nebraska City, Nebraska, are 25 to 31 and 31 to 37 Kcfs, respectively. The channel width for minimum service and full service navigation is 200 and 300 ft (61-91.5 m), respectively.

The winter non-navigation target release also is determined on the basis of water in System storage. The CWCP specifies that if water in System storage is 58 MAF or higher on September 1, then approximately 16 Kcfs is released from Gavins Point Dam for the lower river. If storage is 43 MAF or less, about 12 Kcfs is released. If storage is between the two levels, the release is prorated proportionally.

The CWCP specifies a minimum flow in the spring through fall period to provide water for intakes below the System when water in System storage is not sufficient to provide navigation flows. The upper three reservoirs contain nearly all the water used during drought to meet Congressionally authorized project purposes. Currently, the amount of water stored in these three reservoirs is balanced annually. This operation leads to an equal distribution of the effects of drought drawdown among all three reservoirs. Similarly, in extremely high inflow years, the excess water is distributed among the three so that one reservoir does not carry the burden of storing the high runoff.

Flood control constraints are applied to the System releases from Gavins Point Dam to minimize flooding on the lower river caused by inflows downstream of the System. The flood control constraints are triggered when river flow is predicted to exceed the "target flow" by a specified amount at any of three lower river locations (Omaha, Nebraska City, or Kansas City). The target flow for these three locations is tied to the navigation "service level". Normally, the “service level” is based on the navigation flow requirements. In high inflow years, the “service level” must be increased to the amount needed for navigation based on the amount of water that is forecasted to be evacuated from the System to get to the base of the flood control zones by March 1 of the following year. The “service level” for each month of the year, and thereby target flow, is determined by the amount of water currently in System storage and forecasted runoff for the remainder of the year.

When downstream flows are predicted to exceed the flood constraint flow levels, the Gavins Point Dam release is reduced such that flows will remain at or below the target flow levels of the flood control constraints. The System also includes hydropower peaking for electric generation. These peaking patterns are adjusted each spring and summer based on minimizing stage fluctuations to spawning fish downstream of Fort Randall Dam and on field surveys of the elevation of nesting terns and plovers downstream of Garrison and Fort Randall Dams.

In non-drought periods, the Corps maintains a flat release from Gavins Point Dam unless downstream flooding is occurring. The flows are then reduced for a 2-day period before being brought back up for a day. This cycle continues until the flooding subsides and the flat release occurs again.

Corps' Proposed Alternative to RPA II in the 2000 Biological Opinion
The following description paraphrases the description given in the Corps' November 2003 Biological Assessment. The Corps' proposed action incorporates a majority of the elements of the original RPA contained in the Service's 2000 Biological Opinion, including sedimentation studies, system unbalancing, and habitat creation and restoration. The proposal does not include the environmental flow releases from Gavins Point Dam, which were described in RPA II.A (i.e. spring rise and summer low flow). In lieu of RPA II.A, the Corps proposes to accelerate certain actions to benefit listed species, implement adaptive management including a research, monitoring and evaluation program that includes a series of flow tests. The research, monitoring and evaluation program includes an initial evaluation within the first three years. Additionally the Corps is proposing a modification of RPA II.B, the Ft. Peck test. Each of these components is summarized below:

1. **Proposed System Operations**. The proposed action has two basic flow features that are changed from the CWCP: more stringent drought conservation or retention of water in the upper three reservoirs and a pattern of intrasystem unbalancing.

a. **Modified Drought Conservation Measures.** The purpose of the modified drought conservation plan is to improve the storage in upper basin reservoirs during extended drought periods. The Corps plans to implement measures that modify navigation service (from full to intermediate to minimum service) from what is contained in the current water CWCP. Under the proposed action, on March 15, navigation service would reduce from full to an intermediate level at 54.5 million acre feet (MAF) and to minimum service at 49.0 MAF. The March 15 system storage level, when navigation would not be served for that year, would change from the current 23.5 MAF to 31 MAF. Implementation of back-to-back non-navigation years would require approval from the Secretary of the Army.

Under the proposed action, on July 1, navigation service would reduce from full to an intermediate level at 57.0 MAF and to minimum service at 50.5 MAF. The system storage levels at which navigation season length would be shortened are as follows: at 51.5 MAF, the season would be prorated between 8 and 7 months; at 46.8 MAF, the season would be 7 months long; at 41.0 MAF, the season would be prorated between 7 and 6 months; and at 36.5 MAF, the season would become 6 months.

b. **Unbalancing of the Upper Three Lakes**. The Corps has the authority under the existing Master Manual and currently implements intrasystem unbalancing. Unbalancing of the lakes was also included as a feature of the 2000 Biological Opinion. Unbalancing under this proposed action consists of a set pattern 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. The subsequent 2 years of lower flows would expose sandbar habitat for use by the protected birds. Unbalancing would also provide more sparsely vegetated sandbar habitat around the perimeter of the lakes.

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. 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.

Unbalancing Schedule for Upper Three Reservoirs

	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	Float
Year 2	Raise and hold	Float	High	Float	Low	Hold Peak
Year 3	Low	Hold Peak	Raise and hold	Float	High	Float

c. **Gavins Point Dam Summer Releases**. Summer releases under the proposed action will be adjusted when the Corps determines that birds have begun nesting. Flow support for navigation and other downstream purposes would 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 navigation service support in August when tributary inflows have declined (steady-release); or by some combination of the two methods, as was implemented during the 2003 nesting season (a combination of steady-release and flow-to-target methods). The modeling done for the Missouri River Master Manual Review and Update process 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.

Adaptive management will be used to make decisions about the method to use during any given year and will 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 combination of operation may be followed through the summer season to conserve water in the system.

2. **Research, Monitoring, and Evaluation**. The Corps proposes to operate the System using adaptive management that includes a research program, a monitoring and evaluation program and, within three years, a re-evaluation of the science on flow modifications.

a. **Regional Population Assessments of Interior Least Tern and Piping Plover.** In addition to the population assessment and monitoring efforts on the Missouri River being conducted in response to the 2000 Biological Opinion, the Corps will develop and support a regional coordination process for the Missouri River piping plovers and least tern subpopulations.

b. **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 to which additional habitat can be constructed with flows into Lewis and Clark Lake, 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.

1) Gavins Point Reach Fall Test. After refill of the system following the current drought, a fall flow test will be run in the river reach downstream from Gavins Point Dam and would be conducted when evacuation of the system is necessary. The test will consist of a release of approximately 60,000 cfs 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 islands and sandbars 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. This would increase the total amount of bare sandbar habitat in this reach and would allow for a redistribution of the habitat.

2) 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. This test would 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 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. The test 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.

3) **Gavins Point Spring 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, there will be additional releases in excess of those 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.

4) **Fort Peck Tests**. The Corps' proposed action includes conducting two flow release tests as required by the 2000 Biological Opinion. Preliminary biological data collection is essential to determine the responses and effects of "mini" and "full tests" on pallid sturgeon and the target species that have been selected for this effort, and will provide science critical to recovering fish populations throughout the Missouri River Basin. After assessment of the results of these tests, and through the adaptive management framework, the Corps may implement a Fort Peck Dam release change as a component of System operations.

3. **Accelerated Actions to Benefit the Species**. These actions are intended to improve shallow water habitat for the pallid sturgeon and other Missouri river fish. The actions are not within the area designated as critical habitat and will not be discussed here.

