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NOV 18 2016

Memorandum

To: Area Manager, Billings, Montana
Bureau of Reclamation

From: Assistant Regional Director, Ecological Services

Subject: Consultation on Effects from the Lower Yellowstone Project: Intake Diversion Dam Fish Passage Project

This memorandum responds to the Bureau of Reclamation's (Reclamation) and the U. S. Army Corps of Engineers (Corps) request for consultation with the Fish and Wildlife Service (Service) on effects of the subject project to species and habitats listed under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; [Act]). The request dated August 29, 2016, and received electronically the same day included a biological assessment entitled *Lower Yellowstone Project: Intake Diversion Dam Fish Passage Project (*Assessment), dated August 2016. Through the Assessment, the Reclamation and Corps determined that the subject project may affect several listed species. The final effects determinations are presented below.

Species	Listing status	Determination
Pallid sturgeon (*Scaphirhynchus albus)*	endangered	likely to adversely affect
Interior least tern (*Sterna antillarum athalassos*)	endangered	not likely to adversely affect
Whooping crane (*Grus Americana*)	endangered	no effect
Piping plover (*Charadrius melodus*)	threatened	not likely to adversely affect
Red knot (*Calidris canutus*)	threatened	no effect
Black-footed ferret (*Mustela nigripes*)	Experimental, non-essential population	no effect
Gray wolf (*Canis lupus*)	endangered	no effect
Northern long-eared bat (*Myotis septentrionalis*)	threatened	not likely to adversely affect
Dakota skipper (*Hesperia dacotae*)	threatened	no effect

The Service has prepared a biological opinion with a finding that the proposed project is not likely to jeopardize the pallid sturgeon and has attached it to this memo. We also concur (below) with Reclamation's and the Corps determinations for the Interior least tern, piping plover and Northern long-eared bat.

For the remainder of the species, we acknowledge your determinations, but neither 7(a)(3) of the Act, nor implementing regulations under section 7(a)(2) of the Act require the Service to review or concur with the remaining effect determinations; therefore the Service will not address them further. However, we do appreciate you informing us of analysis for these species even if not required to do so under the Act.

Concurrence for Interior least tern

Terns are known to occur in the action area, though the action area is at the limit of the tern's preferred range (Assessment, p. 40). Terns would most likely be present during their breeding season which is April through September. If terns were nesting on the river, changes in water elevation could flood nests. The proposed action will not result in any significant change from baseline of the amount of flow or water elevations in the action area, thus even if terns nests were present, the likelihood of effects from the action are discountable.

The bypass channel construction would include very limited work near any tern habitat and there are no records of terns nesting in that area (Assessment, p. 101). Therefore likelihood of exposure of terns to construction activities is discountable. In the remote chance that nesting terns are found, Reclamation and the Corps will buffer them from activities by 0.25 miles or line of sight (Assessment p. 101) thereby minimizing any effects to an insignificant level.

Annual project operation and maintenance activities are not likely to have any impact on tern habitat along the Yellowstone River, because the majority of the activities are within the Lower Yellowstone Irrigation Project lands off of the river. These areas are not likely to have habitat for terns and likelihood of effects is discountable.

Based on Service review of the Assessment, we concur with the determination that the project outlined in the Assessment and this memorandum, may affect but is not likely to adversely affect the Interior least tern.

Concurrence for piping plover

Piping plovers are likely to be in the action are and nesting has been confirmed below the Intake Diversion Dam (Assessment, p. 101-102). Like terns, plovers would most likely be present between April and September. The construction activities are planned in areas that have little nesting habitat and there are no nesting records for that area (Assessment, p. 102). As with terns, if plovers were nesting on the river, changes in water elevation could flood nests. The proposed action will not result in any significant change from baseline of the amount of flow or water elevations in the action area, thus even if terns nests were present, the likelihood of effects from the action are discountable.

Construction on the bypass channel is not anticipated to degrade any existing plover habitat around the project site. Therefore likelihood of exposure of plovers to construction activities is discountable. In the remote chance that nesting plovers are found, Reclamation and the Corps will buffer them from activities by 0.25 miles or line of sight (Assessment p. 102) thereby minimizing any effects to an insignificant level.

Annual project operation and maintenance activities are not likely to have any impact on plover habitat along the Yellowstone River, because the majority of the activities are within the Lower Yellowstone Irrigation Project lands off of the river. These areas are not likely to have habitat for plovers and likelihood of effects is discountable.

Based on Service review of the Assessment, we concur with the determination that the project outlined in the Assessment and this memorandum, may affect but is not likely to adversely affect the piping plover.

Concurrence for Northern long-eared bat

The Lower Yellowstone Irrigation Project is on the very western edge of the species range with only one known sighting in Montana in 1978 (Assessment, p. 103). The bats have been documented in North Dakota, but no hibernacula have been documented (Assessment, p. 103). Suitable habitat in the form of large hardwood trees in the area of construction is very limited.

Because the likelihood of the species even occurring in the action area is very low, the likelihood of an effect to the bat is discountable. Therefore the Service concurs with the determination that the project outlined in the Assessment and this memorandum, may affect but is not likely to adversely affect the Northern long-eared bat.

This concludes consultation for the Interior least tern, piping plover and northern long-eared bat. Further consultation pursuant to section 7(a) (2) of the Act is not required. Reinitiation of consultation on this action may be necessary if new information reveals effects of the action that may affect listed species or designated habitat in a manner or to an extent not considered in the assessment, the action is subsequently modified in a manner that causes an effect to listed species that was not considered in the analysis, or a new species is listed or critical habitat is designated that may be affected by the proposed action.

Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; [FWCA])

Reclamation and the Corps have coordinated extensively with the Service on this project and have included many measures to reduce impacts to fish and wildlife. The Service has no additional measures to recommend and will not be providing a report under the FWCA.

Attachment

cc: Montana FWS Field Office, Helena, Montana
Army Corps of Engineers, Omaha, Nebraska

BIOLOGICAL OPINION
On effects to the pallid sturgeon from
the Lower Yellowstone Project:
Intake Diversion Dam Fish Passage Project

TAILS No. 06E00000-2017-F-0001

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Pallid sturgeon (*Scaphirhynchus albus)*

FISH AND WILDLIFE SERVICE
Mountain Prairie Region
Denver, Colorado

Assistant Regional Director for Ecological Services ______________________

Date November 18, 2016

Introduction

The pallid sturgeon is a large river fish that can reach six feet in length, weigh up to 80 pounds and live 50 years, perhaps longer. For thousands of years it has lived, fed, and bred in the large rivers of the West – the Missouri, Yellowstone, and Mississippi. Just over 100 years ago, humans began placing barriers in many of these rivers to collect and manage water to control flooding, support navigation, irrigate crops as well as other uses. This greatly impeded, and in some cases entirely blocked the sturgeon from free movement in the rivers, which in turn, impaired the sturgeon's ability to carry out its full complement of biological functions necessary for its long term survival. The existing Intake Diversion Dam, which supplies water to the Lower Yellowstone Project, is one of those barriers.

The barriers in the large rivers led to a precipitous decline in the numbers of pallid sturgeon; so much so that in 1990 they were listed as endangered under the Endangered Species Act of 1973. Fish raised in hatcheries have been introduced and there are now thousands that have survived and hundreds of them are just now reaching spawning age. As for wild (non-hatchery) sturgeon, only 125 are believed to inhabit the area downstream of Intake Diversion Dam, and none currently inhabit the Yellowstone River above the weir. Every year adult sturgeon swim up to the weir from farther down the Yellowstone and the Missouri River in an attempt to pass upriver to their likely historical spawning grounds, but the weir blocks movement of the adults including the maturing hatchery fish. As time passes, the number of wild, spawning adults grows older and some die, causing the already small wild portion of the population to dwindle to even lower numbers.

Now, the United States Bureau of Reclamation (Reclamation) and the United States Army Corps of Engineers (Corps) are proposing to construct a bypass channel and alter the Intake Diversion Dam, allowing sturgeon to move upstream of the structure and again have access to an additional 162 miles of the Yellowstone River. The habitat above Intake was likely used by the sturgeon for many life history behaviors. If this project is successful, it will be the first time in approximately one hundred years that the sturgeon will have the consistent ability to move beyond the weir and access this additional habitat. This would be a substantial step forward in assisting the long term survival and recovery of the sturgeon in the Upper Missouri River because it is expected to allow access to spawning habitat and potentially provide sufficient drift distance for developing larvae.

As perhaps a harbinger of that future condition, in 2014 there was an unusually high run-off flood event and five tagged sturgeon were able to find their way past the weir by using the existing, but rarely flowing high-flow channel. One of those fish was a female with eggs. Three of these fish, the female and two males, were later located in the Powder River, a tributary to the Yellowstone River. The female was captured shortly after her return to the Yellowstone, and her lack of eggs confirmed that she had likely spawned upriver of the Intake Diversion Dam, perhaps in or near the Powder River. After spawning, the fish returned to the Yellowstone River below the weir. This is the first time the likelihood of spawning has been documented above the weir. In 2015 a juvenile sturgeon also used this channel to pass upstream of Intake Diversion Dam.

A necessary step in the process of implementing this important passage project is meeting a consultation requirement from the Endangered Species Act. In that Act, Congress required that every federal agency must insure that any action "*...authorized, funded, or carried out...is not likely to jeopardize the continued existence of any endangered or threatened species...*". To meet this requirement, Congress required that the action agencies request assistance from the United States Fish and Wildlife Service and seek their biological opinion regarding whether the proposed action is likely to jeopardize the continued existence of a listed species.

This document, then, is the Fish and Wildlife Service's biological opinion on Reclamation's and Corps' proposed action at the Intake Diversion Dam and its effects to the pallid sturgeon. In this document, the Fish and Wildlife Service finds that though there are some limited minor adverse effects to the sturgeon, the action is not likely to jeopardize the continued existence of the pallid sturgeon. And in fact, we believe the proposed action implements a high priority goal of the recovery plan and constitutes a substantial improvement to the outlook for the survival and recovery of this ancient fish in the Upper Missouri River.

Purpose of this Consultation and the Service's Biological Opinion

In section 7 of the Endangered Species Act, 16 U.S.C. §§ 1531 *et seq.* (ESA or Act), Congress required that every federal agency must insure that any action "...*authorized, funded, or carried out*...*is not likely to jeopardize the continued existence of any endangered or threatened species*...". 16 U.S.C. §§ 1536(a)(2). This is known as a section 7(a)(2) finding under the ESA. To meet this requirement, Congress required that the action agencies request assistance from the United States Fish and Wildlife Service (Service) and seek their biological opinion (BO) regarding whether the proposed action is likely to jeopardize the continued existence of a listed species. Agency responsibilities are further set forth in regulations implementing the ESA at 50 CFR Part 402. The definition of "Jeopardize the continued existence of" is "...*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.*" 50 CFR § 402.02.

The Service's BO is not a review of the prudency of the proposed action or judgment regarding its value or effectiveness relative to other potential projects, or of the action agency taking no action. Rather, the task of the Service is to offer a BO as to whether the proposed action of creating a fish passage channel around the Intake Diversion Dam and the operation and maintenance of the Lower Yellowstone Project (Irrigation Project) is likely to jeopardize the continued existence of the pallid sturgeon. This biological opinion does not address critical habitat for pallid sturgeon because none has been designated.

How the Service develops a biological opinion

To address the threshold question of whether an agency action is likely to jeopardize the continued existence of a listed species, the Service evaluates the following four categories of information.

Status of the Species - This category represents the biological or ecological information relevant to formulating a BO and focuses on the current condition of the species (i.e. numbers, reproduction, distribution, etc.). The information is a broad and general examination of the species biology and condition at the scale of its range as described in its listing. This also includes a review of any factors that have, and are, influencing the species status.

Environmental Baseline - This category is similar to the status of the species in that it describes the condition of the species and its habitat, but is focused and limited to the action area (the areas where the proposed action will modify the land, water or air.) Information also includes a review of any factors that have and are influencing the species condition at the scale of the action area.

Effects of the Action - This category of information is the Service's review of the action agency's analysis and discussion of how the proposed action (modifications to land, water, and air) are likely to result in an effect to the species. The analysis is the responsibility of the action agency and is required as part of the materials submitted to the Service when requesting formal consultation (CFR 402.14). It describes how the proposed action modifies the environment, whether listed species will be exposed to those modifications, what the species' response will likely be if exposure occurs and then what biological effect (if any) is likely to result from the response.

Cumulative effects - This category describes the effects to the species (if any) from any future non-federal actions that are reasonably certain to occur in the action area.

The synthesis of all this information forms the Service's opinion on the 7(a)(2) finding. The Service examines the effects from the proposed action and whether those effects resonate at the scale of the listed entity in such a way as to be likely to meet the elements in the definition of Jeopardy (*... 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.*" 50 CFR § 402.02). If the opinion of the Service is that the proposed action is not likely to jeopardize the continued existence of the species, then consultation is complete and this will inform the action agencies' decision on whether to move forward with the action.

If the Service finds that the proposed action is likely to jeopardize the species, the Service, working with the action agency, must develop a reasonable and prudent alternative (RPA) to the proposed action. However, the options for developing this RPA are not unlimited. By regulation (CFR 402.02), it must meet the following criteria.

1) The alternative action can be implemented in a manner consistent with the intended purpose of the action.
2) The alternative action can be implemented in a manner consistent with the scope of the Federal agency's legal authority and jurisdiction.
3) The alternative action is economically and technologically feasible.
4) It must avoid the likelihood of jeopardizing the continued existence of listed species.

In all cases where discretionary Federal involvement or control over the action has been retained or is authorized by law, the action agency is responsible for monitoring the progress of its action and re-initiating the consultation if any of the following four conditions are met.

1) If the amount or extent of taking specified in the incidental take statement is exceeded;
2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or
4) If a new species is listed or critical habitat designated that may be affected by the identified action. 50 CFR § 402.16.

History of Coordination and Consultation to Provide Fish Passage at the Intake Diversion Dam

The following information is drawn directly from Reclamation's and Corps' 2016 biological assessment (Assessment), pages 22 through 25. A more detailed discussion of this history can be found there.

Background - For over 25 years Reclamation, the Corps and the Service have engaged in studies, coordination and consultations regarding providing fish passage at the Intake Diversion Dam. Most recently, in 2015 Reclamation requested 7(a)(2) consultation on a similar project as the one analyzed in this BO. The Service found that the proposed action in that consultation was not likely to jeopardize the pallid sturgeon (Service 2015b). Subsequent court action regarding consistency with the National Environmental Policy Act 42 U.S.C. §§ 4321 *et seq.* (NEPA) led the action agencies to reevaluate their proposed action. As part of this reevaluation, the action agencies reinitiated consultation with the Service. The Service, Reclamation and Corps staffs have worked closely to share information on the project, sturgeon life history, monitoring and associated topics. Records of that coordination are included in our consultation file.

History -The pallid sturgeon was listed by the Service in 1990 and as early as 1992, the Service initiated discussions with Reclamation regarding obligations to consult and address fish passage and entrainment issues at Intake Diversion Dam.

Service comments on a preliminary draft biological assessment for continued O&M of the Lower Yellowstone Project (LYP) in 1993 emphasized the importance of fish passage and entrainment protection at the Intake Diversion Dam. At the same time, the Corps was consulting with the Service on the operation of their six main-stem dams and reservoirs on the Missouri River. At the conclusion of that consultation, the Service recommended the Corps work with Reclamation to resolve pallid sturgeon passage issues at the Intake Diversion Dam.

In 2005, the Corps, Service, Reclamation, The Nature Conservancy, and Montana Fish Wildlife and Parks signed a memorandum of understanding agreeing to work together to resolve the passage and entrainment issues at Intake. By 2006, preliminary designs for passage and entrainment were being considered in addition to continued research on fish passage and entrainment specific to pallid sturgeon.

In 2007, Water Resources Development Act authorized the Corps to use funding from the Missouri River Recovery and Mitigation Program to assist Reclamation in compliance with federal laws and to design and construct modifications at Intake for the purpose of Yellowstone River ecosystem restoration.

By 2008, the Corps and Reclamation had identified alternatives to resolve the fish passage and entrainment issues and initiated the NEPA compliance process in September. The *Intake Diversion Dam Modification Environmental Assessment* was published by Reclamation and the Corps to analyze and disclose effects associated with construction of the proposed modifications to the diversion weir and headworks. The EA described the anticipated effects of the selected fish passage alternative – the Rock Ramp Alternative.

In April 2010, Reclamation and the Corps made the decision to proceed with the modifications, and a construction contract for the new headworks and fish screens was awarded in July 2010. At the same time, the Corps started with the final design of the rock ramp so a construction contract could be awarded in 2011. The conceptual design level cost estimate for the rock ramp was approximately $18 million. In late 2010 and early 2011, the estimated costs for the rock ramp design significantly increased to nearly $90 million due to the detailed design analysis.

In April 2011, Reclamation and the Corps determined further evaluation of other alternatives for improving fish passage was necessary to address the issues that had arisen since 2010. In addition to new cost information, new information regarding pallid sturgeon behavior also became available. Originally, because of uncertainties in pallid sturgeon movement, one of the requirements of the Service's Biological Review Team's (BRT) passage criteria was full riverwidth passage. However, based on new information documenting pallid sturgeon use of side channels (Braaten et al. 2014), the BRT relaxed this criterion in 2011. Reclamation and the Corps believed there was merit in revisiting a bypass channel alternative that had been previously considered but eliminated from detailed study because it did not provide full channel passage. Through collaborative efforts, further data, and preliminary design reviews, Reclamation, the Corps, and stakeholders supported further analysis of a bypass alternative. Changes to the project were substantial enough to trigger preparation of supplemental EA prior to a decision on how to proceed with fish passage.

Construction of the headworks and fish screens was initiated in 2011 and completed in April 2012. Water was first delivered to the LYP using the new headworks structure in May 2012. Because the passage component was delayed while other alternatives were reconsidered, Reclamation and the Service agreed to consult on O&M of the new headworks and fish screens with the commitment to continue consultation on the overall long-term O&M of the LYP once a passage alternative had been identified. Reclamation submitted the *Lower Yellowstone Irrigation Project Intake Headworks and Fish Screens Operations and Maintenance Biological Assessment* to the Service on February 10, 2012. Consultation on this action was completed through informal consultation and issuance of a concurrence letter on March 7, 2012.

Following the 2011 record high flows, approximately 1,500 cubic yards of rock were needed to repair the weir so the LYP could divert its full water right. It was also determined that the diversion weir needed to be maintained to an elevation of 1,991.0 feet due to the head loss through the screens. Consultation on this aspect of rock placement action was initiated with the Service and completed through a concurrence letter from the Service on May 2, 2014.

On December 14, 2014, Reclamation submitted a biological assessment to address the potential effects of the continued O&M of the LYP with the proposed bypass channel alternative for fish passage. Shortly after the submittal of this BA, Reclamation in conversations with the Service determined that an amended BA should be submitted covering construction of the replacement weir and bypass channel, interim operation of the LYP until construction was complete, and the future O&M of the LYP with fish passage and entrainment protection.

In April of 2015 an amended biological assessment was submitted to the Service for formal consultation. On July 10, 2015, Reclamation received a BO from the Service stating that the Lower Yellowstone Irrigation Project and construction of a fish passage project would not cause jeopardy, but was likely to adversely affect pallid sturgeon due to the presence of the existing weir without an alternate passage route during the 2- 3 years of construction, potential future entrainment/impingement of free embryos and larvae at the headworks/screens and physical presence of the replacement weir and bypass channel.