4. **Three-Year Re-evaluation**. Consistent with the adaptive management approach, the Corps' proposed that the status of the species, the scientific findings of the proposed research, monitoring and evaluation program, progress and success of other implemented measures to date, and other relevant new information be re-evaluated within 3 years following the issuance of a new Biological Opinion. This re-evaluation will inform decisions concerning implementation of additional measures or modification of existing measures and strategies, including potential flow releases out of Gavins Point Dam. The "3 year check-in" would include input from The Missouri River Recovery Implementation Committee (MRRIC) to promote conservation of listed species and the broader ecosystem values of the Missouri River.

Status of the Critical Habitat

In September 2002 (*Federal Register* 67:57638-57717), the Service designated critical habitat for the northern Great Plains breeding population of the piping plover. Included were approximately 106,030 acres largely associated with lakes in Minnesota, Montana, and North Dakota, about 440 mi associated with rivers in Nebraska, and 77,370 acres and 768 miles (438 miles associated with reservoir habitat and 330 miles associated with riverine habitat) on the Missouri River in Montana, North Dakota, South Dakota, and

Nebraska. The final rule reported that for piping plovers breeding on the northern Great Plains in the United States, about 69 percent used the lake habitat and the remaining 31 percent were found on habitat associated with Missouri River reservoirs, tributaries to the Missouri River, and the Missouri River. Critical habitat was not designated for northern Great Plains piping plovers breeding in Canada.

Because of dry conditions for much of the northern Great Plains, there may be more exposed shoreline habitat associated with the lakes, mainly the alkali lakes in Montana and North Dakota. The final rule described the primary constituent elements associated with prairie alkali lakes and wetlands as "(1) shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 200 feet (61 m) above the high water mark of the alkali lake or wetland."

The final rule (*Federal Register* 67:57638-57717) that designated critical habitat for the Northern Great Plains breeding population of piping plovers described the habitat on the reservoirs and river reaches of the Missouri River.

> *"Missouri River Units*— Missouri River units consist of riverine and reservoir (Fort Peck Lake, Lake Sakakawea and Lake Audubon, Lake Oahe, and Lewis and Clark Lake) reaches. All reservoirs except Lake Audubon are mainstem impoundments, constructed by dams, and regulated by the Corps. Lake Audubon is a sub-impoundment of Lake Sakakawea and is regulated by the BOR through operation of the Snake Creek Pumping Plant. Overall the Missouri River has accounted for up to 31 percent of the northern Great Plains population of piping plovers. All of the units are occupied.
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> Piping plover habitat within reservoir reaches is composed of shorelines, peninsulas, and islands, below the top of the maximum operating pool and is owned by the Federal government. These reservoir habitats include sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water. These reservoir reaches provide habitat for about 42 percent of the piping plovers on the Missouri River.
>
> Piping plover habitat within riverine reaches consists of inter-channel islands and sandbars including their temporary pools and interface with the river. These habitats are sparsely vegetated and consist of sand and gravel substrates. Riverine reaches provide habitat for about 58 percent of the piping plovers on the Missouri River. Ownership of these sites varies by State. In Montana, islands and sandbars are recognized as owned by the State except along the reservation boundaries of the Assiniboine and Sioux Tribes of Fort Peck. The Assiniboine and Sioux Tribes of Fort Peck own land to the mid-channel of the Missouri River adjacent to the Reservation boundary.

In North Dakota and South Dakota, islands and sandbars are recognized as owned by the State. Four Tribes along the Missouri River in North Dakota and South Dakota have critical habitat designated within the boundary of their reservation including the Standing Rock Sioux Tribe, and the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Tribes) of the Ft. Berthold Reservation, the Cheyenne River Sioux Tribe, and the Yankton Sioux Tribe. Additionally, these Tribes have land or Tribal trust land on submerged sites or sandbars/ islands within the critical habitat designation of the Missouri River in North and South Dakota. In Nebraska, islands and sandbars are owned by the adjacent landowner including the Santee Sioux Tribe.

Montana

Unit MT– 2— This unit encompasses approximately 125.4 mi (201.8 km) from just west of Wolf Point, McCone County, Montana, at RM 1712.0 downstream to the Montana/North Dakota border, Richland County, Montana, and McKenzie County, North Dakota, at RM 1586.6. The Missouri River in this unit flows through reservation land of the Assiniboine and Sioux Tribes of Fort Peck (81.7 mi (131.5 km)), State land, and privately owned land.

*Unit MT– 3, Fort Peck Reservoi*r— This unit encompasses approximately 77,370 ac (31,311 ha) of Fort Peck Reservoir, located entirely within the Charles M. Russell National Wildlife Refuge which is in Federal ownership, managed by the Service.

North Dakota

*Unit ND– 11, Missouri Rive*r—Approximately 354.6 mi (570.6 km) from the Montana/North Dakota border just west of Williston, McKenzie County, North Dakota, at RM 1586.6 downstream to the North Dakota/South Dakota border in Sioux and Emmons Counties, North Dakota, and Corson and Campbell Counties, South Dakota, at RM 1232.0. Lake Sakakawea, Lake Audubon, and Lake Oahe are included in this unit, along with a free-flowing stretch of the Missouri River from RM 1389 to 1302 (Garrison Reach). The North Dakota Game and Fish Department manages the north half of Audubon Reservoir and the Service manages the south half of Audubon Reservoir. The Missouri River and associated reservoirs in this unit include 6.83 mi (11 km) of shoreline (right and left bank) of trust land and 77 linear rm (123.9 km) within the reservation boundary of the Three Affiliated Tribes of Fort Berthold and 23.22 mi (37.37km) of shoreline on trust land and 38 linear rm (61.16 km) within the reservation boundary of Standing Rock Sioux Tribe and 20 mi (32.19 km) of shoreline on trust land. A mix of State and privately owned lands also are included in this unit.

*South Dakota Unit SD– 1 Missouri Rive*r— Approximately 159.7 mi (257 km) from the North Dakota/South Dakota border northeast of McLaughlin, Corson County, South Dakota, at RM 1232.0 downstream to RM 1072.3, just north of

Oahe Dam (Oahe Reservoir). The Missouri River and associated reservoirs in this unit include 3.22 mi (5.18 km) of shoreline (right bank) on trust land and 41 linear mi (65.98 km) within the reservation boundary of the Standing Rock Sioux and 23.44 mi (37.72 km) of shoreline (right bank) on trust land and 77 linear mi (123.92 km) within the reservation boundary of Cheyenne River Sioux Tribe. A mix of State and privately owned lands also are included in this unit.

*Unit SD– 2, Missouri Rive*r— Approximately 127.8 mi (204.4 km) from RM 880.0, at Fort Randall Dam, Bon Homme and Charles Mix Counties, South Dakota, downstream to RM 752.2 near Ponca, Dixon County, Nebraska. One mainstem Missouri River reservoir, Lewis and Clark Lake, and two riverine reaches (Fort Randall and Gavins Point) are included in this unit. In addition to the 127.8 mi (204.4 km) that border South Dakota on the left bank there are approximately 7.8 mi (12.4 km) of river bordering South Dakota on the right bank. All islands and sandbars in South Dakota are in State ownership with the exception of 60.36 mi (97.14 km) of Sioux Tribe. Approximately 120 mi (192 km) (right bank) of river border Nebraska. Sandbars and islands in Nebraska (State line extends to mid-channel) belong to the adjacent landowner. Approximately 16 linear mi (25.75 km) (right bank) of river below Ft. Randall Dam are within the boundary of the Santee Sioux Reservation, including 0.05 mi (0.08 km) of shoreline on trust land."

Based on data in the final rule, for northern Great Plains piping plovers that nest on the Missouri River, about 13 percent is found on reservoir shoreline habitat and about 18 percent is found on habitat associated with rivers. This critical habitat was designated in:

Montana:
Fort Peck Lake 77,370 acres
Missouri River below Fort Peck Dam (RM 1712.0 to RM 1586.6) 125.4 miles

North Dakota: Missouri River
Below Fort Peck Dam (RM 1586.6 to RM 1540.0) 18.6 miles
Above Garrison Dam (RM 154.0-RM 1389.0) 179 miles
Below Garrison Dam (RM 1389.0-RM 1302.0) 87 miles
Lake Oahe (RM 1302-RM 1232.0) 70 miles

South Dakota: Missouri River
Lake Oahe (RM1232.0-RM 1072.3) 159.7 miles
Below Fort Randall Dam (RM 880.0- RM 844.0) 36 miles
Lewis and Clark Lake (RM 844.0-RM811.1) 32.9 miles
Below Gavins Point Dam (RM 811.1-752.2) 58.9 miles

Primary Constituent Elements
In accordance with the ESA in determining which areas to propose as critical habitat, the Service based its critical habitat determinations on the best scientific and commercial data available. The Service considered the physical and biological features (primary constituent elements) that are essential to conservation of the northern Great Plains population of piping plovers that may require special management considerations and protection. These considerations included: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing (or development) of offspring; and (5) habitats protected from disturbance or that are representative of the historic geographical and ecological distributions of a species.

For the northern Great Plains population of the piping plover, the primary constituent elements are those biological and physical habitat processes and components believed to be essential for the biological needs of courtship, nesting, sheltering, brood rearing, foraging, roosting, intraspecific communication, and migration. The overriding biological primary constituent element believed necessary is the dynamic ecological processes that create and maintain the physical components of piping plover habitat. On rivers, the physical primary constituent elements include sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river. On reservoirs, the physical primary constituent elements include sparsely vegetated shoreline beaches, peninsulas, and islands that are composed of sand, gravel, or shale, and their interface with the water bodies.

The final rule also made the following clarification: "Critical habitat for the northern Great Plains breeding population of piping plovers must meet the biological and physical primary constituent element requirements as defined above and are found on areas that—(1) Are currently or recently used for breeding, or (2) were documented to have been occupied historically, or (3) are not specifically documented to have been occupied, but are deemed potential breeding habitat since these areas are part of a riverine system with documented nesting, and are within the historic geographic range, or (4) include habitat complexes, including wetland and adjacent upland areas, essential to the conservation of this species (50 CFR 424.13(d)). The critical habitat designation is effective year-round in order to conserve habitats. Therefore, an area that contains primary constituent elements is considered to be critical habitat even if these elements are temporarily obscured by snow, ice, or other temporary features. Areas found within the critical habitat boundaries that do not conform with the above discussion and the elements of this paragraph are not critical habitat. However, it is important to keep in mind that, because of the nature of the northern Great Plains, some of these designated habitats will not have these components every year but must have them over time to be considered critical habitat."

The final rule also explained the approach used to describe where critical habitat occurred: "Most important, the habitats used by the piping plover in the northern Great

Plains, as explained in this rule, are highly dynamic. By using a coarser approach to the mapping effort and refining the critical habitat boundaries by describing those habitat features (primary constituent elements) essential to the plover's life-history requirements, critical habitat designation will accommodate the dynamic nature of the habitat changing through time as primary constituent elements form in one area while disappearing in another. We believe this approach is the only scientifically credible way to ensure the critical habitat designation reflects the species habitat's naturally ephemeral character."

Environmental Baseline

Weather will greatly impact the amount of designated critical habitat associated with lakes in Minnesota, Montana, and North Dakota (approximately 106,030 ac). In the comments section of the final rule, the Service noted that on the northern Great Plains most 10-year periods encompass both wet and dry cycles. The rule noted that these cycles are the basis for the dynamic nature of prairie alkali lakes and wetlands.

As a result of the continuing drought conditions, water levels have declined and greater expanses of shoreline may be exposed. One of the primary constituent elements associated with this habitat type was defined as "adjacent uplands 200 feet (61 m) above the high water mark of the alkali lake or wetland." Therefore, while there may currently be more critical habitat exposed along the alkali lakes and wetlands in Montana and North Dakota, it is not known to what extent vegetation encroachment may have occurred. Murphy et al. 2001 found that numbers/habitat peaked during high water in 1996 and declined steadily through end of study in 1999. We are unable to assess the area of critical habitat that may be currently exposed and for the purposes of this Biological Opinion, we are assuming that the amount of critical habitat designated on alkali lakes and wetlands is unchanged from the September 2002 designation.

About 440 river miles of critical habitat were designated on the Platte, Niobrara, and Loup rivers in Nebraska. Since the time of designation, drought conditions have continued throughout much of Nebraska, Wyoming, and eastern Colorado. Water levels in Lake McConaughy are low and flows in the Platte River have been reduced. While this has resulted in more exposed riverine habitat, the low flows also promote the encroachment of vegetation which results in the loss of the primary constituent element "sparsely vegetated channel sandbars." Vegetation encroachment is a chronic problem on Platte River piping plover habitat. However, critical habitat on these rivers was designated in river miles and quantification of the area of habitat that had the primary constituent elements is not possible. While it is likely deterioration in riverine habitat on Nebraska rivers is continuing as a result of drought conditions, we believe the conditions are not greatly changed since the September 2002 designation of critical habitat.

With respect to the critical habitat designated on reservoirs associated with the Missouri River, the Missouri River, and its tributaries, the Service's 2003 Supplemental Biological Opinion made the following determinations.

> "Impacts to designated critical habitat from the proposed operating plan in 2003 will depend on the actual operating conditions that occur in 2003, but will be

limited to those critical habitat areas designated in the riverine habitats below Gavins Point and Fort Randall Dams, and on island habitats on Lewis and Clark Lake. The 2000 Biological Opinion (RPAII(A), page 233) called for summer flow modifications by 2003 for steady and then declining flows during the plover nesting season. The Service further envisioned that during drought years that flows would decline for water conservation purposes. However, as discussed previously, conditions not considered during the 2000 consultation process (e.g., new information concerning habitat degradation following 1997 floods; drought conditions and flow scenario impacts) have allowed the Service and the Corps to consider a different alternative to meet all operational purposes in 2003, and to serve as an acceptable substitute for this year's drought conditions for the low summer flow component of the RPA in the November 2000 Biological Opinion. The proposed modified operating plan will actually provide an increase in the availability of critical habitat early in the nesting season when compared to a flat 30 Kcfs flow as proposed in the final AOP, but less total habitat later in the season, than a steady to declining flow where critical habitat would increase during the nesting season. Specific habitat acreages for flow scenarios considered and the proposed operating plan (i.e., 26 Kcfs Minimum Risk) are identified in Table 1 and Figure 11 in the Corps' addition supplemental biological assessment dated April 4, 2003.

The revised proposed action will likely affect the primary constituent elements of the critical habitat. Under the proposed modified operating plan the biological processes that affect physical habitat will be adjusted away from the natural hydrograph (i.e., declining summer flows), potentially decreasing available habitat in the hatching and brood rearing season if higher flows are needed to meet operational purposes. Although data analysis shows that this is likely the case (refer to model efforts and acreage numbers in Table 1 and Figure 11 in the Corps' additional supplemental biological assessment dated April 4, 2003) under the revised proposed operating plan, models project between 650 and 1000 acres of habitat may be made available early in the nesting season whereas approximately 650-750 acres of habitat would be available under a flat Kcfs flow release in the final AOP. The availability of this amount of habitat early in the nesting season should encourage early nesters. These nests tend to have higher nesting success.