As part of the 2015 consultation, the corps requested that their role in the proposed action at the Intake Diversion Dam be considered as "*...a substitute for the relevant RPA elements from the 2003 biological opinion.*" The Service granted this request. However, when the Corps reinitiated consultation on the Intake project in 2016, the Corps did not request that its proposed action at Intake substitute for RPA elements on the Missouri as it had in 2015. Reclamation and the Corps' proposed action at Intake is independent from the 2003 biological opinion and the consultation that is now occurring on the Missouri. With respect to the consultation on the Missouri, currently the Corps of the Kansas City and Omaha Districts are preparing the Missouri River Recovery Management Plan to develop a range of alternatives for management of the Missouri River. This federal action is organized around an adaptive management approach that is intended to be consistent with the purposes of the Act and enhance recovery of the pallid sturgeon. Impacts of river management to pallid sturgeon, management actions to reduce effects to the pallid sturgeon, and actions to support recovery of the pallid sturgeon will be considered as part of the consultation on that plan. The Corps has reinitiated consultation on the Missouri River Recovery Management Plan and coordination between the Corps and the Service for that consultation has already begun. Thus, the Service has conducted a separate consultation on the Intake project while another consultation proceeds on the Missouri. Although these are now two separate consultations, the Service has nevertheless analyzed the effects of the relevant Missouri operations that had originally been part of the 2003 biological opinion in the present Intake biological opinion. This was done to ensure that the Service had adequately captured the context and status of the species as well as future and historical effects.

On August 29, 2016 the Service received Reclamation's and the Corps' request for consultation and a biological assessment entitled *Lower Yellowstone Project: Intake Diversion Dam Fish Passage Project.*

1.0 PROPOSED ACTION

The proposed action includes four components.

"• *O&M of the LYP prior to and during construction of the proposed bypass channel and replacement weir (Reclamation action) and permitting of the interim placement of rock under Section 10 of the Rivers and Harbors Act of 1899 (Section 10) by the Corps (Corps action);*

• *Construction of a bypass channel and replacement weir to improve upstream and downstream fish passage at the Intake Diversion Dam (Corps action);*

• *Operation and maintenance of the LYP after implementation of the fish passage project (Reclamation action); and*

• *Implementation of an adaptive management and monitoring plan (Corps and Reclamation action).*"

These components are often implemented by Reclamation and the Corps through contracts, agreements, and permits. For example, Reclamation retains ownership of the facilities of the Lower Yellowstone Project, but Operation and Maintenance is carried out by the Lower Yellowstone Irrigation Project Board through contracts with Reclamation. Similarly, permits authorized by the Corps for under Section 10 are carried out by the permittee.

For simple organization, the four main components were broken into additional elements (Assessment pp. 9-21).

1. Operation and maintenance prior to and during construction of the proposed fish passage improvements

    Existing headworks
    Existing diversion weir (including continued placement of rock)
    Supplemental pumps
    Main canals and lateral canals
    Weed control

2. Construction of replacement weir and bypass channel for fish passage
    Replacement weir
    Bypass channel

3. Future operation and maintenance of the Irrigation Project
    Existing headworks
    Replacement weir
    Bypass channel
    Main canals and lateral canals

Supplemental pumps
Weed control

4. Monitoring and adaptive management
   Bypass channel design and performance
   Pallid sturgeon passage criteria
   Native fish passage

For clarity in assessment and analysis, the Assessment deconstructed the four main components and associated elements into a total of 47 elements (pp. 58-69). During all these activities, general conservation measures such as working behind coffer dams, doing instream work outside of the pallid sturgeon's migration and spawning period, and "ramping up" activities that create high levels of noise will be employed to reduce the likelihood and significance of effects to all life stages of the pallid sturgeon (Assessment p. 100).

1.1 Action Area

The description of action area is informed by the following definitions.

Action – "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies..... or (d) actions directly or indirectly causing modifications to the land, water, or air." 50 CFR 402.02

Action Area – "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." 50 CFR 402.02

Based on the area where "modifications to the land, water, or air" (directly or indirectly) from this proposed action occur and can be perceived, the action area is described by the Assessment (p. 3) as "The lower Yellowstone River (river miles 0-77) from approximately 3 miles upstream of Intake Diversion Dam, down to the confluence with the Missouri River, and the Missouri River downstream to the headwaters of Lake Sakakawea in North Dakota. This area also includes the lands associated with the LYP canal system and lands serviced by the LYP... The Missouri River downstream of Fort Peck to the Yellowstone River confluence is not considered within the Action Area..."

The Service finds that the Assessment's described action area is appropriate and finds no need to modify it for this BO.

2.0 STATUS OF THE SPECIES

Introduction

The status of the species section presents the biological or ecological information relevant to formulating the biological opinion. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to its survival, is included to provide the background for analyses in later sections (Service 1998 p. 4-19). The scale of the Status section is at the scale of the listed entity or range of the species. The Environmental Baseline section (Section 3.0 below) will provide similar types of information, but at the action area scale (50 CFR § 402.02, Service 1998 p. 4-22).

Information in this section is drawn largely from the Service's Environmental Conservation Online System http://ecos.fws.gov/ecos/home.action, Reclamation's 2016 assessment, Service's Revised Pallid Sturgeon Recovery Plan (Service 2014). Reclamation's 2014 biological assessment (pp. 29-36), and Reclamation's 2010 Environmental Assessment (Reclamation 2010).

2.1 Legal status

The sturgeon was listed as endangered under the ESA on September 6, 1990. No critical habitat for this species has been designated under the Act.

2.2 Description

The sturgeon is a large river fish that can reach six feet in length, weigh up to 80 pounds and can live 50 years and perhaps much longer. For thousands of years it has lived, fed, and bred in the large rivers of the West – the Missouri, Yellowstone, and Mississippi. They are a bottom-oriented, large river obligate fish. They are similar in appearance to the more common shovelnose sturgeon. Both species inhabit overlapping portions of the Missouri and Mississippi river basins. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large-river ecosystem that met the habitat and life history requirements of sturgeon and other native large-river fishes. Sturgeon have been documented over a variety of available substrates, but are often associated with sandy and fine bottom materials.

2.3 Habitat

Research into habitat use produced useful insights for many portions of the sturgeon's range. However, much of these data are based on habitat characterizations in altered environments, in some cases substantially altered environments, including an altered hydrograph and temperatures, suppression of fluvial processes, stabilized river banks, loss of natural meanders and side channels, fragmented habitats, and increased water velocities. Thus, information and current understanding of habitat use may not necessarily reflect preferred habitats for the species, but rather define suitable habitats within an altered ecosystem.

Sturgeon primarily utilize main channel, secondary channel, and channel border habitats throughout their range. Juvenile and adult sturgeon are rarely observed in habitats lacking flowing water which are removed from the main channel (i.e., backwaters and sloughs). Specific patterns of habitat use and the range of habitat parameters used may vary with availability and by life stage, size, age, and geographic location. In the upper portions of the species' range, juvenile hatchery-reared sturgeon select main-channel habitats (Gerrity 2005). In the Yellowstone and Platte rivers, adult sturgeon select areas with frequent islands and sinuous channels while rarely occupying areas without islands or with straight channels (Bramblett and White 2001; Snook et al. 2002; Peters and Parham 2008). In the middle Mississippi River, sturgeon select for areas downstream from islands that are often associated with channel border habitats and select against main-channel habitats (Hurley et al. 2004). Other Mississippi River capture locations tend to be near the tips of wing-dikes (an engineered channel training structure), steep sloping banks, and channel border areas (Killgore et al. 2007b; Schramm and Mirick 2009).

2.5 Food

Data on food habits of age-0 sturgeon are limited. In a hatchery environment, exogenously feeding fry (fry that have absorbed their yolk and are actively feeding) will readily consume brine shrimp suggesting zooplankton and/or small invertebrates are likely the food base for this age group. Data available for age-0 Scaphirhynchus indicate mayflies and midge larvae are important. Juvenile and adult sturgeon diets are generally composed of fish and aquatic insect larvae with a trend toward eating fish as they increase in size. Based on the above diet data and habitat utilization by prey items, it appears that sturgeon will feed over a variety of substrates, however, the abundance of Trichoptera (insect group including caddis flies) in the diet suggests that harder substrates like gravel and rock material may be important feeding areas.

2.6 Life cycle

Spawning

Between March and July, reproductive adult sturgeon (15-20 years old) swim upstream in search of a suitable areas to spawn, carry out spawning and return downriver. The environmental cues for this movement are the rising and peaking river hydrograph and water temperature. Spawning movement occurs in approximately late May – early June in the Yellowstone River. Spawning areas tend to be where firm river bottom substrates occur in deeper water with relatively fast turbulent water flow (without the correct conditions spawning success is reduced). Sturgeon do not create a redd (or nest) in the gravel for the eggs. Spawning takes place when the female sturgeon releases eggs into the river current and nearby males immediately fertilize the eggs by releasing milt directly into the flowing current of the river containing the eggs. The largest upper Missouri River fish can produce as many as 150,000-170,000 eggs, whereas smaller bodied females in the southern extent of the range may only produce 43,000-58,000 eggs. Female sturgeon appear to spawn every two or three years (Service 2014, p. 9).

Eggs and Free Embryos

Once released, the eggs float downstream, sink and stick to objects on the river bed to incubate. Eggs that do not stick to the river bed are unlikely to survive. The incubation period for sturgeon eggs is about 5-7 days. The exact period is determined by water temperature. The warmer the water temperature the shorter the time it takes for the eggs to hatch. At hatching, newly hatched free embryos are less than ½ inch in length and have a yolk sac attached to their stomach which provides food for approximately the first week (depending on water temperature).

Free embryos drift downstream for 9-17 days and in that time can drift long distances depending on water velocity. Braaten et al. (2008) estimated that at water velocities of 1 to 2 feet per second, free embryos could drift from 153 to 331 miles in 11 days. During this time, the hatched free embryo are predominantly pelagic with very weak swimming ability. Free embryos need to have enough distance to drift and become larvae, so that they are mobile and can seek out suitable habitat. Without enough drift distance, they can be passively swept into unsuitable habitat and die. Drift distance is critically important for survival. Once the free embryos completely absorb their yolk sac, they start to feed on tiny aquatic animals and plants. At this point in their development they are typically referred to as larvae.

Larvae

As free embryos develop into larvae, downstream dispersal ceases, they settle into suitable habitats, and begin to forage on the bottom. Specific habitat use by larvae largely remain undescribed, probably due to the low numbers in the wild for study and observation (Service 2014, p. 7). Similar species appear to prefer main channel border habitat with low velocities. Diets of larvae are not well known, but zooplankton and or small invertebrates are likely eaten. Mayflies and midge larvae may also be important. About 20-30 days after hatching, sturgeon larvae are considered "Age-0 juveniles" (also young of the year) and look like miniature adult fish.

Juveniles/Adults

After about a year, the young sturgeon are referred to as juveniles until they reach sexual maturity. Diet is made up of fish and aquatic insect larvae then trending toward more fish as the fish increase in size. Adults can be found using main, secondary and side channels in the river environment. They don't appear to use backwaters or sloughs. They prefer habitats with relatively smooth surfaces, but preference can be related to season, and they can be found in a variety of water velocities and levels of turbidity

Sexual maturity for females is estimated at 15 years of age, while males reach sexual maturity at age 5. Temperature can influence age of sexual maturity (Service 2014, p.9). Pallid sturgeon in the lower Missouri River reached sexual maturity at 9 to 7 years, while sturgeon in the upper Missouri appear to be slower.

2.7 Reproductive Strategy

The sturgeon has evolved a breeding strategy where the reproducing adult commits no parental care to eggs or offspring. This results in a naturally high mortality of the early life stages (egg, free embryo and larvae). Under normal conditions, this strategy is successful and can tolerate a high level of mortality, because the large spawning adults produce as many as 170,000 eggs and can be reproductive for decades. Thus as long as the regular opportunity exists for spawning, and an opportunity for larval drift to allow for transformation of a free embryo into larvae or young of the year, the success rate for a particular single egg or free embryo or larvae can be extremely low and still support a population capable of long term survival.

This strategy allows for long term success under widely variable natural conditions. However, having the capability to migrate to desired spawning areas and then having a long enough drift distance for free embryos to transform is key to reproductive success. This breeding strategy is thwarted when its migration routes are routinely (or completely) blocked. This also degrades the sturgeon's long term viability.

2.8 Population Distribution

2.8.1 Historic distribution

The historic distribution of the sturgeon includes the Missouri and Yellowstone rivers in Montana downstream to the Missouri-Mississippi confluence and the Mississippi River possibly from near Keokuk, Iowa downstream to New Orleans, Louisiana. Sturgeon also were documented in the lower reaches of some of the larger tributaries to the Missouri, Mississippi, and Yellowstone rivers including the Tongue, Milk, Niobrara, Platte, Kansas, Big Sioux, St. Francis, Grand, and Big Sunflower rivers (Assessment, p. 30). The total length of the sturgeon's range historically was about 3,500 river miles.

2.8.2 Present distribution

Since listing in 1990, wild sturgeon have been documented in the Missouri River between Fort Benton and the headwaters of Fort Peck Reservoir, Montana; downstream from Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota; downstream from Garrison Dam, North Dakota to the headwaters of Lake Oahe, South Dakota; from Oahe Dam downstream to within Lake Sharpe, South Dakota; between Fort Randall and Gavins Point Dams, South Dakota and Nebraska; downstream from Gavins Point Dam to St. Louis, Missouri; in the lower Milk and Yellowstone rivers, Montana and North Dakota; the lower Big Sioux River, South Dakota; the lower Platte River, Nebraska; the lower Niobrara River, Nebraska; and the lower Kansas River, Kansas. The contemporary downstream extent of sturgeon ends near New Orleans, Louisiana. Additionally, the species has been documented in the lower Arkansas River (Kuntz in litt., 2012), the lower Obion River, Tennessee (Killgore et al. 2007b), as well as navigation pools 1 and 2, downstream from Lock and Dam 3, in the Red River, Louisiana (Slack et al. 2012).

2.9 Population numbers

In 1995, a preliminary estimate found about 45 wild sturgeon existed in the Missouri River upstream of Fort Peck Reservoir (Gardner 1996). More recent data suggest that substantially fewer wild fish remain today. An estimated 125 wild sturgeon remain in the Missouri River downstream of Fort Peck Dam to the headwaters of Lake Sakakawea including the lower Yellowstone River (Jaeger et al. 2009).

Since 1994, the Sturgeon Conservation Augmentation Program (augmentation program) has released hatchery-reared sturgeon within the Missouri River, portions of the Yellowstone River, and sporadically in the Mississippi River (Service 2013). Hatchery-reared sturgeon are the offspring of wild sturgeon that have been captured. Hundreds of thousands of fish have been released since augmentation began. In Recovery Priority Management Areas 1, 2 and 3 (upper Missouri and Yellowstone Rivers) of the Great Plains Management Areas, as many as 52,000 fish (greater than 1 year of age) are reported to be present (Rotella 2015, p. 104).

While current abundance estimates are lacking for the entire Missouri River downstream of Gavins Point Dam, Steffensen et al. (2012), generated annual population estimates for both wild and hatchery-reared sturgeon for the reach of the Missouri River extending from the Platte River confluence downstream (50 river miles). Their results estimated wild sturgeon at 8.7 to 14.3 fish/river miles and hatchery produced sturgeon at 46.1 to 52.0 fish/river miles. Extrapolating these estimates to the entire lower Missouri River suggests that the wild population may consist of as many as 5,991 mature individuals (Steffensen et al. 2013). The total population in the lower Missouri River may be larger as a result of the augmentation program, but is currently neither self-sustaining nor viable (Steffensen 2012; Steffensen et al. 2013), because limited spawning is not resulting in young of the year fish recruitment into the population.

Garvey et al. (2009) generated an estimate of 1,600 (0.8 fish/river miles) to 4,900 (24.5 fish/river miles) sturgeon for the middle Mississippi River (i.e., mouth of the Missouri River Downstream to the Ohio River confluence). In 2009, a sturgeon survey in the Upper Mississippi River captured a single sturgeon below lock and dam 25 near Winfield, Missouri (Herzog in litt., 2009). No estimates are available for the remainder of the Mississippi River.

2.10 Recovery and Management

The primary strategy for recovery of sturgeon is to:

1) conserve the range of genetic and morphological diversity of the species across its historical range;
2) fully quantify population demographics and status within each management unit;
3) improve population size and viability within each management unit;
4) reduce threats having the greatest impact on the species within each management unit; and,
5) use artificial propagation to prevent local extirpation within management units where recruitment failure is occurring (Service 2014).

In 1993, the Service established six recovery priority management areas to focus recovery efforts at locales believed to have the highest recovery potential (Service 1993). Since that time, the understanding of the species has improved and warranted redefining those management areas into four management units. The management units identified in the revised Pallid Sturgeon Recovery Plan (Service 2014) are described below.

The Great Plains Management Unit is defined as the Great Falls of the Missouri River, Montana to Fort Randall Dam, South Dakota. This unit includes important tributaries like the Yellowstone River, as well as the Marias and Milk rivers. The upper boundary is at the Great Falls of the Missouri River as this is a natural barrier above which sturgeon could not migrate historically. The lower boundary was defined as Fort Randall Dam to ensure consistent management practices on an inter-reservoir reach of the Missouri River.

The Central Lowlands Management Unit is defined as the Missouri River from Fort Randall Dam, South Dakota to the Grand River confluence with the Missouri River in Missouri and includes important tributaries like the lower Platte and lower Kansas rivers.

The Interior Highlands Management Unit is defined as the Missouri River from the confluence of the Grand River to the confluence of the Mississippi River, as well as the Mississippi River from Keokuk, Iowa to the confluence of the Ohio and Mississippi rivers.

The Coastal Plain Management Unit is defined as the Mississippi River from the confluence of the Ohio River downstream to the Gulf of Mexico including the Atchafalaya River distributary system.

The Action area for the proposed action is located in the Great Plains Management Unit.