The Service does not believe that the proposed action will appreciably reduce the value of critical habitat for the survival and recovery of the Northern Great Plains breeding population of the piping plover. This is due to: (1) the short duration of impacts to critical habitat, (2) the habitat measures already being implemented under management actions to comply with the RPA in the November 2000 Biological Opinion, (3) naturally expanding habitat (i.e., the 2003 drought conditions) on reservoir shorelines of Fort Peck Lake, Lake Sakakawea, and Lake Oahe, and (4) large total amount and present good condition of designated critical habitat for the Northern Great Plains breeding population."

This 2003 Amended Biological Opinion follows approximately six months after the completion of the 2003 Supplemental Biological Opinion. The spring, summer, and early fall months of 2003 have experienced a continuation of the drought. The reservoirs are generally at lower levels and the Missouri River has not experienced any natural flood events during this period.

On reservoirs, the amount of possible critical habitat will increase proportionally to the amount of shoreline until the water reaches a level that the distance between the water and the permanent vegetation decreases to the point that piping plovers will no longer use the habitat. On rivers, the amount of possible shoreline critical habitat will increase as river levels drop (more bank habitat will be exposed and greater expanses of sand and gravel bars will be exposed). However, on rivers the temporary pools on sandbars and islands are also recognized as a primary constituent element and, unless river levels fluctuate, these pools may decrease. Unless river flows fluctuate, vegetation will likely encroach on the exposed habitat. Manipulation of the river flows on the river stretches may attenuate these effects if high flows are of sufficient magnitude to scour existing sandbars and build new ones.

Suitable plover habitat on both reservoirs and rivers depends on a cycle of high and low water levels. At any given point in time, as a result of natural or human caused effects, the water levels in the reservoirs and rivers will be fluctuating. During flood events, water levels in reservoirs will increase, as will river flows. During droughts, reservoir levels will drop and river flows will decrease. The natural cycle is attenuated by the Corps' actions. As a result, the availability of critical habitat can only be described in a relative sense. These fluctuations are also recognized as necessary for the long-term maintenance of critical habitat.

Through December 2003, portions of the northern Great Plains have had about five years of below normal precipitation and runoff. Therefore, water levels in the reservoirs and rivers tend to be below average. As was concluded in the 2003 Supplemental Biological Opinion, we expect greater than average amounts of possible critical habitat to be exposed, but the amount of exposed habitat that also contains the primary constituent elements is unknown.

Effects of the Action

For the purposes of this 2003 Amended Biological Opinion, we considered that the ongoing and proposed actions would have "no effect" on the approximately 106,030 ac of critical habitat largely associated with lakes in Minnesota, Montana, and North Dakota. Also, we found that the ongoing and proposed actions would have no effect on the 440 river miles of designated critical habitat on the Platte, Niobrara, and Loup rivers in Nebraska. We believe the scope of the proposed action only encompasses the designated critical habitat that contains the primary constituent elements found on the 77,370 acres of habitat associated with Fort Peck Reservoir and the 768 river miles of designated habitat associated with the Missouri River.

Ongoing Missouri River Operations
The 2000 Biological Opinion found that current Missouri River Operations do not provide the pulse flows necessary for vegetation scouring. The 2000 Biological Opinion stated that channel incision also seems to be partly responsible for vegetation encroachment on islands and sandbars.

The lack of scouring flows and the loss of critical habitat to vegetation encroachment appears to be the main source of detrimental effect to designated critical habitat by directly affecting the primary constituent element of "sparsely vegetated channel sandbars." The 2000 Biological Opinion noted that in "most years, system regulation does not provide flows necessary to scour many of these islands, and encroaching vegetation makes the habitat unsuitable…." The 2000 Biological Opinion stated vegetation encroachment was common below Gavins Point Dam and also occurred below Garrison Dam.

In the past, "bouncing" of releases for water conservation and hydropower was thought to cause loss of sandbar habitat. The 2000 Biological Opinion reported that the bouncing of releases (2 days of low flow followed by 1 day of higher flows) at Gavins Point Dam in 1989 resulted in the taking of "some" habitat.

Proposed Actions and Actions Required by the 2000 Biological Opinion
In the November 2003 Biological Assessment, the Corps stated: "The biological effects on the piping plover designated critical habitat considered here, will include both the proposed action and those actions that are being implemented in response to the 2000 Biological Opinion." With respect to those actions, the Corps made the following determinations.

> **"Adaptive Management**. The implementation of adaptive management through MRRIC will likely have no direct adverse effect on the designated critical habitat. As the adaptive management strategy is based on process and development of information, critical habitat will likely benefit through improved communication and coordination of all activities with the Service and other stakeholders.
>
> **System Operation Changes**. System operation changes will produce flow changes in a planned, adaptive management process. Implementation of drought conservation measures may lower flows on the river below Gavins Point Dam and expose reservoir shore habitat during drought periods. Unbalanced intrasystem operations will periodically inundate and expose reservoir shoreline habitats. Gavins Point summer releases may vary year to year depending upon hydrologic conditions.
>
> a. **Drought Conservation Measures.** The drought conservation measures, aimed at conserving water in the upper three reservoirs during drought periods, will generally reduce flows below Gavins Point Dam earlier in the drought cycle. The resulting lower flows will typically occur during the summer and fall months. The effects of this operation are complex and will have short and

long term impacts to the critical habitat for the plover. In the short-term, lower flows will expose more sandbar and island habitat in the riverine environment below the dams. On the reservoirs, shoreline habitat will potentially continue to be exposed as storage is depleted. During the nesting and brooding season these actions would have a beneficial effect to the plovers by increasing available critical habitat. If the drought conditions persist, these short-term benefits may translate into long-term habitat loss if dynamic ecological processes required to create and maintain critical habitat are not implemented. (See discussion on page 57643 of FR Vol. 67, No. 176, September 2002)

b. **Intrasystem Unbalancing.** The unbalancing of the upper three lakes component of the proposed action would have no effect on riverine habitats. However, the water management strategy of fluctuating the reservoir levels on a three-year cycle introduces variability into the reservoir system. The reservoir biological primary constituent element (sparsely vegetated shoreline beaches, peninsulas, etc.) would be created and maintained by the introduced dynamic process of cyclic rising and falling. This action would allow the habitat to be maintained over time. This would be a positive effect to the critical habitat of the reservoirs.

c. **Gavins Point Summer Releases.** Releases from Gavins Point Dam have been steady-release, flow-to-target or a combination of the two. Steady-release flows have an adverse effect on piping plover critical habitat by inundating habitat early in the nesting season and making this habitat unavailable to the birds throughout the nesting season. By contrast, the flow-to-target regime provides additional piping plover critical habitat during the early part of the nesting season. This regime however requires that tributary runoff later in the nesting season remain high enough to meet flow targets.

3. **Hatchery Facility Improvements**. Hatchery facility improvements will have no effect on piping plover critical habitat.

4. **Accelerated Shallow Water Habitat Construction**. Accelerated shallow water habitat construction will have no effect on piping plover critical habitat as it does not occur within the bounds of the critical habitat designated by the Service.

5. **Artificially or Mechanically Created Habitat**. This action includes measures to create and maintain the physical elements of critical habitat through artificial methods. These methods may provide physical habitat elements without dynamic ecological creation processes. However, currently no data exist that demonstrate the ability of many of these methods (spraying, mowing, bulldozing piles of sand) to provide properly functioning biological habitat elements (food, shelter, habitat in the proper arrangement…) or address the effects of these methods on the physical primary constituents elements over large geographic and temporal scales. The production of physically suitable but ecologically non-

functioning habitat that result in "ecological traps" is of particular concern. An intensive, experimentally based monitoring approach will be used to assess the value of these methods in providing the biological and physical elements of piping plover habitat. One action to address this issue is the proposed sandbar conditioning test. As this information is obtained and analyzed, the measures will be refined through the adaptive management process. The effects of several measures that are aimed at creating piping plover critical habitat are currently unknown, but are designed to increase knowledge and understanding of habitat creation and functionality processes. Addressing these uncertainties is a beneficial effect.

6. **Research, Monitoring, and Evaluation (RM&E)**. There are on-going and proposed RM&E efforts associated with least terns and piping plovers. These include riverine and reservoir habitat monitoring and evaluation, the forage ecology study, and the regional population assessments. These actions will provide for an improved regional understanding of the bird population dynamics, improved coordination and data storage, and will expand current efforts to include actions focused on the wintering grounds. This new information will be used in the adaptive management strategy to inform the recovery decision-making process. Gathering information aimed at improving management of the species will have no adverse effect on critical habitat.

The Corps' proposed action also includes a series of flow tests to gain essential information, the effects of which are described below.

a. **Gavins Point Reach Fall Test.** As described, 60,000 cfs for 60 days, will have beneficial effects on piping plover critical habitat by introducing some of the natural attributes of high flows to create and maintain sandbar habitat. Because of the fall timing of the release, there will not be a conflict with nesting piping plovers.

b. **Fort Randall Reach Fall Rise.** A pulse flow aimed at creating and maintaining habitat below Fort Randall Dam would have beneficial effects on piping plover critical habitat. The degree of the benefit will depend on the magnitude and duration of the flow. Because of the fall timing of the release, there will not be a conflict with nesting piping plovers.

c. **Gavins Point Spring Sandbar Habitat Conditioning.** This measure will inundate habitat for a short period of time in the spring. This action would potentially provide the primary constituent elements of piping plover critical habitat by consolidating substrate and mixing organic material in the surface layer and this in turn would lead to greater productivity compared to sandbars that were constructed and not inundated.

d. **Fort Peck Tests.** Benefits from this action will likely be improved habitat due to the scouring of vegetation through high flows. Another beneficial

> effect of the action will be the release of warmer water into the riverine environment below the dam. This could result in improved forage for piping plovers and increase production overall in the local ecosystem."

The Service has reviewed the ongoing and proposed actions and the effects they could have on the primary constituent elements. In the final rule that designated critical habitat, the Service wrote:

> "The one overriding primary constituent element (biological) required to sustain the northern Great Plains breeding population of piping plovers that must be present at all sites is the dynamic ecological process that creates and maintain piping plover habitat."
>
> "The annual, seasonal, daily, and even hourly availability of the habitat patches is dependent on local weather, hydrological conditions and cycles, and geological processes."
>
> "On reservoirs the physical primary constituent elements include-sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand, gravel, or shale, and their interface with the water bodies."
>
> "On rivers the physical primary constituent elements include-sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river."

For the purposes of assessing the effects of the ongoing and proposed actions, the Service recognized segments of the Missouri River system.

1. Reservoirs: 77,370 acres associated with Fort Peck Reservoir and 438 river miles associated with Lake Sakakawea, Lake Audubon, and Lake Oahe.
2. Lakes: 36 river miles associated with Lewis and Clark Lake

River Stretches:

3. 125 river miles below Fort Peck Reservoir
4. 25 river miles above Lake Sakakawea
5. 88 river miles above Lake Oahe
6. 95 river miles above Lewis and Clark Lake and below Gavins Point Dam

The Service assessed the effects of the ongoing and proposed actions by qualitatively ranking the effects on the primary constituent elements of reservoir and river habitat by Missouri River Segment, as shown in the following matrix. N = No Effect, A = Adverse Effect, a = lesser Adverse Effect, B = Beneficial Effect, b = lesser Beneficial Effect

Action	Missouri River System Segments					
	1.	2.	3.	4.	5.	6.
Current Water Control Plan						
Reduced Vegetation Scouring	N	N	A	A	A	A/b*
Sandbar erosion	N	N	A/b	A/b	A/b	A/b*
Reservoir Inundation	B	N	N	N	N	N
Flooding	B	b	a	A	a	A
Adaptive Management	N	N	N	N	N	N
System Operation Changes						
a. Drought Conservation Measures						
Short-term	b	N	b	b	b	b
Long-term	b	N	a	a	a	a
b. Unbalancing	B	N	N	N	N	N
c. Gavins Pt Summer Releases						
Steady-flow	The Service believes the effects of the Gavins Point Summer Releases are included in the assessment of the Current Water Control Plan					
Flow to Target						
Combination						
Sturgeon Hatchery Operations	N	N	N	N	N	N
Shallow Water Habitat Creation	N	N	N	N	N	N
Habitat Creation and Improvement						
Created	b	b	N	b	b	b
Improved	b	B	N	B	B	B
Research						
Gavins Point Reach Fall Test	N	B**	N	N	N	B
Fort Randall Reach Fall Rise	N	B**	N	N	N	B
Gavins Point Spring Sandbar						
Habitat Conditioning	N	N	N	N	N	b*
Fort Peck Tests	N	N	b	N	N	N

b* = the lesser beneficial effects by scouring of vegetation and building of sandbars as result of Gavins Point Spring Sandbar Habitat Conditioning will depend on the magnitude and duration of flows used.

B** = the beneficial effects to sandbar and island habitat in Lewis and Clark Lake will depend on how the test is conducted. Tests that result in the maximum fluctuation of water levels in Lewis and Clark Lake will have the greatest beneficial effect.

The area and status of critical habitat and the associated primary constituent elements along the Missouri River were not reported when critical habitat was designated in September 2003. For the primary constituent element described as the dynamic ecological processes (local weather, hydrological conditions and cycles, and geological processes) required to sustain the northern Great Plains breeding population of piping plovers, we considered the ongoing actions of implementing the CWCP as the actions

that would interfere with the hydrological conditions and cycles. Building the dams, forming the reservoirs and lakes, and regulating flows are past and ongoing actions that have altered the natural hydrological conditions and cycles. This has resulted in adverse effects to the river primary constituent elements of maintaining sparsely vegetated channel sandbars. Current Missouri River operations were present at the time critical habitat was designated and the Service found the reservoir and riverine habitat still had primary constituent elements of sufficient quality and quantity for the habitat to merit recognition as critical habitat. Therefore, it is reasonable to assume that the continuation of the operations will, over time, keep the primary constituent elements in the condition they were at the time when critical habitat was designated.

Current Water Control Plan Operations

We identified four types of effects to primary constituent elements that are likely to result from ongoing Missouri River operations: lack of scouring of vegetation, sandbar erosion, and vegetation suppression in the reservoir reaches by inundation (caused by the unbalancing actions) and flooding (caused by the need to store water).

> **Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.**

We believe current operations are contributing to vegetation encroachment in the riverine stretches. Adverse effects to the primary constituent element of sparsely vegetated channel sandbars occur on the 125 miles of river below Fort Peck Reservoir, 25 miles of river above Lake Sakakawea, 88 miles above Lake Oahe, and the 36 miles of river above Lewis and Clark Lake. Below Gavins Point Dam, for the 59 miles of river habitat, the adverse effects will be attenuated by the Gavins Point Reach Fall Test and the Gavins Point Spring Sandbar Conditioning flows. The 77,370 acres of critical habitat on Fort Peck Reservoir and 438 miles of reservoir habitat are not affected by a lack of vegetation scouring flows.