Figure 1. Map depicting Pallid Sturgeon management units (from Service 2014, p.49)

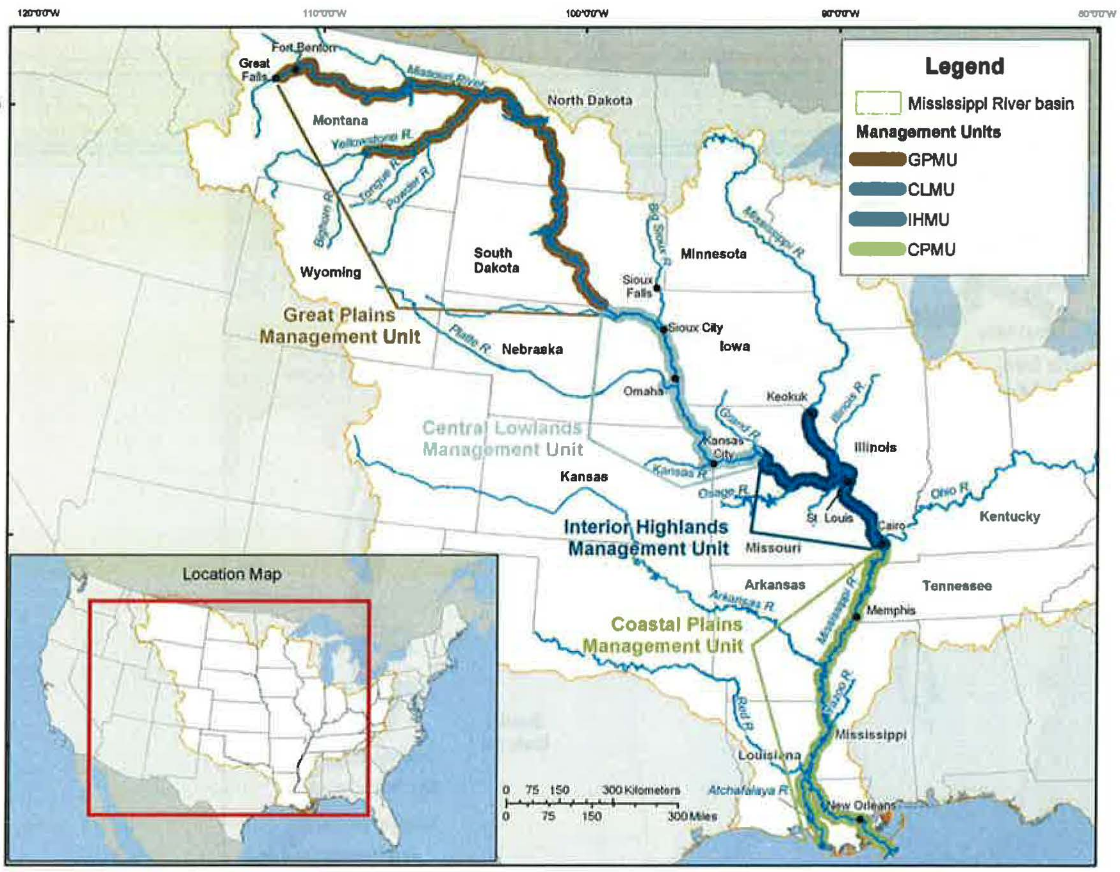
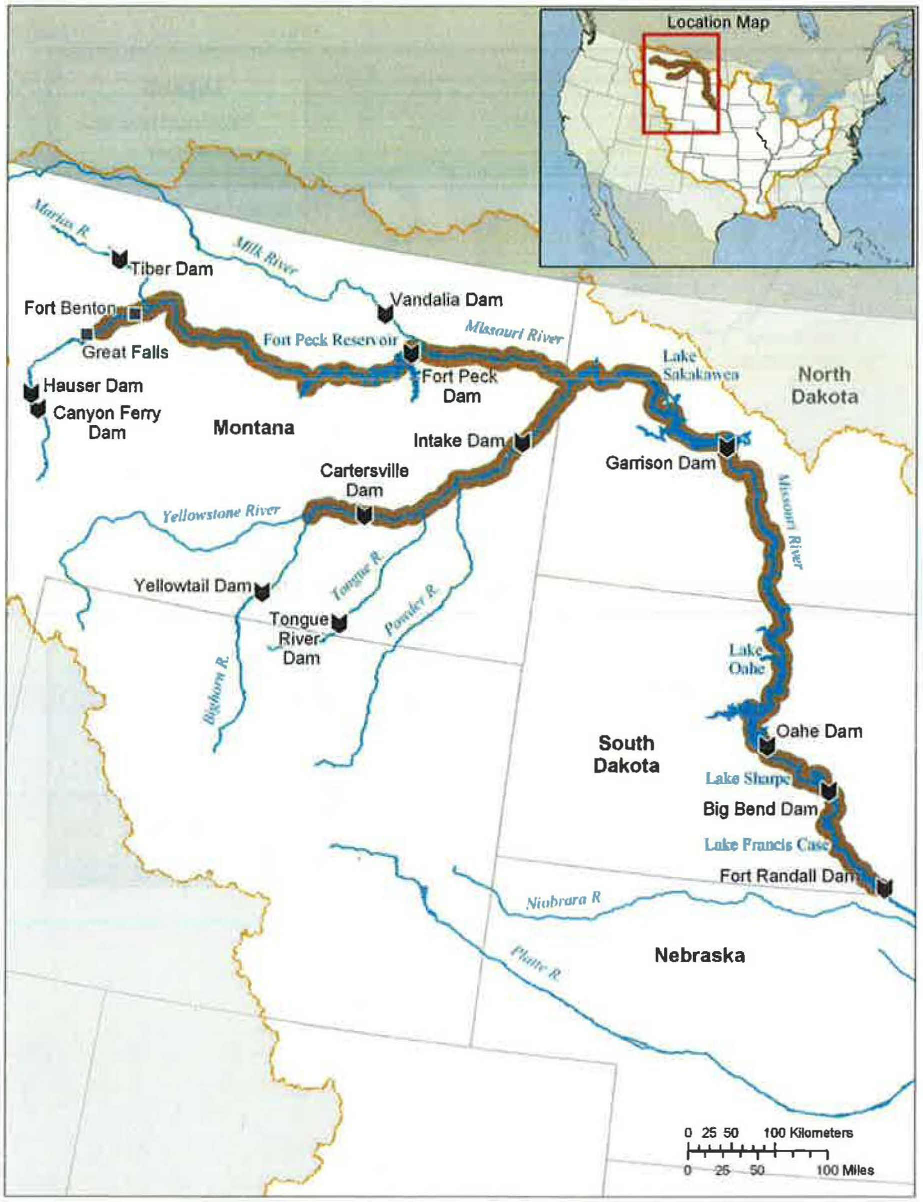


Figure 2. Map depicting Great Plains Management unit (from Service 2014, p. 50)



Currently the Corps of the Kansas City and Omaha Districts, are preparing the Missouri River Recovery Management Plan to develop a range of alternatives for management of the Missouri River. This federal action is organized around an adaptive management approach that is intended to be consistent with the purposes of the Act and enhance recovery of the pallid sturgeon. As a federal action, it will be subject to 7(a)(2) consultation with the Service. The Corps has reinitiated consultation on its Management Plan and the Service continues to work with the Corps on this consultation.

2.11 Climate Change

The potential impact of climate change on the sturgeon's environment is very difficult to assess. We reviewed the National Oceanic and Atmospheric Administration's (NOAA), Technical Report Regional Climate Trends and Scenarios for the U.S. National Climate Assessment (NOAA 2013). Specifically, we examined Part 4 of that report which focused on climate of the U.S. Great Plains. The action area and a large portion of the species range is within that geographic area.

The report makes it clear that the scientific information available and used for the report is **not** predictive. "*The future climate scenarios are intended to provide an internally consistent set of climate condition that can serve as inputs to analysis of potential impact of climate change. The scenarios are not intended as projections as there are no established probabilities for their future realization.*" (NOAA 2013, p. 1). However, the scenarios presented give us our best glimpse at whether models agree in showing a significant change from the past and if they agree in the direction of that change.

For the first period reported by the report (2021-2050) more than 50% of the models show a significant difference in temperature and more than 67% agree that the change is to a higher temperature in the action area and larger surrounding areas. The difference expressed is 1.5 to 2.5 degrees Fahrenheit (NOAA 2013, p. 37).

For the same period changes in average annual precipitation are more mixed with less than 50% of the models showing a statistically significant change (NOAA 2013, p. 55). As the models are pushed out into periods 2041-2070 and 2071-2099, they generally show increased annual average precipitation in the northern Great Plains and decrease in the southern part of the region (NOAA 2013, p. 55).

Given that the sturgeon lives in river systems influenced by winter precipitation (snow pack), we examined the report's information regarding differences in annual and seasonal precipitation. Less than 50 % of the models showed statistically significant change to annual precipitation in our area of interest in the Great Plains region for 2021-2050. For the period 2041-2070 as with the annual precipitation change, less than 50% of the models show a statistically significant change in any of the seasons (NOAA 2013, p. 57).

Under the scenarios produced by the models, the Service's assessment is that a change in temperature consistent with the scenarios does not represent changes that can be reasonably expected to impact the status of the sturgeon. Sturgeon are not cold water dependent fish and in fact if air temperatures were to increase the temperature of the water, one could hypothesize a quicker maturation time of the free embryos. An increase of the maturation rate would reduce the distance needed to drift before maturation. Fewer than 50% of the models showed scenarios of a statistically significant change that would alter the precipitation rate and therefore no effect to the sturgeon can be reasonably inferred.

2.12 Condition of pallid sturgeon within the Great Plains management Unit

As mentioned earlier, we use a large scale, that of the listed entity or species for the discussion in the Status section (Service 1998, p. 4-19). The Environmental Baseline section then captures information at a smaller scale, that of the action area (50 CFR 402.02 and Service 1998, p. 4-22). Because the Great Plains Management Unit (GPMU) is intermediate in scale to those two sections, the Service will describe the condition of the species more specifically in the GPMU. In this way the Service can provide information at an intermediate scale to help better set the context for the BO while still remaining consistent with the regulations and policy regarding scale noted above. The Assessment contains a detailed discussion of the condition of the pallid sturgeon and its habitat (pp. 32-36). We draw heavily from that section in presenting the discussion below.

2.12.1 Pallid sturgeon distribution (GPMU)

In the GPMU, pallid sturgeon can be found in the Missouri River: 1) from Fort Benton, Montana to the upper end of Fort Peck Reservoir; 2) Downstream of Fort Peck Dam to the upper end of Lake Sakakawea, including the lower Yellowstone River; 3) Downstream of Garrison Dam to the upper end of Lake Oahe; and 4) Downstream of Oahe Dam to the upper end of Lake Sharpe (Service 2014).

2.12.2 Pallid Sturgeon Abundance (GPMU)

Missouri River (upstream of Fort Peck Dam) - An estimate in 1995 indicated that about 45 wild pallid sturgeon existed in this area (Gardner 1996), but more recent information indicates far fewer wild fish are present, with only three wild fish collected in recent years (Service 2014a). Between 1998 and 2015, over 300,000 free embryos, larvae, and juveniles were released in this area of the GPMU. The estimated number of surviving hatchery fish in this area is 7,900 juveniles (Rotella 2015).

Missouri River (downstream of Fort Peck Dam to headwaters of Lake Sakakawea including lower Yellowstone River) - In 2004, an estimated 158 wild adult pallid sturgeon were reported to remain in this area (Klungle et al. 2005). More recent estimates were 125 fish (Jaeger et al. 2009). Between 1998 and 2015, over 980,000 free embryos, larvae and juveniles have been released). The estimated number of surviving hatchery fish in this area is 43,000 (Rotella 2015). Based on a calculation of total number of adult sturgeon that may have been present in this area in 1969, the current hatchery population is likely to exceed the estimated, historic population of pallid sturgeon (Braaten et al. 2009).

The wild fish described above were estimated to be 43-57 years of age because they are likely to be fish spawned before Lake Sakakawea was filled in the 1950s (Braaten et al. 2015). A current estimate of 85-112 extant adults has been made for the GPMU (Upper Basin Workgroups 2016, p.23). Hatchery fish monitoring data indicates that the current populations in these areas are dominated by the 2001, 2006, 2009, 2010 and 2013 year classes (Rugg 2014). These fish are now reaching reproductive age, but no reproduction has been observed yet.

2.12.3 Pallid sturgeon reproduction (GPMU)

Missouri River - Suitable spawning habitat is presumed to be available for pallid sturgeon in the river below Fort Peck Dam in areas of coarse substrate. One spawning location was documented in 2011 downstream of the Milk River and one free embryo was collected in the Missouri River (Delonay et al. 2014). This was the first time pallid sturgeon spawning was documented below Fort Peck Dam and contrasts with most studies indicating the vast majority of telemetered pallid sturgeon typically move from the Missouri River upstream into the Yellowstone River, for spawning.

Yellowstone River - Currently on the Yellowstone River the majority of pallid sturgeon spawning occurs in several locations from River miles 6 to 20 (Delonay et al. 2015; Fuller and Braaten 2012; Bramblett and White 2001; Bramblett 1996). However, approximately 12 to 26 percent of telemetered fish migrate up to Intake Diversion Dam in any given year and presumably would continue to migrate further upstream if not blocked by the weir (Braaten et al. 2014).

There is evidence of pallid sturgeon spawning in the Yellowstone and Missouri Rivers, but that spawning has not produced evidence of recruitment into the population. The most likely reasons for this are the effects from the presence of both the dams on the Missouri River and diversion structures on the Yellowstone River. These structures segment those rivers into shorter pieces than historical conditions. This segmentation blocks adults from accessing upstream historical spawning areas and also means that even if spawning occurs at the upstream end of those segments, the drift distance is shortened and likely inadequate for free embryos to drift and mature before entering anoxic reservoir habitat (See Drift distance and Temperature discussion below).

In 2011 when a spawning location was documented and a free embryo collected in the Missouri River (Delonay et al. 2014) flows were high in the Missouri River, due to the combined high flows from the Milk River and Missouri River from a large snowpack and high spring rainfall. Even though approximately 200 miles of the Missouri River were available for drifting pallid sturgeon free embryos during the 2011 season, there is no indication of any recruitment. This could be a result of the large snowpack causing high flow velocities (moving the free embryos faster) and low water temperature (from snow melt) slowing free embryo maturation before reaching anoxic conditions at Lake Sakakawea.

For example, Braaten et al (2012) estimated that 160-230 river miles are necessary for 25% of drifting free embryos to settle out at a water temperature of 68°F and at a drift speed of 2.25 fps. The flow velocities may have been higher and water temperatures were generally lower than 68°F, so 300 or more miles may be required for drifting free embryos to mature and settle out prior to entering Lake Sakakawea rather than the available 200 miles.

2.12.4 Influences of dams and reservoirs (GPMU)

The effects described below regarding the presence of other dams and reservoirs and their management, are not part of the proposed action. . However, the impacts are discussed to describe the condition of the species and its habitat. As stated at the beginning of this BO, the Status of the Species section is one of the four components reviewed to help inform the Service's biological opinion regarding whether the proposed action in combination with all the other components is likely to jeopardize the species. In that way the effects from the presence and management of the dams and reservoirs and all other environmental impacts are considered in the final conclusion.

Though dams and reservoirs affect almost every physical or biological feature of the sturgeon's habitat and life history, the most immediately observable features are blocking access to spawning habitats, reducing drift distances, negative changes to hydrology and turbidity, negative changes to water temperature, and creating habitats with depleted oxygen. These are discussed individually below.

Blocking access to spawning habitats - The upper Missouri River has been fragmented or segmented by Fort Peck (Fort Peck Reservoir) and Garrison dams (Lake Sakakawea), filled in 1942 and 1955, respectively. These two large dams/reservoirs have changed 312 miles of the formerly turbid, sediment-rich, and multichanneled river with extensive bars and islands into lake-like habitats and isolated fish populations upstream and downstream of each dam. The Intake Diversion Dam on the Yellowstone River segments 255 miles (Cartersville Dam to the mouth of the Yellowstone) into a 73 mile segment below Intake Diversion Dam and 165 mile segment above Intake Diversion Dam. In all these situations historical spawning habitats and migration corridors were blocked from access.

In recent decades, very few adult pallid sturgeon had ever been documented upstream of Intake Diversion Dam, but in both 2014 and 2015, pallid sturgeon were tracked[1] migrating upstream of Intake Diversion Dam via the high water channel around Joe's Island (Rugg 2014, 2015). One adult female and four adult males migrated upstream in 2014 and the female presumably spawned in the Powder River (tributary to the Yellowstone River upstream of Intake Diversion Dam). Tracking data and recapture of the female after she moved downstream found she had lost 13% in body weight (presumably, from loss of eggs during spawning; Rugg 2014). Surveys of potential habitat for pallid sturgeon indicate that suitable spawning and rearing habitat exists upstream of Intake Diversion Dam (Jaeger et al. 2005, 2006). A juvenile pallid passed above Intake Diversion Dam in 2015 (Assessment, p. 54).

Reducing drift distance - Water levels in the reservoirs impounded by Fort Peck Dam (Fort Peck Reservoir) and Garrison Dam (Lake Sakakawea) may be impediments to larval pallid sturgeon survival by limiting the amount of riverine (vs. reservoir) habitat available for pallid sturgeon to complete the transition from free embryos to exogenously feeding larvae. Studies to assess larval Pallid Sturgeon drift dynamics (Braaten et al. 2008, 2010) released hatchery-reared Pallid Sturgeon free embryos and larvae in 2004 and 2007. Subsequent sampling has collected juvenile Pallid Sturgeon derived from these releases (Braaten et al. 2012b). Survivorship of released embryos and larvae to age-1 is related to age at release (days post-hatch) and correlated with release location. Survivorship of the younger free embryos (i.e., 5 days post hatch) to age-1 was

[1] Pallid sturgeon are tracked using electronic telemetry devices inserted into their body cavities. The devices are then tracked using sensors placed throughout the river system.

only observed from the most upstream release site (Braaten et al. 2012b). These data indicate that free embryos, as young as five days post-hatch, have adequate dispersal distance to complete the developmental transition to feeding larvae. These observations support the hypothesis by Kynard et al. (2007) which implicates total drift distance as a limitation on natural recruitment in this reach of the Missouri River.

In 2013, the Corps, working with the Missouri River Recovery Implementation Committee and following the recommendation of its Independent Science Advisory Panel, initiated a detailed analysis to evaluate efficacy of its management actions on listed species (Service 2015, p. 11) Alterations to timing and amounts of release flows from Ft. Peck Dam were considered as a way to increase the effective drift distance below the dam. Changed flows would have the effect of slowing drift distance speeds and reducing the upstream extent of Lake Sakakawea, which would result in an extension of the riverine segment (drift distance). Intensive modeling efforts using multiple variables demonstrated recruitment failure for free embryos and larvae was still likely unless pool levels in Lake Sakakawea approached historic minimums (Service 2015, p.12). Therefore, this method of changing drift distance below Ft. Peck Dam was rejected. No other alternatives for Ft. Peck management to increase effective drift distance before entry to Lake Sakakawea have emerged.

Negative influence on hydrology and turbidity - The operation of Fort Peck and Garrison Dams has changed the river hydrology substantially by minimizing peak flows and increasing low flows to create a relatively stable hydrograph throughout the year (Delonay et al. 2016). The dams also have trapped sediment, substantially reducing transport of sediment downstream and reducing turbidity.

Canyon Ferry, Hauser, and Holter Dams are upstream of Great Falls, Montana. Though they do not impose any migratory barriers for Pallid Sturgeon, these structures, like other main-stem Missouri River dams, can affect sediment and nutrient transport and maintain an artificial hydrograph. Thus, the main-stem and tributary dams upstream of Fort Peck Dam affect downstream reaches by reducing both sediment input and transport. The results are a reduction of naturally occurring habitat features like sandbars. Discharge and sediment load, together with physiographic setting, are primary factors controlling the morphology of large alluvial rivers (Kellerhals and Church 1989). Seasonally high turbidity levels are a natural component of pre-impoundment ecological processes. Reduced sediment transport and the associated decrease in turbidity could affect Pallid Sturgeon recruitment and feeding efficiency.

The relationship between high turbidity levels and larval pallid sturgeon survival is unclear. In laboratory studies, increased predation on White Sturgeon yolk-sac larvae was observed at low turbidity levels, suggesting that high turbidity levels associated with a natural hydrograph and natural sediment transport regimes may offer concealment for free-drifting sturgeon embryos and larvae (Gadomski and Parsley 2005). Given that the diet of pallid sturgeon is generally composed of fish and aquatic insect larvae with some preference for piscivory as they mature (Assessment, p. 27), higher pre-impoundment turbidity levels may have afforded improved foraging effectiveness by providing older juveniles and adults some level of concealment. From the headwaters of Lake Sakakawea above Garrison Dam, North Dakota to Gavins Point Dam, South Dakota, the Missouri River retains little of its historical riverine habitat; most of this reach is impounded in reservoirs.