We believe current operations are eroding sandbars. On the river reaches (125 miles of river below Fort Peck Reservoir, 25 miles of river above Lake Sakakawea, 88 miles above Lake Oahe, 36 miles of river above Lewis and Clark Lake, and 59 miles of river below Gavins Point Dam) we believe current operations adversely affect sandbar habitat by decreasing their area through erosion. However, we also believe there is a beneficial effect of lesser magnitude because the flows that erode sandbars also move sediment and may build and rehabilitate sandbars elsewhere.

We found that flooding would have an adverse effect of lesser magnitude on sandbar habitat in these riverine reaches. Conversely, we found that flooding, by building sandbars and islands, would have a beneficial effect of lesser magnitude in Lewis and Clark Lake. We did not find any detrimental effects to sandbar habitat on Lewis and Clark Lake. We also concluded there would be no effect to temporary pools on the islands and sandbars nor would there be an effect on the interface with the river.

Effects on reservoirs: sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand, gravel, or shale, and their interface with the water bodies.

We concluded that inundation of reservoir habitats, as a result of ongoing operations, would have a beneficial effect by helping to suppress vegetation on the shoreline beaches, peninsulas, and islands. There may also be a benefit to the habitat by the nourishment effect of fluctuating water levels. This beneficial effect would apply to Fort Peck Reservoir (77,370 acres), Lake Sakakawea, and Lake Oahe (about 409 river miles).

Habitat on Lewis and Clark Lake would probably not benefit from inundation. We also found that the primary constituent elements of islands composed of sand, gravel, or shale and their interface with the water body would not be affected.

We also believe that flooding would predominately benefit reservoir shoreline habitat. The majority of foraging and nesting by piping plovers on reservoir shoreline habitat occurs in a relatively narrow (in comparison to the shoreline reach that is often exposed) band above the water line. As the water level in the reservoirs increases, the miles of shoreline will also increase, often dramatically. Therefore, the amount of critical habitat available to the plovers will also increase. This will be true until the water level is so high that the distance between the water line and permanent vegetation or geological structures, such as a cliff, decreases to the point that it is no longer used by plovers. Historically, the reservoirs have only filled to capacity on two occasions. Therefore, we found that the beneficial effects of flooding reservoirs would greatly outweigh any possible adverse effects to reservoir critical habitat.

Proposed Actions in the 2003 Biological Assessment

Adaptive Management

The Service supports the concept of adaptive management to address scientific uncertainties and build upon stakeholder efforts to develop strategies to conserve the species and restore the Missouri River ecosystem. However, the Service believes that the adaptive management action will have no effect on currently designated critical habitat.

System Operation Changes

Short-term Drought Conservation Measures

Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

The Service believes that the short-term drought conservation measures will have beneficial effects, but not greatly beneficial, to the primary constituent element of sparsely vegetated channel sandbar habitat. The lower flows will expose more sandbar and island habitat and thus make more sparsely vegetated channel sandbar habitat

available. We do not anticipate any effects to the sand and gravel beaches, temporary pools, or the interface with the river.

Effects on reservoirs: sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand, gravel, or shale, and their interface with the water bodies.

Likewise, the Service believes that the short-term drought conservation measures will have beneficial effects, but not of great magnitude, to the reservoir primary constituent element of sparsely vegetated shoreline beaches, peninsulas, and islands. Reservoir shoreline habitat will be exposed as the water level declines and this will increase the amount of sparsely vegetated shoreline beaches, peninsulas, and islands.

Because water is managed differently in Lewis and Clark Lake, the Service believes that short-term drought conservation measures will not affect primary constituent elements on Lewis and Clark Lake. We also believe that short-term drought conservation measures will not have an effect on the sand, gravel, or shale substrates and their interface with the water bodies.

Long-term Drought Conservation Measures

Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

The Service believes that the long-term drought conservation measures will have adverse effects, but not effects of great magnitude, to this primary constituent element. Over the long-term, the sandbar and island habitat that was exposed in the short-term is likely to become vegetated and sparsely vegetated channel sandbar habitat will decrease in area. We conclude that there will not be an effect on the sand and gravel beaches on islands, the temporary pools, or the interface with the river.

Effects on reservoirs: sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand, gravel, or shale, and their interface with the water bodies.

The Service believes that the long-term drought conservation measures will continue to have beneficial effects, but not great in magnitude, to the reservoir primary constituent element of sparsely vegetated shoreline beaches, peninsulas, and islands. Reservoirs have considerable interior areas and the shoreline habitat will continue to be exposed as the water level declines and this will increase the amount of sparsely vegetated shoreline beaches, peninsulas, and islands.

The primary constituent elements of sand, gravel, or shale substrates and the interface with the water body will not be affected. Because water is managed differently in Lewis

and Clark Lake, the Service believes that long-term drought conservation measures will not affect primary constituent elements on Lewis and Clark Lake.

Intrasystem Unbalancing

Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

The Corps proposes to unbalance the three upper reservoirs on a three-year cycle. This will result in high, medium ("float"), and low water levels on alternating years. The flows between reservoirs will not be appreciably altered by the reservoir unbalancing cycle. Therefore, the Service finds that unbalancing will not affect the riverine primary constituent elements of sparsely vegetated channel sandbar habitat, the sand and gravel beaches on islands, the temporary pools on islands, or the interface with the river.

Effects on reservoirs: sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand, gravel, or shale, and their interface with the water bodies.

The Service believes unbalancing the reservoirs will have a beneficial effect on the primary constituent element of sparsely vegetated shoreline beaches, peninsulas, and islands. The cycle of fluctuating water levels will retard vegetation encroachment on the reservoir habitat.

We do not anticipate any effects on the sand, gravel, or shale substrate nor on the interface with the water body. Because Lewis and Clark Lake will not be included in the cycle of unbalancing, this action will not have an effect on primary constituent elements in this lake.

Gavins Point Summer Releases

The Corps' proposes to use three methods of managing summer releases: steady-release flows, flow-to-target, and a combination of these two methods. All effects of this action would be in the 59 mile riverine stretch below Gavins Point Dam. Steady-release flows would likely result in adverse effects on sandbar habitat by covering it with water before and during the nesting season. Flow-to-target flows would result in increased habitat early in the season but the habitat would likely be inundated later in the season and the beneficial effect would be lost. The combination of flows would result in effects from both types of flows during the year and among years. The Service believes Gavins Point Summer Releases are part of the Current Water Control Plan operations and these effects have already been included in the earlier review of effects resulting from ongoing operations. Therefore, the effects of Gavins Point Summer Releases on the primary constituent elements in the Missouri River below Gavins Point Dam will not be reiterated here.

Sturgeon Hatchery Facility Operations
The Service finds that hatchery operations will not affect the primary constituent elements of river and reservoir habitat.

Accelerated Shallow Water Habitat Construction
Because the proposed areas for shallow water habitat construction are not within the bounds of designated critical habitat, this action will have no effect on the primary constituent elements associated with river and reservoir habitat.

Artificially or Mechanically Created Habitat
The Corps proposes to create and maintain habitat. The Corps noted that "currently no data exist that demonstrate the ability of many of these methods (spraying, mowing, bulldozing piles of sand) to provide properly function biological habitat…" The Service agrees that the value of this habitat is yet to be determined, but we also believe the Corps has the engineering expertise, when combined with a rigorous scientific and adaptive management approach, to create and maintain suitable habitat for nesting and foraging piping plovers.

The Corps proposes to create about 1,560 acres of sandbar habitat and to rehabilitate another 1,560 acres. Rehabilitation would involve vegetation removal on existing sandbars and islands. The Corps did not delineate where habitat creation would occur, but in the Service's 2000 Biological Opinion, we recommended about 35 percent shoulld be created downstream from Gavins Point Dam, 35 percent in Lewis and Clark Lake, about 22 percent downstream from Garrison Dam, and the remaining 8 percent should be downstream of Fort Randall Dam. We also noted that the Corps has committed to restoring habitat in the reservoir reaches.

> **Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.**

Habitat creation is not proposed for the 125 mile river stretch below Fort Peck Dam. Therefore, we concluded there would be no effect to habitat in this area.

We believe there is a difference between "created" habitat and "rehabilitated" habitat. While there is no doubt that habitat can be created and we believe it is desirable to create habitat, we also believe that it is largely unknown at this time whether fully suitable habitat for foraging and nesting piping plovers can be created. On the other hand, sandbar and island habitat already exists that, except for vegetation encroachment, would be suitable for foraging and nesting piping plovers. We believe this habitat could become suitable habitat if the vegetation were removed. Therefore, we judged habitat rehabilitation to be of greater benefit to the primary constituent element of "sparsely vegetated channel sandbar habitat" than the creation of habitat. However, both benefited the primary constituent element. We also believe the engineering skills of the Corps will allow them to ensure that only quality sand and gravel habitat is created and they will be able to landscape the created habitat to include important physical elements such as

temporary pools. Likewise, on the rehabilitated habitat, we believe the Corps can create the temporary pool habitat where it does not currently exist.

For these reasons, we found the creation of habitat to be beneficial to the primary constituent elements, although the uncertainty of success makes it of lesser benefit than the rehabilitated habitat. The benefits of created and rehabilitated habitat would occur in the 25-mile river reach above Lake Sakakawea, the 88 miles above Lake Oahe, the 36 miles above Lewis and Clark Lake, the 59 miles below Gavins Point Dam, and in Lewis and Clark Lake.

Effects on reservoirs: sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand, gravel, or shale, and their interface with the water bodies.

We found the rehabilitation of habitat to be beneficial to the sparsely vegetated shoreline beaches, peninsulas, and islands primary constituent element of reservoirs. However, the Corps was not specific in the amount of habitat that would be created or rehabilitated. For that reason, although the creation and rehabilitation of habitat will be beneficial to the primary constituent element, we could not determine that the benefit would be of great magnitude. Because Lake Sakakawea and Lake Oahe are used for foraging and nesting by many piping plovers, we encourage the Corps to focus their efforts on habitat in these reservoirs.

Research, Monitoring and Evaluation

The Corps proposes four flow tests to investigate the effects of flows on habitat building and retention. These tests have the potential to benefit the primary constituent elements of the riverine segments where the tests occur. However, currently the tests are proposed as one-time tests, which limit the beneficial effects. If the tests prove to be beneficial, the Corps should routinely implement the measures needed to build and maintain foraging and nesting habitat for piping plovers.

Effects on reservoirs: sparsely vegetated shoreline beaches, peninsulas, islands and islands composed of sand, gravel, or shale, and their interface with the water bodies.

None of these tests will have an effect on critical habitat in the reservoir reaches, therefore the Service made a no effect determination for the primary constituent elements found on reservoir critical habitat.

Gavins Point Reach Fall Test

Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

The fall test will pulse up to 60,000 cfs for five to 60 days below Gavins Point Dam. These flows should redistribute sandbar habitat and build new habitat. We believe this test is important and will benefit the primary constituent elements of sparsely vegetated shoreline beaches, peninsulas, islands and islands composed of sand, gravel, or shale, and their interface with the water bodies for the 59 mile river reach below Gavins Point Dam. For the piping plover, the greatest benefit will likely occur if the Corps maximizes both the discharge and duration of the test. However, we recognize that this fall flow could be detrimental to the survival of the highly endangered pallid sturgeon. Therefore, the flows required by the Reasonable and Prudent Alternative in the November 2003 Amended Biological Opinion must be implemented to prevent jeopardizing the existence of the pallid sturgeon. The flow regime required in the Reasonable and Prudent Alternative will create and maintain sandbar habitat for the piping plover. If, for any reason, implementation of the Reasonable and Prudent Alternative is delayed, the Corps should conduct the Gavins Point Fall Test.

Restoration of flows would benefit the primary constituent element of sparsely vegetated channel sandbar habitat in Lewis and Clark Lake. The release of water from the lake would result in a drawdown and refilling that would be beneficial by killing and retarding vegetation. We lack the specifics to fully assess the potential benefit to habitat in Lewis and Clark Lake. There will be no effect to the primary constituent elements found in the other river reaches of the Missouri River.

Fort Randall Reach Fall Test

Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

The flow test will result in a fall rise out of Fort Randall Dam. First, the water level in Lewis and Clark Lake will be reduced followed by a release from Fort Randall Dam. The releases could be as much as 60,000 cfs. The duration of the test would depend on the time it took to refill Lewis and Clark Lake. If this test was concurrent with the Gavins Point Reach Fall Test, the duration could be as long as 60 days. If the test was run separately, the duration might only be five days.

As with the Gavins Point Reach Fall Test, we believe this test has the possibility to greatly benefit the primary constituent elements found in both the river reach below Fort Randall Dam and in Lewis and Clark Lake. The test should create and maintain sandbar and island habitat, kill or retard existing vegetation, and improve the interface with the river. However, as was the case for the Gavins Point Fall Test, we recognize that this fall flow could be detrimental to the survival of the highly endangered pallid sturgeon. Therefore, the flows required by the Reasonable and Prudent Alternative in the November 2003 Amended Biological Opinion must be implemented to prevent jeopardizing the existence of the pallid sturgeon. The flow regime required in the Reasonable and Prudent Alternative will likely create and maintain sandbar habitat for the piping plover. If, for any reason, implementation of the Reasonable and Prudent

Alternative is delayed, the Corps should conduct the Fort Randall Fall Test. In Lewis and Clark Lake, the action would benefit the primary constituent element of sparsely vegetated sandbar habitat because the drawdown and then refilling should kill and retard vegetation on existing habitat. If the flow regime recommended in the Reasonable and Prudent Alternative is delayed, then the magnitude of benefit would likely be greatest if the test were run concurrently with the Gavins Point Reach Fall Test and the maximum flow for the maximum duration were used.

Because the other river reaches of the Missouri River are not within the scope of this test, the primary constituent elements in those reaches will not be affected by the test.

Gavins Point Spring Sandbar Habitat Conditioning

> **Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.**

Other than the 59 mile river reach below Gavins Point Dam, this test would not affect primary constituent elements in the other river reaches. Also, this test will not have an effect on the primary constituent elements found on critical habitat in Lewis and Clark Lake.

The purpose of this test is to determine if modest flows can be used to improve created sandbar habitat. The test would involve a one or two day test in the spring. The flows should inundate habitat for a short period of time. While the Service believes these tests are desirable and should be done, the Service believes the beneficial effects to maintaining sparsely vegetated channel sandbar habitat and consolidating the sand and gravel beaches on sandbars would not be of great magnitude. If these tests are successful, full implementation of the regime could result in significant beneficial effects to the sandbar habitat.