However, some pallid sturgeon persist in the more riverine reaches within a few of these reservoirs, though successful spawning and recruitment is unlikely. Because of the presence of pallid sturgeon in some inter-reservoir reaches, those occupied reaches have been included in recovery efforts (Erickson 1992; Jordan et al. 2006; Wanner et al. 2007). Despite these data, most of these inter-reservoir reaches are poorly understood and further research is needed to evaluate and define their significance to species' recovery.

Negative influence on spawning cues and water temperature - The dams are designed with water release structures that release water from deep in the reservoirs (except rarely during flooding emergencies when surface flows are released from the spillways). Water from the lower portion of reservoirs is several degrees colder than that at the surface, or what the water would be in a typical free-moving river. These releases reduce the temperature of the water in the river reaches below the dams. A change in downstream water temperature from dam releases, has been associated with spawning delays in several native riverine fishes and changing fish community composition downstream (Wolf 1995; Jordan 2000).

Water temperature is also important in the development of free embryos (and in turn affects the drift distance needed to transition to larvae). The cooler water can delay free embryo maturation. When combined with the already artificially shortened segment available for drift, this results in very low likelihood that free embryos will have transitioned into larvae before drifting into anoxic reservoir environments downstream.

In 2009, the Corps studied ways to improve downstream temperatures (Service 2015, p. 13) with their Fort Peck Dam Temperature Control Device Reconnaissance Study (Corps, 2009). Ten alternatives for structural or water management changes at Ft. Peck Dam were considered as potential methods to reduce or eliminate the temperature impacts downstream. The only one that survived evaluation for further examination was a flexible curtain suspended behind the dam and anchored to the lake bottom with anchors and ballast to pass surface water over the crest into the intake area rather than releasing cold water from the dam's engineered water discharge (Service 2015, p. 13). After further analysis, this change was rejected due to short lifespan of the curtain, uncertainty that it would meet temperature targets, and significant dam operation safety concerns (Service 2015, p. 14). Alternatives for changing the downstream temperatures through structural changes at Ft. Peck were exhausted.

Compared to the Missouri River, the Yellowstone River has only a slightly altered hydrologic, temperature and turbidity regime as there are no major dams/reservoirs on the mainstem river. Large dams/reservoirs are present on the Bighorn River, which results in reductions to peak flows in the Yellowstone River (Corps and YRCDC 2015), but still maintains significantly more natural hydrologic fluctuations, natural water temperatures and turbidity and thus, cues for spawning migrations (Delonay et al. 2016).

Historically, discharge increases in the spring flows in the Missouri and Yellowstone Rivers between Fort Peck Dam and Lake Sakakawea and the elevated flows cued adult pallid sturgeon residing in this reach to initiate spawning movements. In most years, adult pallid sturgeon migrate into the unregulated Yellowstone River (Fuller and Braaten 2012) to spawn. Spawning adults favor the elevated spring flows and warmer temperatures of the Yellowstone River and are believed to avoid the colder, less turbid flows in the Missouri River.

Reducing dissolved oxygen to lethal levels - The level of dissolved oxygen in the water column plays a major role in the health and survival of most fish species, including pallid sturgeon. A study of dissolved oxygen and pallid sturgeon survival conducted at the upper end of Ft. Peck Reservoir (Guy et al. 2015) indicated that pallid sturgeon free embryos and 40-day old larvae experienced 100% mortality in about one hour at dissolved oxygen concentrations of 1.5 mg/L or less.

Low levels of dissolved oxygen below Ft. Peck Dam, in Lake Sakakawea, have been hypothesized as a potential key cause of recruitment failure for pallid sturgeon below the Ft. Peck Dam and Intake Diversion Dam because free embryos do not have sufficient drift distance from spawning areas to develop into exogenously feeding larvae and settle to the substrate before they drift into reservoirs and perish (Delonay et al. 2016).

Recent research supports this hypothesis. For example, dissolved oxygen levels near the bottom in the transition zone from the Missouri River to upper end of Fort Peck Reservoir were near 0 mg/L, likely due to the biological oxygen demand in the organic enriched deposition zone (Guy et al. 2015). And below Fort Peck Dam, low dissolved oxygen levels just above and within fine sediments in the transition zone and upper end of Lake Sakakawea were also confirmed in 2015 (Bramblett & Scholl 2016). These conditions have led to the current hypothesis that the lack of sufficient drift distance and potentially lethal conditions in Lake Sakakawea are responsible for the lack of recruitment in the GPMU (Delonay et al. 2016).

2.13 Summary of Status of the Sturgeon

2.13.1 Status (rangewide)

Since listing, the status of the species appears to have stabilized. While the numbers of wild sturgeon collected in the Missouri, Mississippi and Atchafalaya rivers are higher than initially documented when listed and evidence for limited recruitment exists for the lower Missouri and Mississippi rivers, the population has not been fully quantified. Population estimates for wild sturgeon within some inter-reservoir reaches of the Missouri River indicate the extant wild populations are declining or gone. Natural recruitment of young (from limited natural spawning) into the population in the lower Yellowstone River and the upper Missouri River below Fort Peck is non-existent. Augmentation of the wild fish with hatchery raised sturgeon is supporting continued presence of sturgeon in many reaches of the Missouri River. Hundreds of the thousands of the fish released through augmentation are reaching the age where they are expected to begin spawning, while existing wild adult fish are reaching an age of increased mortality.

2.13.2 Status in the (GPMU)

Approximately 100-125 wild fish (spawning age) and 52,000 hatchery fish (reaching spawning age currently and through now and over the next 14 years) reside in the GPMU. All of these fish are blocked from large stretches of potential spawning habitat. These blockages also serve to reduce the necessary drift distance for free embryo before reaching lethal reservoir environments. Based on a calculation of total number of adult sturgeon that may have been present in this area in 1969, the current hatchery population is likely larger than the historic population (Braaten et al. 2009).

Temperature and hydrology influences from Ft. Peck Dam reduce spawning cues in the Missouri River and effectively elongate the needed drift distance (which is already limited) before drifting free embryos reach likely lethal conditions in Lake Sakakawea. The Corps has evaluated many changes to structures and management at Ft. Peck Dam to eliminate those negative impacts and extend effective drift distance, but to date, none have proven feasible or compatible with the most recent science on drift behavior.

Warmer water temperatures and elevated spring flows (Service 2015, p. 5) in the Yellowstone River create an apparent preference for spawning pallids. From 60-90 percent of telemetered adult fish leave the Missouri River and enter the Yellowstone during spawning season (Assessment, p. 54). Many swim 70 miles up the Yellowstone River where they are blocked by the Intake Diversion Dam from using another 162 miles above the structure. If pallids spawn below Intake Diversion Dam, free embryos face a peril from shortened drift distance similar to free embryos in the Missouri River below Ft. Peck Dam.

Because the Yellowstone has a more natural hydrograph favorable for spawning, further temperature control and flow studies at Fort Peck do not seem likely to increase survival and recovery. Although this will be more closely examined in the Missouri consultation, these tests do not currently appear to be beneficial for pallids because if they were pursued, they may increase the likelihood that a small percentage of adults pallids will choose to spawn in the Missouri rather than the Yellowstone. As explained above, there appears to be insufficient drift distance for recruitment below Fort Peck dam. Thus, these tests could have the effect of diverting spawning pallids away from the more promising Yellowstone, and if there is successful passage at Intake, diminishing potential recruitment.

In 2014, a few of the remaining wild fish made it past Intake Diversion Dam using an ephemeral high-water channel. In 2014, they moved up that segment of the Yellowstone River 78 miles, and then 20 miles up the Powder River. There is circumstantial evidence of egg release (in 2014), but no current evidence of free embryo survival. In 2015 a hatchery juvenile moved above Intake Diversion Dam.

The number of wild fish in the GPMU are slowly declining due to age, but thousands of augmented fish are reaching the age where spawning is likely. Even with a growing number of spawning age fish over the next decade, shortened drift distances for free embryos are likely to result in their death as they reach reservoir influenced water with low oxygen content.

Successful recruitment of wild pallid sturgeon in the GPMU likely will require both access to greater amounts of suitable spawning habitat and greater drift distance to suitable settling and rearing habitats. At this time the Yellowstone River above Intake Diversion Dam provides the most likely area to provide the greatest combined drift distance.

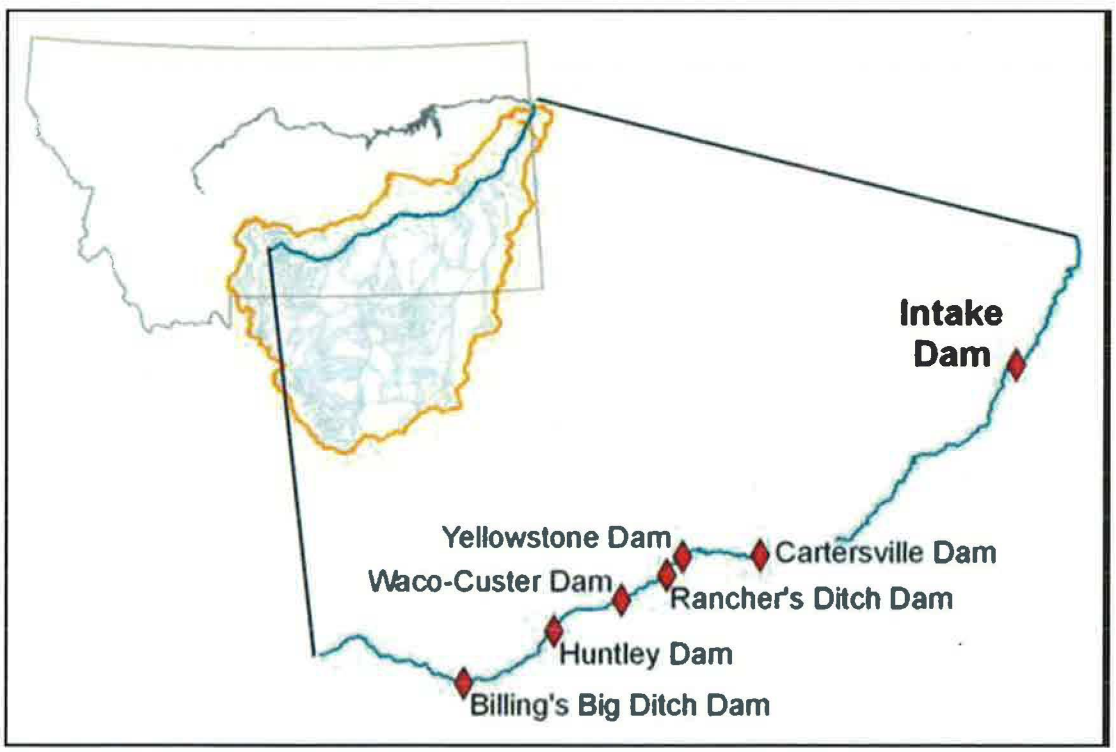
3.0 ENVIRONMENTAL BASELINE (Action Area)

The Environmental Baseline section presents a review of the past and present human and natural factors leading to the current state of the species, including its habitat and ecosystem within the action area (CFR 402.02; Service 1998, p. 4-22). The scale of the Environmental Baseline section is at the scale of the action area. Most of the information below was drawn directly from Reclamation's 2010 EA, Reclamation's 2015 Assessment (Reclamation 2015) and Reclamation's 2016 Assessment (Assessment).

3.1 General Description of Yellowstone River Basin Condition

The Yellowstone River is not impounded by storage reservoirs, and the mainstem of the river is not regulated. Therefore, it is considered to be essentially free-flowing. However, there are six diversion dams upstream of Intake Diversion Dam on the Yellowstone River.

Figure 3. Diversion Dams along the Yellowstone River (Reclamation 2015, p. 26)



The uppermost diversion dam is Billings Big Ditch Dam. The next dam downstream is the Huntley diversion and is Reclamation-owned and managed by the local irrigation district, while the middle four (Waco, Rancher's Ditch, Yellowstone, and Cartersville) are privately-owned and managed by local irrigation districts. Intake Diversion Dam is Reclamation-owned and managed by the local irrigation district. All six dams present varying degrees of impediment to fish passage. The extent of fish blockage at these dams depends on river stage and the swimming ability of the various species trying to negotiate the dams.

The Bighorn and Tongue Rivers are major tributaries to the Yellowstone River. Reclamation currently operates Yellowtail Dam and Afterbay Dam on the Bighorn River while the Montana Department of Natural Resources and Conservation operates the Tongue River Dam on the Tongue River. Yellowtail Dam was constructed for the production of power, flood control, and the storage of water for irrigation. The Tongue River Dam was constructed primarily for irrigation purposes.

Bank stabilization projects have proliferated over the years, and the action area contains some of these projects. In the immediate area of Intake Diversion Dam there are a total of five man-made structures that stabilize the river channel. These structures are the old headworks, the new headworks, the Intake Diversion Dam (also referred to below as weir), a boat ramp, and a field of boulders extending about 300 feet downstream of the weir. The boulders originally served as a means to raise the water surface elevation for diversion into the Lower Yellowstone Project Main Canal, but have been pushed downstream due to ice and high flows.

Conservation groups have been working with landowners to conserve and restore riparian areas. The Natural Resource Conservation Service continues to work with landowners adjacent to the Yellowstone River on a wide variety of conservation efforts including water and natural resource conservation. Recently, the Corps has been requiring screening to minimize fish entrainment in irrigation intakes on the Yellowstone River. However, many older irrigation projects have unscreened intakes (Reclamation 2015, p. 28).

3.2 Habitat in the action area

Instream habitats of the lower Yellowstone River include main channel pools, runs and riffles, side channels, and backwaters. Most pools are 5 ft. - 10 ft. deep, although some are at least 18 ft. deep during summer flows. There are many islands and braided channels with associated backwaters, except in the reaches from Miles City to Cedar Creek and from Sidney to the confluence with the Missouri River. The lower Yellowstone River main channel riverbed upstream from Sidney is primarily gravel and cobble. Downstream from Sidney, the substrate is mainly sand and silt (Reclamation 2010, p. 3-19).

Fifty-two species of fish have been recorded in the lower Yellowstone River (Montana Fisheries Information System, http://fwp.mt.gov/fishing/mfish/default.aspx). Of these, 31 species are native and 21 species are introduced. Native species considered abundant include the blue sucker, channel catfish, emerald shiner, flathead chub, goldeye, longnose sucker, paddlefish, river carpsucker, sauger, shortnose redhorse, shovelnose sturgeon, smallmouth buffalo, stonecat, western silvery minnow, and white sucker (Montana Fisheries Information System, http://fwp.mt.gov/fishing/mfish/default.aspx) (Assessment, p. 53).

Based on the information reported above, aquatic habitat in the action area appears to be in adequate condition to generally support all the life history needs of the sturgeon, except successful reproduction (due to migration barrier at the weir and short free embryo/larva drift distance below Intake Diversion Dam).

3.2.1 High water channel at Intake Diversion Dam

There is an existing side channel at the Intake Diversion Dam. Its downstream mouth is approximately two miles downstream of the weir and its upstream mouth is approximately two miles upstream of the weir. This channel only becomes active when the Yellowstone River is flowing at 20,000 to 25,000 cfs (Assessment p. 76). Otherwise it does not form a continuous channel. Once active, if the flow is great enough, it can allow for fish to pass around the weir.

When the first fish was documented using the channel in 2014, the Yellowstone River was flowing at approximately 47,000 cfs (D. Trimpe, Bureau of Reclamation, pers. Comm. May 22, 2015). However, in 2016 when flows peaked at 34,000 cfs, no pallid sturgeon were detected by telemetry using the side channel (D. Trimpe, Bureau of Reclamation, pers. Comm. October 4, 2016).

If flows of 47,000 cfs are needed to pass pallid sturgeon in the existing channel during the May 15 – June 15 spawning season, then based on the historical record of river flow - this condition would be expected to occur only 7 days in 5 out of 10 years (Service 2015). This means that in only 5 out of every 10 years, the channel would support pallid sturgeon passage, but then only 7 days out of the 30 day spawning season.

3.3 Reproduction, numbers and distribution

3.3.1 Reproduction in the action area

Spawning – The first necessary step for successful recruitment young fish into the population is spawning. The significance is highlighted by the 2009 Science Review Report. "*...Without the resumption of natural spawning there is no real possibility that the naturally produced (i.e., non-stocked) pallid sturgeon population in RPMA2 will recover from its endangered status...*". (Reclamation 2009, p.15). Except as described below, spawning above the weir is currently thought to be sporadic to nonexistent because adult wild fish are typically unable to move above the Intake Diversion Dam and spawn. Below Intake Diversion Dam, two spawning sites were found in 2015 at approximately river miles 6 and 8). Three free embryos were captured below those sites (Upper Basin Workgroups 2016, p. 23), but there are no detectable levels of recruitment occurring (Assessment p. 55).

In a recent unusual event, an egg-bearing adult female and four adult males used a four and a half mile long high water channel to migrate around and upstream of Intake Diversion Dam in June 2014 (Assessment, p. 36). Three of these fish – the gravid female (egg bearing) and two males - were later located in the Powder River. The gravid female moved approximately 20 miles up the Powder River and spent approximately six days there (D. Trimpe, Bureau of Reclamation, pers. Comm. March 5, 2015). The two males moved between five and eight miles up the Powder River. The other two males moved upstream of the Intake Diversion Dam where one stayed in the general vicinity and the other moved upstream to near Glendive, Montana. The female was captured shortly after her return to the Yellowstone River and no longer had eggs. Telemetry data regarding her movements (and percentage of time spent in the Powder River) suggest that she is likely to have spawned in or near the Powder River. Later, all three fish passed the Intake Diversion Dam, (telemetry data indicates they did not use the high water channel, but passed safely over the weir and rubble field) and returned to the lower Yellowstone River (Assessment, p. 54). The observations of these fish entering the Yellowstone River, swimming 73 miles to Intake, finding the natural channel and swimming 4½ miles up the channel, then 98 miles further upstream to spawn, demonstrates the strong motivation for some wild fish to pass above Intake Diversion Dam if circumstance allows. When conditions were right, a total of 41% of the motivated fish used the high water channel in 2014 (Rugg 2014) and one hatchery juvenile (14%) passed in 2015 (Rugg 2015).

Recruitment – Recruitment of young fish into the population is the key to a healthy population. Though successful recruitment is dependent on many environmental variables, the first necessary step is spawning. Currently, despite some spawning below the weir and the capture of three free embryos below those sites, no pallid sturgeon recruitment has been detected in the action area. Braaten et al. (2008) suggests larval drift distance presently available below the weir is insufficient in length and settling habitat (Assessment, p. 55). The known spawning sites in the Yellowstone River (RM 6-20) results in only 21-72 miles of larval drift distance (depending on low or high pool) before the anoxic habitat of Lake Sakakawea. As a result of this short available distance, larvae could drift into Lake Sakakawea and die due to unsuitable habitat conditions there (Assessment, p. 55). The potentially lethal conditions include lack of food, predation and low oxygen levels. Even if spawning took place, as far up as the weir at the Intake Diversion Dam the larval drift distance would only be 97 miles which is still a far shorter distance than necessary for larval survival.

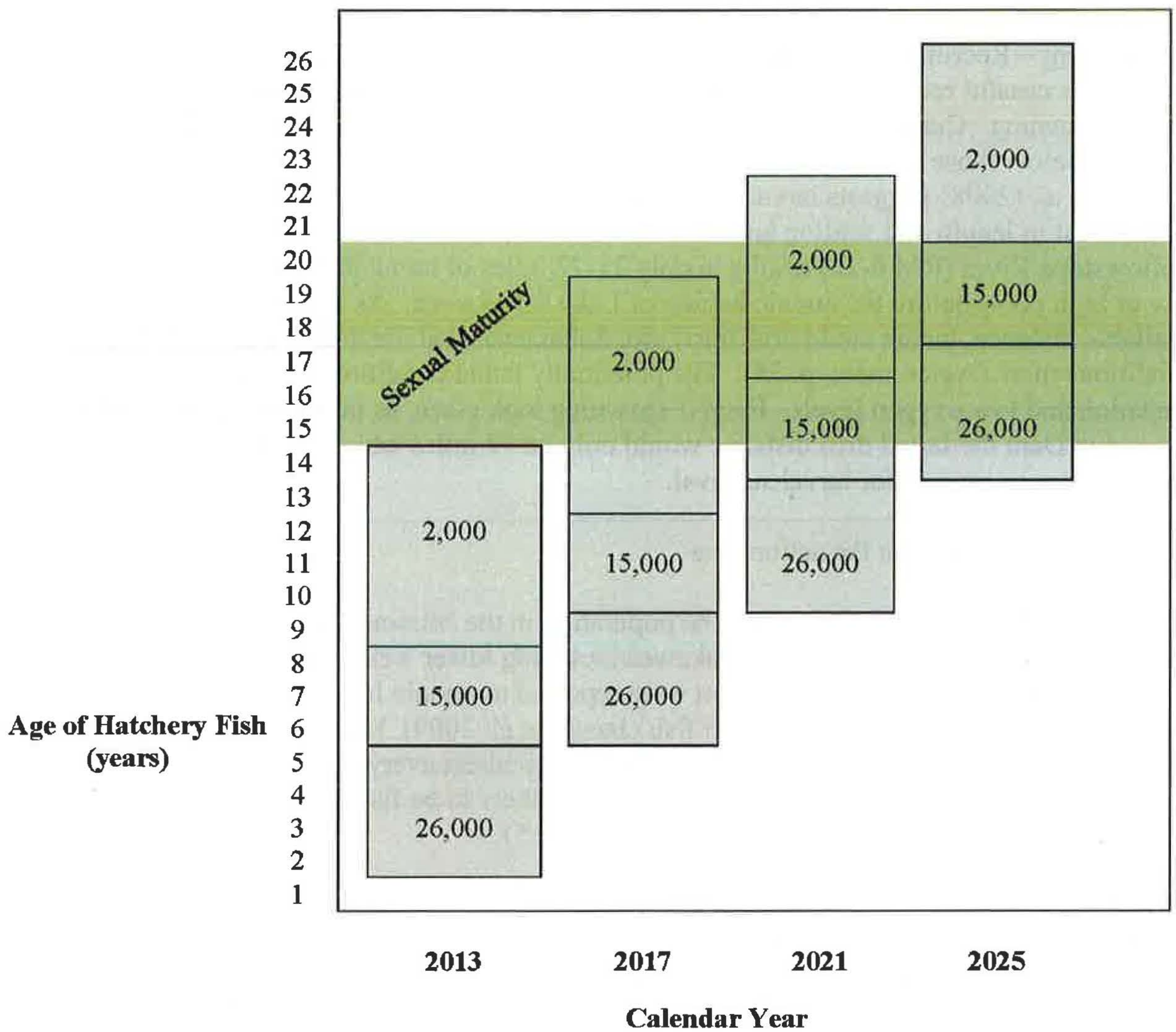
3.3.2 Numbers in the action area

The fish in the action area come from the population in the Missouri River (downstream of Fort Peck Dam) to headwaters of Lake Sakakawea including lower Yellowstone River. In 2004, an estimated 158 wild adult pallid sturgeon were reported to remain in this area (Klungle et al. 2005). More recent estimates were 125 fish (Jaeger et al. 2009). Members of this number are aging and natural mortality is slowly reducing their numbers every year. The wild fish were estimated to be 43-57 years of age because they are likely to be fish spawned before Lake Sakakawea was filled in the 1950s (Braaten et al. 2015).

Since 1994, the augmentation program has released thousands of hatchery-reared pallid sturgeon within the Missouri River and portions of the Yellowstone River. Early stocking included some broad stocking of hatchery larvae greater than 1 ½ inches above the Intake Diversion Dam, but most limited stocking now takes place below the weir. Stocking typically took place in the fall (September and October) of the year (Reclamation 2015, p. 13).

The estimated number of surviving hatchery fish in this area is 43,000 (Rotella 2015). Estimates are that 15,455 of these fish are aged 6-8 years and 1,981 are greater than 9 years of age. Assuming no large mortality event or an unexpected increase in the natural mortality rate, this means that over the next 14 years, almost 18,000 pallid sturgeon in this group will be reaching maturity (at age 15-20 years) and the capacity to reproduce (Figure 4).[2] Hatchery fish monitoring data indicates that the current populations in these areas are dominated by the 2001, 2006, 2009, 2010 and 2013 year classes (Rugg 2014). Based on a calculation of total number of adult sturgeon that may have been present in this area in 1969, the current hatchery population likely exceeds the historic population (Braaten et al. 2009).

Figure 4. Number of hatchery fish reaching sexual maturity over the next decade



[2] In 2016, 18 telemetered pallid sturgeon were identified at Intake. Seven were hatchery fish and two of these (one a female), were 20 years old (D. Trimpe, Bureau of Reclamation, pers. Comm. October 17, 2016).

In 2011 fish screens were installed on the Intake Diversion Dam headgates to reduce the number of fish (all species) entrained into the Lower Yellowstone's Project's Main Canal.[3] Before the current screens were in place, it was estimated that about 500,000 fish of 36 species were annually entrained into the main canal, of which as many as 8% were sturgeon sp. (Assessment, p. 54). This substantially decreased mortality of fish in those populations.

Information from monitoring from 2012 to 2014 showed a change from the previous estimate for sturgeon. In 2012, approximately 99 percent of the larval fish entrained belonged to the minnow or carp families and were typically quite small (4-8 mm total length) (Assessment, p. 54). One shovelnose sturgeon free embryo/larva was entrained in 2013 (Assessment, p. 55).

The loss of fish for decades (up until the screens were installed) may have also included any life stage of pallid sturgeon, including free embryos produced sporadically throughout the decades, juveniles that happened to have been above the weir, and potentially some adults. The screens perform two functions that reduce fish loss. They are designed to prohibit passage of fish larger than 1 ½ inches and the screens change the characteristics of the approaching water velocity so it is less likely for small fish (even for fish small enough to potentially pass through the screens) to be drawn near the screen-channel interface. Using a 2D modeling program, at 24,000 to 25,000 cubic feet per second (cfs), the extent of the water column where diversion flow influence could be detected at all is 50 feet away from the screens. At higher flows the influence distance into the river current is even smaller (Assessment, p. 73).

The installation of the screens has all but eliminated loss of fish (greater than 1 ½ inches in length) through entrainment and will substantially improve the survival of any fish in the future that are exposed to the area near the headgates and screens. This may have eliminated a long-existing source of loss of pallid sturgeon larvae from the rare spawning pallids that made it up river past the weir. The screens significantly improved the current environmental baseline condition for fish of all species including the pallid sturgeon. In the future, when adult sturgeon are able to move upriver beyond the replacement weir and spawn, some free embryos may be entrained by the screens. Given monitoring results for shovelnose sturgeon (a much more numerous species) the number of pallid free embryos entrained should be a very small portion of the total resulting in higher survival rates for embryos that without screens.

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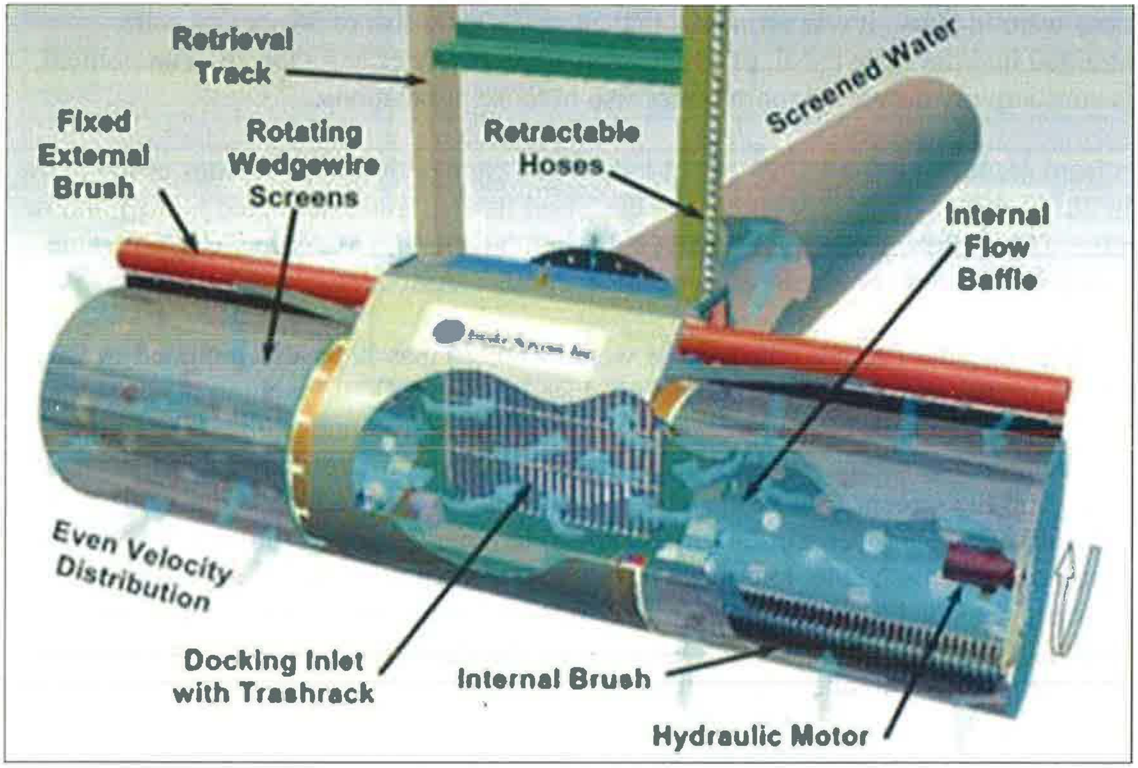
[3] Consultation on the effects of installation of the screens was completed in April 2010 with a concurrence letter from the Service. As such it has been included in the environmental baseline.

Figure 5. Diagram of removable drums screen (from Assessment p. 12)



3.3.3 Distribution, timing, and life history in the action area

Currently the distribution of adult and hatchery fish is limited to about a 70-mile stretch of Yellowstone below Intake Diversion Dam and the area of the Missouri River below Fort Peck Dam. Wild and hatchery fish are mixed and spend July through April in the lowest part of the Yellowstone and Missouri rivers. As mentioned above, estimates are that approximately 43,000 augmentation fish (various age classes) currently exist in this area.

As the river rises due to snowmelt, the ascending limb of the hydrograph apparently cues the adults in the Missouri River and Yellowstone River to move upstream to spawn. Due to preferable temperatures and hydrology, 60-90 percent migrate into the lower Yellowstone River (Assessment, p. 36 and p. 54). Of those motivated fish (fish demonstrating desire to migrate up the Yellowstone River during spawning period), approximately 12-26 percent of the telemetered wild adults) continue up the river to Intake Diversion Dam (Assessment, p. 54). These fish arrive at the weir in late May or early June; historically they would probably have moved beyond the area of the weir and spawned in or near the tributary rivers (Tongue, Powder, etc.).

Adult sturgeon migrate upstream to the weir each year, however, very few sturgeon have been documented above the weir (see previous section for sturgeon above the weir in 2014) (Assessment, p. 36). Before the passage in 2014, there were four additional confirmed observations of wild adult pallid sturgeon collected upstream of Intake Diversion Dam; one in 1950 in the mouth of the Tongue River and one in 1991 near Fallon, Montana (Brown 1955, Watson and Stewart 1991). In addition, one hatchery released fish was found above the weir in 2011 and 2013. It is unknown if these fish migrated upriver over Intake Diversion Dam or around it in the natural existing side channel (Service 2015, p. 14). Given the water velocity, debris field and the weir it seems unlikely that they passed up over the weir structure, however shovelnose sturgeon, sauger, and paddlefish have been documented moving up over the weir (Upper Basin Work Groups 2015, p. 23). The high water channel and conditions that allowed documented passage in 2014 are relatively rare and short-lived. The Service estimates that it occurs only for about 7 days, every 5 out of 10 years (Service 2015 p. 14). No telemetered adults used the channel in 2015 (Upper Basin Work Group 2016, p. 23) and no pallid sturgeon were documented passing Intake in 2016 probably due to low flows in the high water channel (D. Trimpe, Bureau of Reclamation, pers. Comm. October 4, 2016). However, 18 telemetered pallid sturgeon were observed at Intake in 2016. Seven were of hatchery origination, seven were wild and four from unreported origin. The number of wild is consistent with Braaten's (2014, p. 9) estimate regarding the number of adult wild fish that may desire to migrate beyond Intake (D. Trimpe, Bureau of Reclamation, pers. Comm. October 17, 2016). The rarity of passage and passage conditions means the current weir presents what is essentially a complete barrier to upstream movement of sturgeon.

Juveniles are unlikely to move upstream to the area near the weir due to a lack of sexual maturity to respond to natural spawning cues. However, in 2015 a juvenile was detected moving upstream through the natural channel (Assessment, p. 54). And again in 2016 juveniles were detected at the weir (D. Trimpe, Bureau of Reclamation, pers. Comm. October 17, 2016). After spawning, sturgeon head back down river. The one example from 2014 showed a spawned female and a few males at the upstream side of the weir on June 20. After passing the weir they returned to the lower Yellowstone and Missouri Rivers.

Free embryos from a spawning area (for example the Powder River) would drift downstream to the replacement weir area in approximately 2-4 days (D. Trimpe, Bureau of Reclamation, pers. comm. March 24, 2015) then drift further down the river and transition to larvae and later life stages in the lower Yellowstone and Missouri rivers.

3.3.4 Climate change in the action area

The Service discussed various scenarios for climate change in the Status section (2.11). Those scenarios included the action area. In that section we found that the climate change scenarios do not present changes that would be reasonably expected to impact the status of the sturgeon. There are no more specific or refined scenarios for the action area, therefore that conclusion holds for the action area also.

3.4 Role of the action area for the conservation needs of the sturgeon

Recruitment is the key to conservation of the pallid sturgeon in the action area, but recruitment cannot occur without pallid sturgeon spawning in an area that allows for a long enough period of drift (anywhere from 160 – 329 miles depending on velocity and water temperature) for free embryo's to survive and find suitable rearing habitat. Currently below the Intake Diversion Dam, there is not enough distance for that to occur.

The lower Yellowstone River upstream of the weir contains what is expected to be some of the best remaining habitat for successful spawning (Service 2000a, Service 2003) and provides the greatest effective drift distance (approximately 250 miles) in the GPMU. Passage at the weir is crucial to take advantage of the river's habitat and unregulated flow.

Providing passage at the weir would open approximately 165 miles of additional habitat (between Intake Diversion Dam and Cartersville Dam – the next potential barrier) in the Yellowstone River to sturgeon, as well as providing access to the confluences of the Powder and Tongue rivers (Reclamation 2010). Combined with the approximately 90 miles of current habitat below Intake Diversion Dam the total habitat available for drift would be approximately 250 miles.[4] That distance is significant because it is believed to provide sufficient time for a portion of the embryos to drift, mature, and find suitable habitat before reaching Lake Sakakawea (Assessment, p. 82), which is likely lethal for free embryos and larvae.

Motivated, spawning adults reach the weir every spawning season, but cannot reliably pass upstream. When a few adults did in 2014, spawning was documented at least 98 miles above the Intake Diversion Dam (Assessment, p. 54). This indicates the drive for spawning sturgeon to move substantial distance above the weir to find appropriate spawning areas.

Restoring habitat connectivity where barriers to fish movement occur is considered priority level 1 in the pallid sturgeon recovery plan (Service 2014, p. 77). Priority 1 actions are considered "... actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future." (Service 2014, p. 75). Passage for pallid sturgeon at the Intake Diversion Dam is an example of a priority level 1 action for recovery of the pallid sturgeon in the Upper Missouri River.

By creating opportunity for fish passage every year at the Intake Diversion Dam to spawning habitat above the weir, the larval drift distance (before Lake Sakakawea) is increased to approximately 250 miles (calculated from the Cartersville Dam). This distance makes it much more likely that a portion of larva fish will survive to one year of age (an age class that is currently missing and is thought to be a main cause for lack of recruitment). The potential impact of this new habitat to the sturgeon population is significant. The significance is highlighted by the 2009 Science Review Report. "*...Without the resumption of natural spawning there is no real possibility that the naturally produced (i.e., non-stocked) pallid sturgeon population in RPMA2 will recover from its endangered status...*". (Reclamation 2009, p.15)

3.5 Summary of baseline condition

Currently there are approximately 125 wild pallid sturgeon adults and 43,000 hatchery fish (including 15,455 aged 6-8 years and 1,981 greater than 9 years of age) distributed below the Intake Diversion Dam in the lower Yellowstone and Missouri Rivers. Approximately 125 wild adults of spawning age are currently available to migrate upriver to spawn. Based on telemetry

[4] The first potential impediment in the Tongue River is twenty miles from its confluence with the Yellowstone. The Powder River is largely unblocked and several hundred miles long, but it is unknown how much of this is potential sturgeon habitat. Pallid sturgeon were observed twenty miles up the Powder River in 2014.

data, 60 to 90 percent of the telemetered wild adults enter the lower Yellowstone River likely due to preferable water conditions compared to the Missouri River. Those that continue up river are essentially blocked from passing by the existing weir. However, the fish that passed above the weir via a side channel in 2014 appear to have spawned. Sturgeon that spawn below the weir in the Yellowstone or Missouri rivers have produced free embryos, but recruitment of fish into the population is non-existent. This lack of success is likely a result of not enough larval drift distance below the weir before free embryos or larvae would reach Lake Sakakawea. Fish screens at Intake Diversion Dam have largely eliminated the risk of any fish upstream of the weir being entrained. The large group of hatchery fish below the weir is reaching potential spawning age. If passage can be built around the weir, and spawning age fish pass above it, the condition is set for a population response and potential for recovery in the Upper Missouri River.

4.0 EFFECTS OF THE ACTION

Effects of the action are defined as the "*...direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdepended with that action that will be added to the environmental baseline.*"(50 CFR 402.02)

In this section, is the Service's review of the action agency's analysis and discussion of how the proposed action (modifications to land, water, and air) are likely to result in an effect to the species. This analysis is the responsibility of the action agency and is required as part of the materials submitted to the Service when requesting formal consultation (50 CFR 402.14). It describes what modifications to the environment from the proposed action the species will be exposed to, what the species' response will likely be if exposure occurs, and then what biological effect (if any) is likely to result from the response.

Effects of the action are a reasonable prediction of the likely reaction of, and biological effect to, individuals of a species to the environmental changes brought about by implementation of the chosen proposed action. It is not an exploration of alternatives to the proposed action. As with any prediction of an animal's response to environmental impacts, there are many uncertainties associated with it. The prediction must be a reasoned prediction that is informed by science (if available). But because scientific literature reports on the results of controlled experiments and purposefully restricts its findings to the conditions and circumstances of the study, its findings can only be used to inform a predicted result from a future proposed action – it cannot determine the outcome with certainty. Therefore, additional information from observations on other species, from other environments and professional judgment from biologists familiar with the species also play a role in arriving at a reasoned prediction.