Fort Peck Tests

> **Effects on rivers: sparsely vegetated channel sandbar habitat, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.**

This test will only affect the habitat in the 125-mile river reach below Fort Peck Reservoir. Primary constituent elements in the other river reaches and in Lewis and Clark Lake would not be affected by the action.

For the river below Fort Peck Reservoir, two tests would be used: a “mini test” and a “full test.” While the Service believes that the tests will have a beneficial effect to the primary constituent elements by scouring of vegetation, it is not clear that the flows will be of sufficient magnitude and duration to have a beneficial effect of great magnitude. The tests will also release warmer water into the riverine environment and the warmer

water could benefit the interface with the river primary constituent element. This in turn could improve foraging habitat for the piping plover.

Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur (50 CFR Section 402.02). It is possible that the ongoing actions as a result of implementing the CWCP would infrequently inundate the delta where the Platte River joins the Missouri River. It is not known to what extent critical habitat occurs in the delta area, but the effects of infrequent inundation would likely be beneficial to the primary constituent elements by helping to suppress vegetation encroachment on the sandbars and islands and could help create sandbar and island habitat.

Conclusion

In September 2002, the Service designated critical habitat for the Northern Great Plains piping plover in the United States. This designation included 106, 030 acres associated with lakes, mostly alkali lakes, in North Dakota, South Dakota, and Montana. The designation also included 440 river miles of habitat on the Platte, Niobrara, and Loup rivers in Nebraska. These areas of designated critical habitat are outside of the action area and are not directly affected by the ongoing CWCP actions or the proposed actions. If indirect effects occur, they likely benefit a small portion of habitat in the Platte and Missouri rivers delta region.

The direct effects of the ongoing CWCP actions and the proposed actions were limited to critical habitat designated on 77,370 acres associated with Fort Peck Reservoir, on 438 miles associated with reservoirs along the Missouri River, and on 330 miles of Missouri River habitat. Overall, we found that the ongoing Current Water Control Plan operations are having an adverse effect on the primary constituent elements associated with the river reaches of the Missouri River. Ongoing operations have attenuated the river flows and as a result, there is a lack of sandbar inundation and scouring, which causes a loss of the primary constituent element of sparsely vegetated channel sandbars. Ongoing operations result in flows that erode sandbars. While there is some beneficial effect of lesser magnitude through the movement of sediment and formation and rehabilitation of sandbars, the overall effect is an adverse effect to the primary constituent element of sand and gravel channel sandbars.

The Corps noted (2003 Biological Assessment, Appendix A, page 31) that historically, over 98 percent of the least tern and piping plover habitat within the Missouri River has occurred on Lake Sakakawea and Lake Oahe. On the average, these lakes, and two riverine stretches, provide nesting habitat for about 85 percent of the piping plovers nesting on the Missouri River. We found that the ongoing CWCP actions of reservoir inundation, reservoir flooding, and reservoir unbalancing will have a beneficial effect on the reservoir primary constituent elements, especially by maintaining sparsely vegetated shorelines.

Except for Fort Peck Reservoir, critical habitat was designated in river miles, which does not allow quantification of the area of habitat with primary constituent elements. The final rule that designated critical habitat noted that habitats used by the piping plover in the northern Great Plains are highly dynamic. Therefore, the Service used a coarse approach to map and refine critical habitat boundaries because of the dynamic nature of the habitat changing through time as primary constituent elements form in one area while disappearing in another. The Service believed that this approach was the only scientifically credible way to ensure the critical habitat designation reflected the naturally ephemeral nature of the habitat.

Except for the long-term drought conservation measures, which were judged to have an overall adverse impact of lesser magnitude on the riverine stretches, the actions proposed by the Corps in their 2003 Biological Assessment were assessed as being either beneficial or of no effect to designated critical habitat. Of special note are the Corps' actions to create and rehabilitate over 3,000 acres of habitat, primarily in the riverine stretches and in Lewis and Clark Lake. The Service believes that this action has great potential to create habitat critical for piping plover nesting and foraging. Rehabilitating existing habitat by reducing the vegetation to no more than 10 percent ground cover provides the opportunity to quickly create habitat on naturally formed sandbars and islands. This is the most desirable method. However, the Service believes the Corps' engineering expertise can be used to create habitat that will provide the primary constituent elements needed for piping plover foraging and nesting and habitat creation could be of great benefit to piping plovers.

In making a determination of whether an action destroys or adversely modifies designated critical habitat, the Service must determine whether the action is likely to destroy or adversely modify critical habitat to the extent that the value of critical habitat is appreciably diminished for the survival and recovery of the species. We determined that the adverse effects of the Corps ongoing and proposed actions would primarily affect the primary constituent elements of maintaining sparsely vegetated channel sandbar habitat in the 330 miles of riverine habitat on the Missouri River. We also concluded that the proposed habitat creation actions, the flows required by the Reasonable and Prudent Alternative in the November 2003 Amended Biological Opinion or the Gavins Point Fall Test and the Fort Randall Fall Rise Test, would benefit habitat on portions of the riverine stretches.

The final rule that designated critical habitat noted that habitats used by the piping plover in the northern Great Plains are highly dynamic. Because habitats are ephemeral, nesting does not always occur in the same location year after year. Birds may relocate within a given nesting season, and will use a variety of habitats during the course of the nesting season. Only a portion of the 330 miles of riverine critical habitat on the Missouri River actually has habitat with the primary constituent elements used to designate critical habitat. Because the habitat is ephemeral, quantification at the time of designation was not possible.

Therefore, critical habitat occurs on some portion of the 330 miles of riverine habitat. The Corps ongoing and proposed actions will both benefit and adversely impact the riverine critical habitat. The Service believes that the critical habitat that occurs on some portion of the 438 miles of reservoir habitat and on the 77,370 acres on Fort Peck Reservoir will, overall, benefit from the Corps ongoing and proposed actions. The critical habitat that occurs on some portion of the 440 miles of Nebraska rivers will not be directly affected by the Corps' actions and the indirect effects could be beneficial to a small area of critical habitat on the Platte River. The Service determined the critical habitat found on some portion of 106,030 acres of lakes in Montana, North Dakota, and South Dakota will not be affected by the Corps' actions.

The Service concludes that the ongoing CWCP actions, the actions included in the Service's 2000 Biological Opinion that are being implemented by the Corps, and the actions proposed in the Corps' November 2003 Biological Assessment will not destroy or adversely modify critical habitat to the extent that the value of designated critical habitat is appreciably diminished for the survival and recovery of northern Great Plains piping plovers that occur in the United States and Canada.

Conservation Recommendations

The Service believes the Conservation Recommendations provided to the Corps in the portion of the November 2003 Amended Biological Opinion that assessed effects to the northern Great Plains piping plover recommended the actions that would monitor, evaluate, and enhance critical habitat and will not be reiterated here.

Reinitiation Notice

This concludes formal consultation on the actions outlined in the reinitiation request with respect to the 2002 designation of critical habitat for the northern Great Plains breeding population of piping plovers. As provided in 50 CFR section 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation of consultation.

In addition, the Service believes consultation on effects of the Corps' actions on designated critical habitat for the northern Great Plains piping plover should be reinitiated if the efforts, as required in the Reasonable and Prudent Measure for Piping Plovers in the December 2003 Biological Opinion, to create and rehabilitate sandbar and island habitat are not successful. The Service also believes consultation should be reinitiated if future flow management does not adequately include adaptive management or flow/habitat management does not result in flows or physical manipulation that improve and maintain

critical habitat by suppressing vegetation encroachment and by building and rehabilitating channel sandbar habitat.

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