4.1 Analytic Approach

One of the most effective techniques for arriving at the effects of an action on a listed species is to follow the logic chain of Exposure – Response – Effect. In other words, the first evaluation is whether the species will be exposed to modifications of land, water or air from the proposed action. Then, if exposed, what is the likely physiological response to that exposure. And then (understanding the biology of the species) what biological effect results from that physiological response. Following that chain of logic, Reclamation and the Corps first deconstructed the proposed action into four major components (Assessment, p. 9).

1. Operation and maintenance of the LYP prior to and during construction of the proposed fish passage improvements
2. Construction of replacement weir and bypass channel for fish passage
3. Future operation and maintenance of the Irrigation Project
4. Monitoring and adaptive management

Then to reduce the likelihood of missing an impact, those four major components were further deconstructed into 47 elements or tasks (Assessment, p. 58-69). Using that deconstruction, Reclamation and the Corps examined each element against each life stage of the pallid sturgeon to look for the potential of that life stage to be exposed to changes in the environment caused by the elements (Assessment Table 4). This table also provided a rationale for the finding regarding the potential exposure and the mechanism for how that exposure could occur. Therefore, the table represents determinations where no exposure exists; where exposure is possible, but its likelihood is discountable; where exposure is probable and the effect is insignificant; and where exposure is probable and effects are not insignificant. If a response and effect was unlikely to occur, the effect was considered to be discountable. If the effect was considered to be small enough that its effects to the species could not be meaningfully measured, detected, or evaluated it was considered insignificant. The rationale for the determinations included consideration of the spatial arrangement of the activity and the species in the action area, the life history of the species, timing of the element, and implementation of any conservation measures or best management practices.[5]

The components or elements that were likely to result in effects that are discountable or insignificant are incorporated by reference as a part of the effects of the action section, but will not be discussed individually below. These include noise, turbidity, disturbance, pumps and temporary increased velocities due to coffer dams. The remaining components and elements, where exposure, response and effects were likely and NOT insignificant, will be discussed further in this effects section.

Those components and elements are 1) the continued operation of the fish screens, 2) the physical presence of the replacement weir (with notch) in the river, and bypass channel, including closure of the high water channel, 3) maintenance of the existing weir structure for approximately two-three years until the replacement weir and bypass are operational, and 4) monitoring and adaptive management. These are discussed individually below.

[5] During all these activities, general conservation measures such as working behind coffer dams and doing instream work outside of the pallid sturgeon's migration and spawning period will be employed to reduce the likelihood and significance of effects to all life stages of the pallid sturgeon (Assessment p. 100).

4.2 Components and elements that are likely to have adverse effects

4.2.1 Continued presence of the current weir with rocking

The current weir is used to deliver specified amounts of water to the Irrigation Project as originally authorized (Assessment, pp. 7, 9). To provide water and allow for fish passage, the proposed action is to build a replacement weir and fish bypass channel. The construction timing and phasing of a complex project in a river environment is driven by many environmental considerations such as ice, high water, irrigation season, access, etc. Reclamation and the Corps have determined that it will take 2-3 years to complete the project. In the intervening period of time, Reclamation, acting through its authorized agent the Lower Yellowstone Irrigation District, will continue to maintain the current weir to provide water to the irrigation project. Part of the proposed action is the Corps' permitting additional rock placement on the existing weir until the new weir is constructed. The Corps issuance of the permitting for placement of rock is done under the authority of Section 10 of the Rivers and Harbors Act of 1899. Though the permitting and physical action of maintaining the weir (adding rock to the existing weir) is not likely to produce adverse effects (Assessment p. 58), its presence in the river will.[6] Those effects are that any spawning adult sturgeon that attempts to pass above the weir will be thwarted. (Observations from 2014 and 2015 suggest that both adults and juveniles passed downstream safely over the weir indicating that it is not a downstream barrier.) This will be the situation for 2-3 years and is similar to the situation that has existed for decades. After the replacement weir and fish passage channel are built, any spawning sturgeon that attempts to pass the replacement weir will have the opportunity to pass upriver every year through the new bypass channel and downstream through the bypass channel or weir notch (see discussion in later section).

Data on approximately how many sturgeon are likely to be adversely affected by the weir as a barrier does not exist, but can potentially be inferred from data from the Comprehensive Sturgeon Research Project (CSRP). The CSRP is a multiyear, multiagency collaborative research framework developed to provide information to support pallid sturgeon recovery and Missouri River management decisions (DeLonay et. al. 2014, p. 1). The research consists of several interdependent and complementary tasks that engage multiple disciplines.

The CSRP have developed effective telemetry tagging and tracking methodology to track and relocate individual fish over long periods of time. Fish selected for tagging are male and female sturgeon in reproductive condition. Between 2006-2010 approximately 70 pallid sturgeon were tagged (DeLonay et. al. 2014, p. 15). Monitoring stations at the confluence of the Missouri and Yellowstone Rivers identify tagged fish that move into the Yellowstone River from the Missouri River and another monitoring station at the Intake Diversion Dam identifies individuals that are in the immediate area of the weir and rubble field.

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[6] The proposed action does not include building the Intake Diversion Dam, so its presence would typically be a part of the environmental baseline of the action area and not a part of the proposed action. It is part of the proposed action to add rock to it as a maintenance action. However, if the maintenance were not completed as necessary, at some distant point in time the weir would cease to exist. Though that time is probably decades off, for simplicity of analysis, and to ensure that its effects in the interim are recognized and assessed, the Service has analyzed the maintenance of the weir as effectively resulting in its continued presence.

The 2014 report showed that between 2005 and 2011 the percentage of total telemetered fish that migrated into the Yellowstone River ranged from 60 to almost 90 percent (DeLonay et. al. 2014, p. 64). Specific to the migrating upstream to the Intake Diversion Dam, Braaten et. al. (2014. p. 6) reported that eight pallid sturgeon were recorded in the vicinity of the Intake Diversion Dam in 2011, and five in 2012. In those years, this represented 25.8 and 12.2 percent of the telemetered population respectively (Braaten et. al. 2016, p. 6). Braaten et. al. (2014, p. 9) infers from their study that "...12-26% of the population may possess the motivation to migrate beyond the reach."

Additional information shows seven pallid sturgeon (12 percent of the tagged population) at the Intake Diversion Dam in 2013 and five (unknown percentage) in 2014 (D. Trimpe, Bureau of Reclamation, pers. comm. June 22, 2015). Those in 2014 are the ones that passed above the weir via the high water channel. The additional numbers reported from 2013 and 2014 and 2016 are reasonably consistent with Braaten et. al. previous numbers and percentages D. Trimpe, Bureau of Reclamation, pers. Comm. October 17, 2016).

The tagging effort for wild pallid sturgeon continues each year as a part ongoing monitoring, but because of battery loss, fish mortality and difficulty in capturing individuals in a small population, approximately 45 individuals (wild) carry active telemetry at any given time (D. Trimpe, Bureau of Reclamation, pers. comm. June 23, 2015).

If we assume that on average approximately 36 percent of the wild population (45 of 125) are telemetered this means that approximately 64 percent are not telemetered. That implies that for every 1 telemetered fish known to have reached the Intake Diversion Dam, it can be extrapolated to represent 2 others that have also reached the weir, but are not detectable. Using the current wild population estimate, the past number of detected fish at the weir and without any more specific or conclusive data, this suggests that in any given year, the 12- 26% represents approximately 15-32 fish of the total wild adult population (telemetered and not telemetered). These fish migrate from the lower Yellowstone River up to Intake Diversion Dam and are kept from passing above the structure. In 2014 the only female sturgeon that was observed to pass above Intake through the temporary high flow channel, appears to have spawned. Given that observation, the Service considers an inability to pass to be an injury to those individuals by impairment of their reproduction for that year.

4.2.2 Operation and maintenance of fish screens

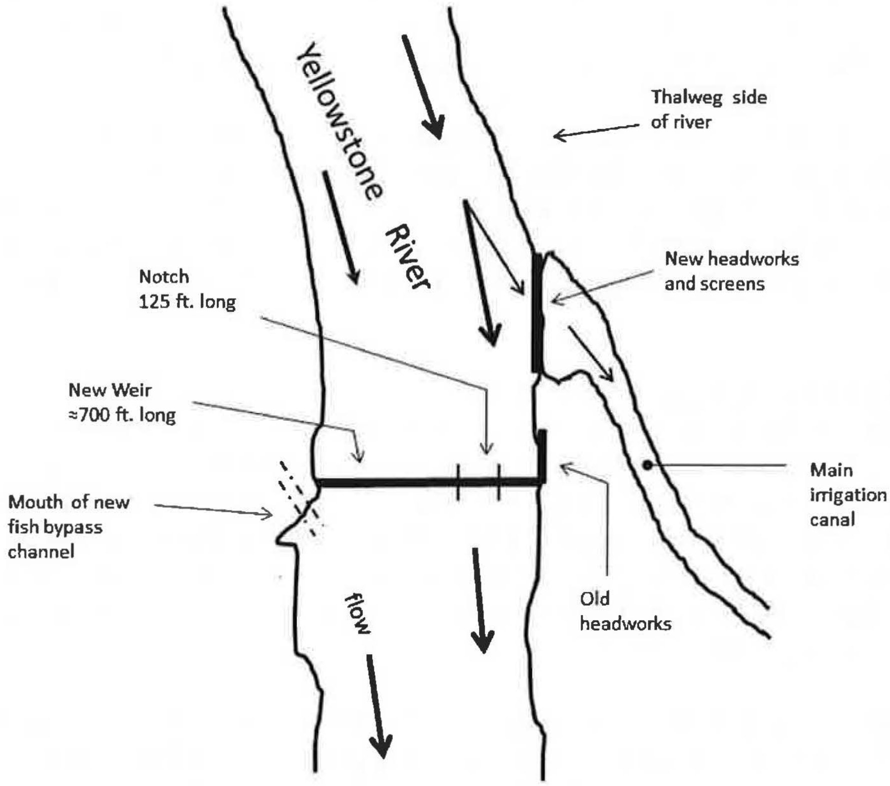
As part of the proposed action the fish screens on the headgates will be in operation reducing entrainment of fish into the irrigation project's canals. The current fish screens are expected to all but eliminate entrainment of fish larger than 40 mm (approximately 1½ inches). Depending on maturity, some sturgeon embryos are smaller than this size and therefore some may be entrained. Information from monitoring from 2012 to 2014 showed that in 2012, approximately 99 percent of the larval fish entrained belonged to the minnow or carp families and were typically quite small (4-8 mm total length) (Assessment, p. 54). One shovelnose sturgeon free embryo/larva was entrained in 2013 (Assessment, p. 55). Given that shovelnose sturgeon are common spawners above the Intake Diversion Dam, this is a very small number.

The adverse effects from the screen presence are likely to occur to only very small fish (less than approximately 1 ½ inches) that can pass through the screen and be entrained into the canal, or small fish that become trapped against the screen by mild suction and then are brushed off the screen by the screen wipers (Assessment, p. 54-55).

Once the fish bypass channel is operational, sturgeon are predicted to pass by the weir and spawn many miles upstream.[7] (For example, in 2014 a spawning female that passed the weir spent several days 20 miles up the Powder River – approximately 98 river miles above the weir.) Though adult fish will be at no risk of effect from the screens, free embryo drifting downstream after hatching may be. If spawning takes place in the Powder River, within about 2-4 days free embryo would arrive at the weir. Because free embryo are weak swimmers and generally are moved by the river current, there will only be a short period of days when free embryo are passing through the portion of the river that contains the weir, headgates and screens. The screens are located slightly upstream of the weir and to the side of the river channel. This position is influenced by the thalweg of the channel. (The thalweg is the deepest part of the channel in cross section and is typically found on outside bends of the river.) Free embryo will be distributed throughout the width of the river, but because of hydraulic flow of the river, are likely to be disproportionally prevalent in the thalweg and screen side of the river (Assessment, p. 73). See Figure 6 below.

[7] The discussion, regarding probable effects from the screens, is focused on future effects, after the bypass is complete and spawning pallid sturgeon are likely to pass the weir and spawn. However, the discussion applies equally to any pallid sturgeon with opportunity to spawn above the weir in the interim before the bypass channel is complete.

Figure 6. Schematic of project area (approximately to scale).



At the time of the free embryo's downstream drift, the portion of water being withdrawn from the river is approximately 3-6 percent of the river's total volume (Assessment, p. 73). This circumstance reduces the likelihood for the water withdrawal to have a disproportionate physical "draw" for the free embryo passing by the screens. Based on modeling, the area where any flow influence exists is approximately 50 feet of the River's 700 foot width (Assessment, p. 73). The screens are 150 feet from the thalweg and thus its zone of influence does not extend to the thalweg area (Assessment, p. 73). In addition, the screens were designed to meet National Marine Fisheries Service salmonid screen standards and have a very low "approach velocity" at the screen interface, further reducing the area within that 50 foot zone which could draw fish and free embryo passing by.[8] Only one shovelnose sturgeon larva has been collected during monitoring in 2012 and 2013 (Assessment p. 73). Given that shovelnose sturgeon are fairly common spawners above the weir, finding only one larva so far supports a finding that the screens are very effective.

[8] Approach velocity is determined by taking the flow of the river, the diversion amount at that flow and designing the screens such that both the angle of the flow toward the screen and the strength of that flow act in concert to reduce the "draw" toward the screen – making an interaction with the screen much less likely. It also lowers the flow's energy at the screen, so that fish interacting with the screen are more likely to move across the face of the screen without becoming impinged.

For all these reasons, the Service expects the number of pallid free embryo exposed to the screens to be relatively low, and the number killed or injured by that exposure to be small compared to the total number of free embryo in the water column. However, if free embryo come into direct contact with the screen, they are likely to be killed or injured by the trauma of passing through the screen or being impinged against it and then wiped off.

Although the likelihood of embryos being impinged or killed is low, the Service cannot predict the exact number of free embryos that will be exposed to the screens. This is due to the size of the free embryo as it develops, the volume of water passing through the screens, and the withdrawal of water for the Main Canal. Likewise, the Service cannot estimate the number of those free embryos exposed to screens that will be injured or killed. We discuss this issue later in section 4.3.

4.2.3 Closure of the high water channel

As part of creating a stable bypass channel, the upstream mouth of the existing high flow channel must be filled during construction, blocking potential access to fish. This is a necessity to prevent the uncontrolled water in the high flow channel from potentially undermining the construction of the new channel. As noted by the Service earlier, this high flow channel passed 5 adult fish in 2014, and 1 juvenile in 2015, but the channel is not a dependable passage (no pallid sturgeon passed in 2016) because it does not occur every year and may not have adequate flows for the entire spawning period.

Currently the high flow channel becomes active at 20,000 to 25,000 cfs flows (Assessment p. 76). In 2014, the Yellowstone River was flowing at approximately 47,000 cfs when the first fish was documented using the existing high flow channel (D. Trimpe, Bureau of Reclamation, pers. Comm. May 22, 2015). If flows of this magnitude are needed to pass pallid sturgeon in the existing high flow channel during May 15 – June 15, then this condition would be expected to occur only 7 days in 5 out of 10 years (Service 2015).

Even though the natural high flow channel does not flow enough water to pass fish every year, in the 2-3 year construction period it is reasonable to assume that in one year the channel would be passable (Assessment, p. 76). The effect of the construction blockage for that year would be that 5-16 fish [9] that would have been able to pass – will not pass. This represents an impairment of their reproduction that year from the closure of the natural high flow channel. These fish represent a subset of the fish discussed earlier in section 4.2.1.

4.2.4 Physical presence of the replacement weir and bypass channel

The physical presence of the replacement weir in the river potentially affects adult sturgeon in two ways -- by impeding upstream migration for spawning and impeding downstream migration following spawning.

[9] In 2014, 41% (5 of 12) fish detected at the weir passed above the weir. In 2015, 14%, (1 of 7) fish detected at the weir passed above. Extrapolating that 32 adult fish from the wild population (Section 3.3.3) would be present at the weir, 14-41 percent potentially using the side channel represents 5-16 adult wild fish.

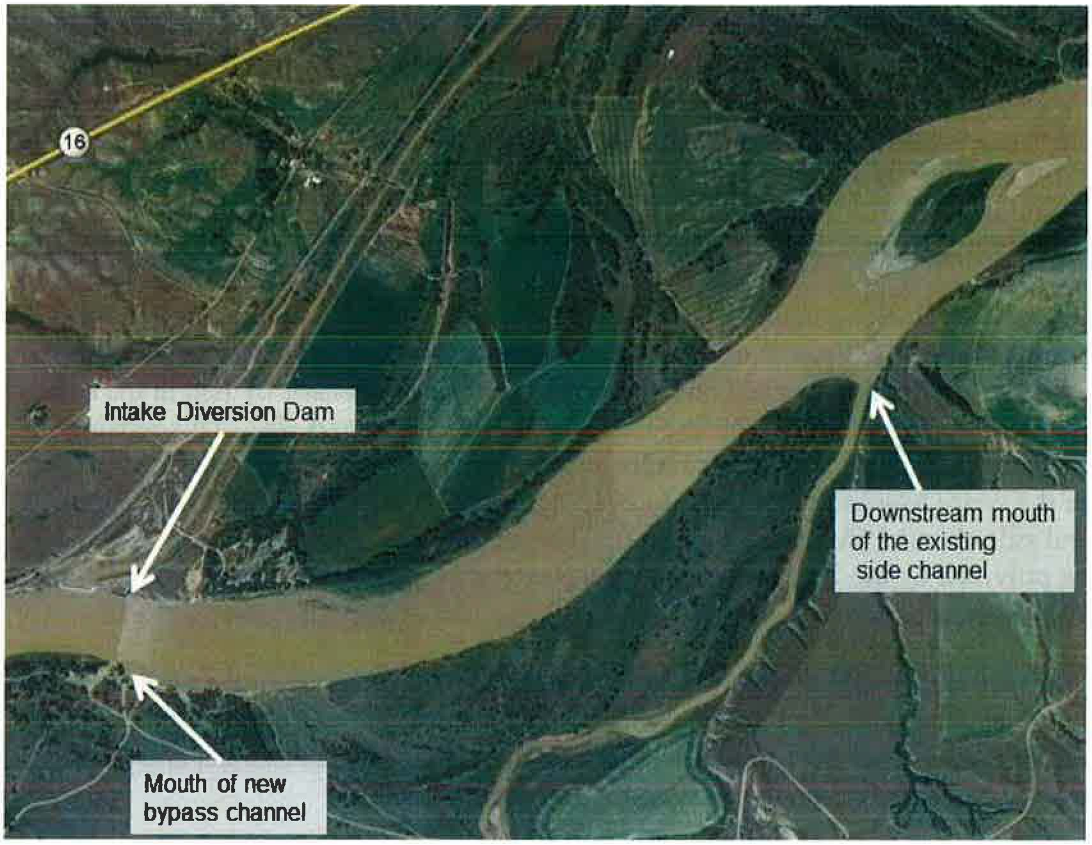
Upstream effects to adults from presence of replacement weir and bypass channel – For moving upstream, the replacement weir will have a constructed bypass channel on the south side of the river. Adult pallid sturgeon are known to use side channels when moving up the Yellowstone River (Braaten et al. 2014). In two instances, adult and juvenile sturgeon have been observed using an existing, (but ephemeral) high water channel to pass around the Intake Diversion Dam (Assessment, p. 78). Though little information exists for channel bottom type, there appears to be a preference for a relatively smoother surface rather than a surface with large rocks extending into the water column (Assessment, p. 98). The bypass channel has been designed for a smoother bottom surface to meet the Service's Biological Review Team's recommendations.

Water flow volume and velocity can affect likelihood of fish use of channels (Assessment, p. 97). This channel was specifically designed with appropriate flow volume and velocity to allow for a fish to move up and around the weir, and also a flow that can be sensed by fish in the area of the weir and serve as an attractant to the bypass channel (Assessment, p. 78). This sensing ability was demonstrated in 2014 when five adults found a natural side channel and moved upstream above the weir (Assessment p. 36). In 2015 a juvenile fish was observed finding and using this natural side channel (Assessment, p. 70). The design of the bypass channel followed physical criteria provided by the Service's Biological Review Team specifically to facilitate sturgeon passage (Assessment, p. 83).

Based on observations with the existing highwater channel, studies of swimming pallid sturgeon in artificial flumes, and careful design of this bypass, it is expected that fish cued to move up the river to spawn, if they encounter the replacement weir, will find the bypass channel and move upstream. The Service's expectation is based on the following points.

The new bypass channel design improves on the existing ephemeral highwater channel in several ways. The new bypass channel entrance will be located about 8,555 feet upstream from the current existing channel mouth (Figure 7).

Figure 7. Position of new bypass channel mouth.



This position puts it much closer to the barrier represented by the replacement weir. This also shortens the passage around the weir from 4.45 miles to 2.17 miles (Assessment, p. 13). To make it even more likely for the sturgeon to find the bypass channel, the engineered channel will carry 13-15 percent of the total river flow as opposed to the approximately 2-6% carried sporadically by the natural channel (Assessment, p. 78). The new bypass channel is also being designed to pass pallid sturgeon when the flows are as low as 15,000 cfs in the Yellowstone River. From May 15 to June 15 the Yellowstone River is expected to flow 15,000 cfs or greater for 25 days in 10 out of 10 years greatly increasing passage success around the weir. Over a 10 year period, this means a comparison of 250 total days of passage conditions vs. 35 days for the natural channel.)

Unlike a novel or new fish passage project around a complete barrier, this one mimics and substantially improves on an ephemeral channel that is already being successfully used (when available) by pallid sturgeon at this site. The new channel's entrance is closer to the barrier, will be shorter, will flow every year, pass more water than the high flow channel, pass it longer, provide greater depths, be more stable, is of known design, and can be more easily modified for performance if monitoring indicates modification is needed. For these reasons it is reasonable to expect that the new bypass channel will pass spawning and juvenile fish every year, and for a longer period than the current ephemeral channel.

The Service expects motivated spawning sturgeon to be fully able to move upriver beyond the weir. Any delay to moving upriver is expected to be temporary and not represent an impairment of breeding or reproduction that leads to actual injury or death. (See section 4.2.5 for monitoring this aspect of the project and adaptive management approach to act on observations.) The ability to pass upstream through the bypass channel is the first necessary step in improving spawning opportunities. With greater spawning opportunities, and substantially longer drift distances, successful reproduction and recruitment of young fish is possible; without passage (status quo), recruitment has not been observed and is unlikely to occur.

With the new bypass channel, the Service expects motivated fish to pass above the Intake Diversion Dam via the passage channel every year. However, the Service recognizes that not all fish that are detected at the weir will pass upstream. We have little information to form an estimate for passage in the future; and passage can be influenced by many biological or environmental factors that may not be related to the presence of a weir.[10] The only example the Service has of spawning adults passing upstream of the weir is from 2014. That year 41% of the fish detected at the Intake Diversion Dam passed upstream using the high flow channel (Rugg 2014). Based on that one event, and the design of the new bypass channel, we believe it is reasonable to expect the percentage of fish that passes using the bypass channel will be much greater than that observed in 2014. We also believe that passage will occur annually, (rather than sporadically with the existing channel), but we do not have additional information that would allow for a more precise prediction. Therefore, using the past passage data, we estimate that up to 59 % of the fish detected at the weir may not pass upstream through the new bypass channel. The only other estimate we are aware of comes from the Service's Biological Review Team. Based on decades of experience with the movement of pallid sturgeon, they have set an expectation that the channel will pass 85% of the spawning adults that move up to the weir (Assessment Appendix A, p. 6). For fish that do not use the bypass channel, the Adaptive Management Plan and monitoring are designed to try and identify causes and implement changes to ensure efficient passage.

<u>Downstream effects to adults</u> – At a river flow 15,000 cfs, the water depth and velocity over the current weir is 2.1 – 2.9 feet and 8 feet per second. The replacement weir at the same flow would have a depth of 3.5 feet and 5 feet per second (Assessment, p. 82). This should make passage downstream for all life stages easier than the current condition. The weir design also includes a gradually sloping approach to the replacement weir (from upstream) making the hydraulics less likely to impede passage (Assessment, p. 82). In addition, fish can use the bypass channel (that the sturgeon would have likely used to pass above the replacement weir) to travel downstream.

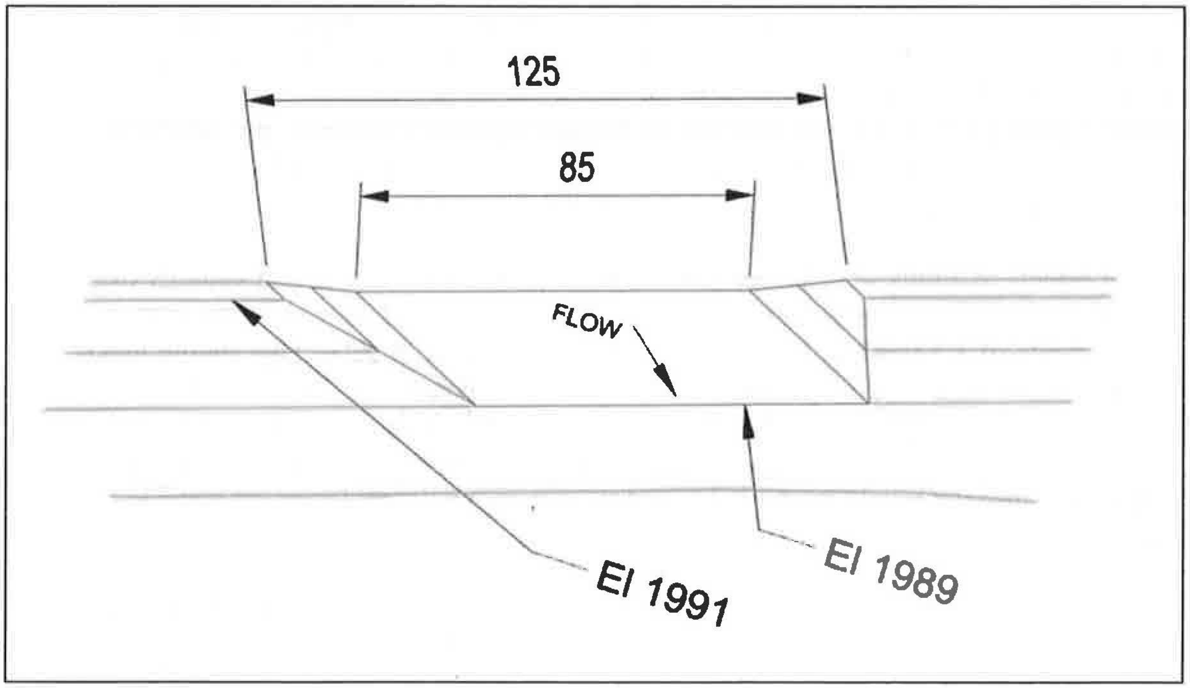
To further facilitate downstream movement, the weir is constructed with a tapered notch in the weir (125 foot at the top and 85 feet at the bottom) which is not centered in the weir but is

[10] In addition to environmental and biological conditions, the ability to differentiate in the future between telemetered spawning adults and telemetered maturing juveniles will be impossible based just on detection. While a juvenile may swim upstream to the weir, it may not be sexually mature and desirous of passing above the weir. This further complicates assessing what percentage of the "motivated" fish are influenced by the weir and don't pass vs. fish that meet the weir and pass upstream. Future research and monitoring efforts and the adaptive management approach will allow for better understanding of this situation.

oriented about 100 feet from the thalweg side of the river (Assessment, p. 14, and Figure 8). The current weir has a wooden structure that is at an elevation of 1989 feet. For appropriate irrigation flow, an additional two feet of rock are added for a total elevation of 1991. The replacement weir top will be built to the same elevation (1991 feet). The bottom of the replacement weir's notch will be the same elevation as the old structure without the additional rock height (1989 feet) (Figure 8). In addition, the rock fill immediately downstream from the notch will also be at 1989 feet providing a slight channel downstream of the replacement weir notch (Assessment p. 75). At the typical time of passage (high water) the water is approximately 7.5 feet over the bottom of the notch (D. Trimpe, Bureau of Reclamation, pers. comm. May 5, 2015 – email including *Lower Yellowstone – Intake Bypass Channel ADH (2-D) Downstream Focus Model, Summary of Initial Results – Notch Comparison*). Given that in 2014 and 2015 sturgeon that moved upstream beyond the weir found their way safely back down over the existing weir and rocks below (Assessment, p. 54), it is expected that future passage downstream over an improved weir and notch will occur and be even easier.

Again, any delay to moving downstream is expected to be temporary (even less than when moving upstream) and will not likely represent an impairment of breeding or reproduction that leads to actual injury or death for adult sturgeon.

Figure 8. Notch dimensions (in feet) and elevations (above sea level).



<u>Downstream effects to</u> <u>free embryo</u> - Recently hatched free embryo will also meet the replacement weir as they drift downstream. The weir is not constructed like a weir where water flow is stalled by an abrupt vertical wall. The weir is more of an instream "hump" that checks the flow in such a way as to create a slightly higher water surface elevation. This "bulge" of

water behind the weir acts as a very small pool to assist in supplying the correct amount of water to the screens and headgates.

Free embryos moving downstream are not capable of swimming well and are largely dependent on the current. Since the weir is designed for smooth water flow over the top of the weir (Assessment, p. 82) it seems unlikely to trap or significantly stall free embryo. At the time of passage (late June and early July), the water is predicted to be greater than 3.5 feet deep over the top elevation of the weir.

Free embryos may also pass through the bypass channel or the notch in the weir (described above). Given this information, the Service expects the free embryo to encounter the weir, and associated water bulge, and pass over the weir without great delay. (Arguably, if they were delayed slightly by the weir without incurring injury, it could be advantageous by acting as additional maturation time before moving down river.) Free embryos passing over this replacement weir, which is designed for smooth flow, will be less likely to be injured than if they had to pass over the current weir/rock structure. Also, since it is likely that the free embryos will be somewhat disproportionately distributed more toward the thalweg side of the river (Assessment, p. 72), they are more likely to drift through the notch. This further reduces the impact of moving downstream.

Upon floating over the weir crest, the free embryo will encounter faster flowing and more turbulent water immediately below the weir (though not a drop typical of a weir). This condition will vary along the weir depending on location and water level. Also, they may encounter scattered rocks (debris from the current weir) in the river current directly downstream of the weir. It is possible that some of the free embryo moving over the weir will be unfortunate enough to encounter the worst of the turbulence, and then also strike rocks. If they strike the rocks hard enough, there is potential to be injured or killed. (In the future, since rocks will not simply be piled to produce the necessary water elevation, the high water and ice will disperse the existing debris field and potential for injury will be further reduced.) The Service knows of no information to inform us as to the likelihood of injury or death of free embryos that encounter rocks. The Assessment notes a preliminary evaluation of white sturgeon larvae injury rates when drifting past rip rap (p. 83). In that study, no differences in injury rate (with a control group) due to rip rap were noted.

Sturgeon have evolved in river systems that often have rock, riffles, tree debris, etc. in them and it seems unlikely that through adaptation these would have caused mortality risks beyond the sturgeon's breeding strategy. Regardless, it is reasonable to assume some very small level of mortality. However, given the distribution of the free embryo in the water column, the height of the water over the weir, and the variability of the turbulence and obstructions, it seems reasonable that it would be only a very small portion of the total free embryo in the water.

Unfortunately, like the earlier discussion on estimates for impacts from the fish screens, the Service does not have information to allow for an accurate approximation of the number of free embryo killed or injured by exposure to the weir. Later in section 4.3 we explore this issue regarding estimating impacts.

4.2.5 Uncertainties related to fish passage

As discussed in the introduction to this section, the effects of the action are a reasoned prediction of how the species will respond to the proposed action informed by scientific literature (if available) and the professional judgment by biologists familiar with the species.

The most obvious uncertainty regarding the proposed replacement weir and engineered fish bypass channel is whether it is likely to pass fish above Intake. Though there are varying views on likelihood of passage (Corps 2013 and Corps 2016), at this time it is impossible to prove whether fish will, or will not, use the new bypass channel. To create the most likely condition for fish passage, the action agencies reviewed information on swimming ability of pallid sturgeon, characteristics of similar species, performance of other fish bypass channels, potential causes for bypass channels failures, the use of side channels for upstream movement, and potential preference for type of river or channel bottom during movements (Assessment, pp. 95-99). The current design for the proposed bypass channel is informed by that review including examples of potential causes for unsuccessful fish passage. The current design follows recommendations from the fish biologists on the Service's Biological Review Team made specifically to make pallid sturgeon passage likely. These factors, suggest it is reasonable to expect the proposed bypass channel will pass fish more often and in greater numbers than the current ephemeral channel did in the only year of the last three that passage occurred.

Additionally, concern has been raised that even if passage occurs it may not lead to recruitment of young into the population (Corps 2013 and Corps 2016). Though recruitment is the key to expanding a population, recruitment cannot occur without spawning. And in the pallid sturgeon's case, spawning is ineffective without hundreds of miles of larval drift distance (Braaten et. al. 2008). Insufficient drift distance, causing the death of free embryos is the fate for spawning pallid sturgeon below Ft. Peck Dam and the Intake Diversion Dam (Braaten et.al. 2015, p. 827). Therefore, the first step in increasing the likelihood of recruitment in the Yellowstone River is passage of spawning adults at the Intake Diversion Dam. After passage and successful spawning, survival of free embryos and recruitment can be assessed, but currently there is no evidence that any recruitment has occurred since 1950 under the status quo (Braaten, 2015).

In the next section, Monitoring and Adaptive Management, is a discussion of the action agency's commitment to monitoring the proposed action and actions that would be taken if predicted behavior of the structure or fish passage does not occur.

4.2.6 Monitoring and adaptive management [11]

Though the weir and bypass channel, are well engineered for fish passage, there are uncertainties regarding their performance and passage consequences. Therefore, Reclamation, in cooperation

[11] We discuss the predicted effects the monitoring and adaptive management plan could have to individual pallid sturgeon. This plan is an important tool to gain information on the physical and biological performance of project; however, it is not relied upon in our eventual conclusion regarding the likelihood of whether this proposed action is likely to jeopardize the pallid sturgeon. That conclusion is based on the described probable effects of the proposed action.

with the Corps, has established a monitoring and adaptive management plan (AMA) to monitor that performance and provide a structure for making decisions to correct any deficiencies that are discovered (Assessment-Appendix A). This adaptive management plan is a commitment to take appropriate action based on explicit monitoring goals. The plan is consistent with the Department of Interior's technical guide to adaptive management, with an emphasis on reducing uncertainty and achieving the proposed action's goals (Appendix A, p. 1). Reclamation have committed to funding and support of the AMA (Reclamation 2016a).

Specific future actions proposed through adaptive management (and their effects) are not adequately foreseeable at this time, therefore any discussion or analysis would be speculative. The adaptive management plan has listed the most probable types of management measures to be implemented should elements fail to meet criteria and expectations (Appendix A, p. 14-19). To the maximum extent possible, those measures will use conservation measures such as project timing, work site exclusion, and sediment control to reduce effects to the pallid sturgeon. However, it is possible that future proposed changes to structures or management will result in effects to the pallid sturgeon. In those instances, the action agency(s) will consider whether reinitiation of consultation is required.

The monitoring is designed to provide information on two important, but different, aspects of the project – physical performance and biological performance. The effects from the monitoring activities and potential adaptive management measures are discussed below.

1) <u>Do the physical features produce the expected hydraulic characteristics in the channel and at the upstream and downstream mouths</u>?
Monitoring to determine if water velocity and depth meet established criteria (Appendix A, p.5) will use standard observation, inspection, and measuring techniques for structures and water flow (Appendix A, p. 8). These are not intrusive and the probability of any effects to sturgeon is discountable. Alternatively, any effects that do occur are expected to be insignificant.

2) <u>Are adult and juvenile sturgeon able to pass upstream past the replacement weir?</u>
The expectation is that motivated fish will pass above the Intake Diversion Dam through the bypass channel every year. The target for passage of motivated adult pallid sturgeon is 85 percent annually (Appendix A, p. 6). Monitoring designed to answer this question will be done by capturing and tagging adult sturgeon, and monitoring their movements with radio telemetry tags (Appendix A, p. 9). There are no specific expectation or target for juvenile passage, but juveniles will be tagged and tracked similar to adults (Appendix A, p.10). The tagging of sturgeon will require capture and handling of fish. This is an adverse effect, and though rare, capture, handling, tagging and release of large adult fish can result in the death of captured fish. The current program of capture, transport, tagging and release is performed according to strict handling protocol (Service 2012) and the Service knows of no mortalities from this program to date. However the Service cannot dismiss the possibility that injury or death is possible. No information is available to predict with certainty how many fish will be injured or die. To enable the Service to assess the impact from the effects of handling during monitoring, the Service is using an estimate of t 2 adults and 5 juveniles. (We estimate more juveniles due their smaller size and larger number likely to be handled.) Given the past performance of the monitoring program, we believe this is probably an over estimate of injury or death, but the

estimate does have value for a sense of the likely magnitude of effects and establishes a threshold for reassessment should it be met.

Currently a monitoring and tagging program is performed by the Service, U.S. Geological Survey (USGS) and Montana Fish, Wildlife and Parks (MTFWP). Impacts and take (under section 9 of the ESA) of individual pallid sturgeons is authorized through a take permit under 10(a)(1)(A) of the ESA, and an agreement (pursuant to section 6 of the ESA) with the state of Montana. The rate of death incidental to capture outlined above is in addition to any expected loss already considered in the issuance of the existing 10(a)(1)(A) permit or section 6 agreement.

3) Are adult sturgeon able to pass downstream past the replacement weir?
The expectation and target for adult sturgeon passage downstream past the replacement weir is passage of motivated adults with a mortality from passage of less than or equal to 1 percent during the first ten years (Appendix A, p. 6).[12] The fish monitored will be the same fish already tagged under number 2 above. No effects from radio telemetry for downstream passage are expected.

4) Do sturgeon free embryos and larvae pass downriver past the weir? As described earlier, the replacement weir is designed specifically to allow for smooth water flow over the top which will facilitate movement of free embryos (and other life stages) of sturgeon over the weir rather than potentially impairing their movement or stalling them behind the weir. Also, the notch in the weir and the bypass channel provide additional avenues for free embryos to pass the weir. When telemetry monitoring indicates that spawning sturgeon have moved past the weir, Reclamation will arrange monitoring at fish screens and below the weir to detect presence of free embryos (Appendix A, p. 11). In addition to monitoring for sturgeon, other fish with similar life histories may be caught. If so, this would indicate that the weir is likely not impairing movement of fish (including sturgeon). In the process of netting and capturing free embryos, some may be injured or killed. This monitoring effort will be performed in cooperation with the Service, USGS and MTFWP and effects are analyzed and anticipated through existing Service section 10(a)(1)(A) permits and a section 6 agreement with the state of Montana.

In addition to weir monitoring, the monitoring and adaptive management plan also includes the possibility of using live pallid or shovelnose free embryos to test movement downstream (Assessment, p. 11). The live pallid free embryos will be supplied from excess hatchery stock and the effects is anticipated and in the existing permits and agreements mentioned above.

5) What is the impact of the fish screens to sturgeon free embryos? Data from monitoring of fish and free embryos will inform Reclamation and the Service on the hydraulic performance of the screens and their screening effectiveness. This information could inform potential implementation of screening criteria on other diversions in the Yellowstone and Missouri Rivers. As described earlier, the fish screens are designed to exclude fish greater than about 1 ½ inches from passing through the screen to the network of irrigation channels and ditches. Past monitoring by Reclamation in 2012 and 2013 has shown effectiveness at screening large fish out of the canal behind the screens and only one sturgeon larvae (shovelnose) has been detected

[12] Adult or juvenile mortality from passage over the weir has not been documented and is not expected. Therefore the Service's Biological Review Team suggested a 1% as a protective limit.

(Assessment, p. 73). Adverse effects from the screens are anticipated (see section 4.2.2 and 4.3). The free embryos or larvae observed and collected from the screens or canal behind the screens have already been considered in the effects from the screens. No additional effects from monitoring at the screens is anticipated.

4.3 Estimating number of free embryos injured or killed in the future by screens and weir

4.3.1 Uncertainty and lack of information

We find that it is likely that some sturgeon free embryos will be entrained through the screens and injured or killed passing over the replacement weir. As a part of the effects analysis, typically the Service is able to enumerate the number of a particular life stage of the affected species that will be affected. This number can be useful in making a conclusion regarding the likelihood of the effects resulting in jeopardy to the species. In this case, the effects are in the future after the weir and fish bypass are constructed and the Service has no information that would allow for making a reasonable estimate. However, we do know that the reproductive strategy of sturgeon generally accepts very high mortality of eggs and early life forms without detriment at a population level. Also, in 2009, Reclamation convened a scientific panel to review the available science surrounding the Lower Yellowstone Intake Project. In their final report (Reclamation 2009, p.25) they concluded that "*the net benefit of passage and spawning upstream from Intake Dam is likely to be significant even if a portion of the reproduction is the subject to entrainment losses as long as associated diversion fractions are not excessive.*"

Even without specific information, the Service believes that by using a surrogate species we may be able to assess the magnitude of impact to determine any changes to the population. The Service's Endangered Species Handbook (Service 1998) outlines the Service's policy for use of surrogates when describing effects and incidental take.

"*In some situations, the species itself or the effect on the species may be difficult to detect. However, some detectable measure of effect should be provided. For instance, the relative occurrence of the species in the local community may be sufficiently predictable that impacts on the community (usually surrogate species in the community) serve as a measure of take, e.g., impacts to listed mussels may be measured by an index or other censusing technique that is based on surveys of non-listed mussels. ... Similarly, if a sufficient causal link is demonstrated (i.e. the number of burrows affected or a quantitative loss of cover, food, water quality, or symbionts), then this can establish a measure of the impact on the species or its habitat and provide the yardstick for reinitiation.*" Service 1998, p 4-47

In addition, the Service recently promulgated regulations (Service 2015a) confirming the use of surrogate species for describing the amount or extent of take.

50 C.F.R. §402.14 (i)(1)(i) – "*Specifies the impact, i.e., the amount or extent, of such incidental taking on the species (A surrogate (e.g., similarly affected species or habitat or ecological conditions) may be used to express the amount or extent of anticipated take provided that the biological opinion or incidental take statement: Describes the causal link between the surrogate*

and take of the listed species, explains why it is not practical to express the amount or extent of anticipated take or to monitor take-related impacts in terms of individuals of the listed species, and sets a clear standard for determining when the level of anticipated take has been exceeded.)"

4.3.2 Surrogacy

We use the shovelnose sturgeon as a surrogate for describing (and in the future measuring) the scale of impact to pallid sturgeon free embryos, which informs our view on what the impact means to the population. Below, we outline the assumptions and rationale for use of this surrogate. There are inherent risks with making simple assumptions, but without more specific information, or a more practical manner of approximating the scale of impacts, we feel it is the most reasonable biological approach at this time. We discuss below why the shovelnose sturgeon is the best biological surrogate available. During the 2-3 years between now and when the weir and bypass channel are in place and the impacts to pallid sturgeon actually occur, the Service will work with Reclamation to explore whether a more accurate or precise method for approximating impacts exists.

The shovelnose sturgeon is considered abundant in the Yellowstone River and there is no information that suggests the population is not stable and self-sustaining.

In the context of a 7(a)(2) analysis and monitoring of effects, we believe shovelnose sturgeon will work as an effective surrogate for pallid sturgeon based on the following assumptions:

Assumption 1 – the life history, reproduction strategy and free embryo drift characteristics of shovel nose sturgeon are more similar to those of the pallid sturgeon than any other species in the action area.

Assumption 2 – the shovelnose sturgeon population in the area above the current weir is relatively stable and self-sustaining.

Assumption 3 - this assumed stability of the shovelnose sturgeon population occurs in an environment that included an open diversion at Intake Diversion Dam (before 2012 screen installation) and the presence of the current weir and rubble field, which presents greater hazard than will exist after the replacement weir and passage channel are constructed. Therefore, shovelnose will present a steady surrogate in a changing environment.

Based on these assumptions we predict that the scale or magnitude of impacts likely to be experienced by the future pallid free embryos is similar (proportionally to the population densities) to what has been experienced by shovelnose sturgeon and that like the shovelnose sturgeon, these impacts will not result in a negative population response.

In order to confirm the reasonableness and validity of these assumptions, Reclamation has committed to monitoring impacts from the screens and the replacement weir to pallid sturgeon embryos and larvae. Their monitoring and adaptive management plan has monitoring actions for both areas. In the incidental take statement we characterize the goal and approach of that monitoring. This information could also help in developing information regarding screening criteria for other diversions in the Yellowstone and Missouri Rivers.

4.4 Effects of Interrelated or Interdependent Actions

The implementing regulations for section 7 consultations define interrelated actions as *"...those [actions] that are a part of a larger action and depend on the larger action for their justification."* 50 CFR § 402.02. Interdependent actions "*...are those [actions] that have no independent utility apart from the action under consideration."* 50 CFR § 402.02. Interrelated or interdependent actions (such as the maintenance of canals and ditches, withdrawal of water, operation of the fish screens, maintenance of the current weir, etc.) have already been incorporated into the proposed action and are analyzed in the effects of the action section (or incorporated by reference from the Assessment (Table 4, 12 and p. 99-100).[13]

4.5 Summary of Effects from the Action

Most elements or tasks described in table 4 of the Assessment present a discountable likelihood of an effect occurring or, alternatively, an effect that is likely to be insignificant (Assessment, p. 90-94 and 99). As discussed above, until the replacement weir is complete with the notch and bypass channel (2-3 years), the Service estimates that up to 32 wild adult sturgeon (approximately 26% of the current wild adult population, - section 4.2.1) moving to the weir, each year, will be blocked from moving above the weir to spawn. This is a temporary, but significant impairment of breeding and is considered an "injury" to the sturgeon. Because the impairment represents the status quo, it does not actually change the current reproduction, numbers or distribution of pallid sturgeon in the action area.

After the replacement weir and bypass channel are complete, spawning adult pallid sturgeon will have the opportunity for passage every year, for the entire spawning period around the Intake Diversion Dam. Some percentage of the spawning adults at the weir will not pass above using

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Pursuant to the regulations for consultation, the effects of the action include effects of any additional interrelated or interdependent actions. Interrelated actions are "*... those actions that are part of the larger action and depend on the larger action for their justification"*. The word "larger" in the definition of interrelated can cause confusion (Handbook 4-26-28). It does not relate to size, but actually refers to the proposed action being consulted on. In this case the "larger" action is the proposal for LYP and fish passage. The Missouri River Management Plan does not depend on the Intake Diversion Dam project for its justification; therefore it is not an interrelated action for this consultation.

Interdependent actions are actions that "*...have no independent utility apart from the action under consideration.*" The Missouri River Management Plan clearly has utility apart from the LYP and fish passage; therefore it is not an interdependent action to the Intake Diversion Dam project being consulted on in the BO.

Though not meeting the definition of an interrelated or interdependent action, currently the Corps of the Kansas City and Omaha Districts, are preparing the Missouri River Recovery Management Plan to develop a range of alternatives for management of the Missouri River. This federal action is organized around an adaptive management approach that is intended to be consistent with the purposes of the Act and enhance recovery of the pallid sturgeon. That management plan may impact environmental conditions in the action area considered in this consultation. If that occurs, the Corps, Reclamation, and Service will evaluate whether reinitiation of this consultation is warranted.

the bypass channel. Others are likely to be temporarily delayed at the weir as they seek and find the bypass channel to move above and below the weir. Although there may be adverse effects to sturgeon from temporary delays at the weir, or not passing, there will be a considerable net gain for sturgeon that do pass because of access to 162 miles of river upstream of the Intake Diversion Dam via the new bypass channel.

Increased drift distance will allow pallid sturgeon free embryo/larvae more time to mature and become mobile (and able to seek suitable habitat) before encountering the less suitable (potentially lethal) conditions in Lake Sakakawea (Assessment p. 55). Current observations show that 60-90 percent of the wild telemetered fish enter the lower Yellowstone River. Twelve to twenty six percent of telemetered adult fish migrate to the Intake Diversion Dam. If that pattern is repeated by the thousands of fish that are maturing, then hundreds of maturing fish will be migrating to Intake Diversion Dam in the next decade. Overall, this represents an appreciable potential improvement in the sturgeon's reproduction, overall numbers (through potential recruitment) and distribution in, and near, the action area.

For free embryos, the Service described the potential injury or death of a portion of the individuals exposed to the headgate screens, and also a portion of the individuals that move over the weir. We also described (using both simple explanation and a surrogate species) our rationale for why we believe the number of that life stage injured or killed is likely to be small compared to the number in the river and why the breeding strategy of the sturgeon allows for survival even in the face of early life stage mortality. Given that discussion, the Service believes that the loss of free embryo described earlier is not likely to have a discernable negative effect on recruitment of fish into the population and thus will not negatively change the reproduction, numbers or distribution of the sturgeon population in the action area.

Overall, the proposed action is consistent with the recovery plan's goal of improving passage. Passing these spawning adults upstream of the Intake Diversion Dam greatly improves the likelihood of survival of drifting free embryos. That survival is the key to recruitment of young fish in to the population and would substantially improve the likelihood of not just survival, but recovery in the upper Missouri River area.

5.0 CUMULATIVE EFFECTS

The implementing regulations for section 7 define cumulative effects as "*...those effects of future State, or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation.*" 50 CFR § 402.02 We have identified no activities fitting the cumulative effects definition for pallid sturgeon. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation.

6.0 JEOPARDY DISCUSSION AND CONCLUSION

6.1 Introduction

In section 7 of the Endangered Species Act, Congress required that every federal agency must insure that any action "*...authorized, funded, or carried out...is not likely to jeopardize the continued existence of any endangered or threatened species...*".

The definition of "Jeopardize the continued existence of" is "*...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.*" 50 CFR § 402.02.

As described in detail earlier, to address the threshold question of whether a proposed agency action is likely to jeopardize the continued existence of a listed species, the Service evaluates the status of the species, the environmental baseline of the action area, the effects of the action and any cumulative effects. The synthesis of all this information forms the Service's opinion as to whether the proposed action's negative effects resonate at the scale of the listed entity in such a way as to be likely to meet the elements in the definition of Jeopardy (... *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.*" 50 CFR § 402.02).

The Service's BO is advisory and is not a review of the prudency of the proposed action or judgment regarding its value or effectiveness relative to other potential projects, or of the action agency taking no action.

6.2 Discussion

6.2.1 Negative effects

The baseline reproduction condition of pallid sturgeon in the action area is poor, but contains potential. While the habitat is generally supportive of feeding and sheltering, the current weir blocks spawning in the tributary rivers above the weir. The total population of pallid sturgeon near the action area is estimated to be approximately 43,000. Estimates are that 15,455 of these fish are aged 6-8 years and 1,981 are greater than 9 years of age. However, the number of wild fish in the action area, that are known to be mature enough to spawn, is small (approximately 125) and aging. Where spawning occurs below the weir, there is not enough drift distance for the free embryos and larvae to become mature enough to seek out suitable habitat before entering Lake Sakakawea. Because the lake is very poor habitat for larval survival, if embryos do not mature enough to be able to swim on their own and find suitable habitat before reaching the lake, few if any, will survive. Though recruitment is subject to many environmental factors, lack of sufficient larval drift distance is thought to be the main reason that young fish are not being recruited into the population and the most likely impediment to survival and recovery of pallid sturgeon in this area.

Most impacts (e.g. noise, turbidity, disturbance, pumps and temporary increased velocities due to coffer dams, etc.) from components and elements of this proposed action (described in Assessment, Table 4) present a discountable likelihood of an effect occurring (low probability of sturgeon being exposed to the impact), or an effect that is likely to be insignificant (type of physiological response results in an effect that cannot be meaningfully measured, detected or evaluated). The Service estimates that two adults and five juveniles may be injured or killed through capture and handling. The remaining effects described in detail in the effects section of this biological opinion do not actually kill adult pallid sturgeon. However, for the next 2-3 years, the existing weir will be maintained in the river until the replacement weir, notch, and bypass channel are constructed. The weir currently and for the next 2-3 years will impair up to 26 percent of the adult, wild pallid sturgeon from passage and spawning above the weir, annually, during the 2-3 year construction schedule. This can be considered an "injury" to the potential breeding success of the sturgeon. However, it is not actually a change to the sturgeon's condition because the baseline condition is for no passage around the current weir. This is a 2-3 year continuation of a degraded reproduction condition that applies to pallid sturgeon in the action area. In addition, the high water channel with intermittent suitable flow conditions to move fish upstream beyond the weir will also be closed off. Assuming that the natural high water would flow enough water for passage in one of those years, a subset of 5-16 spawning wild adults (Section 4.2.3) will be impaired through blocked access to the natural channel during construction.

The effects from impacts of this proposed action are likely to result in injury and death of a small portion of sturgeon free embryo. This is likely to occur as a result of injury at the fish screens and from passing through the rubble field below the weir. As described in the effects summary, those effects are not likely to cause an appreciable reduction in the reproduction, numbers, or distribution of the sturgeon in or near the action area. We base that conclusion on our prediction that the loss will represent a small portion of the total number of that life stage present, and sturgeon have a reproductive strategy that tolerates extremely high mortality of early life stages. We are also using successful surrogate species and monitoring to help confirm that conclusion.

6.2.2 Beneficial effects

The potential beneficial effect of the action on the long-term survival and recovery of the sturgeon is very high. Recruitment is the key to conservation of the pallid sturgeon in the action area, but recruitment cannot occur without pallid sturgeon spawning in an area that allows for a long enough period of drift for free embryo's to survive and find suitable rearing habitat. Currently below the Intake Diversion Dam, there is not enough distance for that to occur. The action creates the opportunity (and likelihood) of pallid sturgeon spawning above the replacement weir every year. The observations that in 2014 telemetered fish swam to the Intake Diversion Dam area and used the ephemeral natural channel, swam 4½ miles up the channel, then 98 miles further upstream to spawn, demonstrates the strong motivation for wild fish to pass above Intake Diversion Dam if circumstance allows. Because of design, length, position (along with flow depth and velocity, and longer period of availability) the new bypass channel is expected to pass motivated fish every year, for the entire spawning period, and at a greater percentage than the existing high water channel.

Currently, the known spawning sites in the Yellowstone River (RM 6-20) result in only 21-72 miles of larval drift distance before the anoxic habitat of Lake Sakakawea (depending on low or high pool). By creating opportunity for fish passage every year at the Intake Diversion Dam to spawning habitat above the weir, the larval drift distance (before Lake Sakakawea) is increased by as much as 235 miles (calculated from the Cartersville Dam to the current spawning sites in the Yellowstone River) to a total of 269 miles (from Cartersville to Lake Sakakawea. This distance makes it much more likely that a portion of larva fish will survive to one year of age (an age class that is currently missing and is thought to be a main cause for lack of recruitment). The potential impact of this new habitat to the sturgeon population is significant. The significance is highlighted by the 2009 Science Review Report. "*...Without the resumption of natural spawning there is no real possibility that the naturally produced (i.e., non-stocked) pallid sturgeon population in RPMA2 will recover from its endangered status...*". (Reclamation 2009, p.15)

A circumstance that acts as a potential multiplier for improvement is the presence of a large cohort of fish from the augmentation program. Estimates are that 15,455 of these fish are aged 6-8 years and 1,981 are greater than 9 years of age. This means that over the next 15 years, almost 18,000 pallid sturgeon in this group will reach maturity and become capable of reproducing (Figure 4). A few of these older (20 years of age) hatchery fish have already demonstrated the same patterns of wild fish and been tracked to the Intake Diversion Dam in 2016). If that trend follows patterns of wild fish, approximately 2,800 to 4,200 of them will migrate to the Intake Diversion Dam. The bypass channel, replacement weir and fish screens will allow this biological potential to be expressed in a pattern of migration and spawning which is the first necessary step to recruitment and recovery in the upper Missouri River.

6.2.3 Synthesis of effects

In the short term (2-3 years during construction) passage above the weir will not occur. Given the long lived nature of the sturgeon, their reproduction strategy, and the thousands of augmentation fish now reaching potential spawning age, the Service does not believe that the short term impacts of maintaining the weir will appreciably reduce the sturgeon's likelihood of survival and recovery.

In addition, the replacement weir, notch, and fish bypass channel will provide annual opportunities for passage and spawning for decades to come, unlike the sporadic and brief availability of the high flow channel. The largest direct negative impact of the future condition is anticipated to occur to a portion of free embryos as they move past the screens and over the weir. However, as we described earlier, these losses are expected to be small, and the reproduction strategy of the sturgeon is a strategy that tolerates heavy mortality in the early life stages.

Therefore, taken as a whole, the proposed action of creating fish passage and the opportunity for successful spawning and recruitment, represents a great potential for increasing reproduction, numbers and distribution of the wild pallid sturgeon in the action area. This action implements an identified priority 1 action from the pallid sturgeon recovery plan "Restoring habitat connectivity where barriers to fish movement occur." (Service 2014, p. 77). Priority 1 actions are considered "... actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future." (Service 2014, p. 75).

6.2.4 Conclusion

The status of the pallid sturgeon is stable, but largely due to the support from the augmentation program. The Missouri River has been altered and those alterations have negatively affected the river below Fort Peck Dam through changes to temperature, hydrology and flow effectively reducing drift distances before reaching anoxic waters at Lake Sakakawea. Many management actions to correct or mitigate those effects have been examined by the action agencies, but none have proven to be feasible. No additional or new methods for reducing those impacts have been proposed. Therefore, in the Upper Missouri River, no change to the status of the pallid sturgeon is expected in the next several years.

Likely as a result of the negative changes to the Missouri River, and a largely unregulated hydrology in the Yellowstone River, 60 to 90 percent of the current wild adults migrate into the Yellowstone River during spawning season. Recently, some spawning has been confirmed miles below the Intake Diversion Dam and that spawning has produced free embryos, but none have recruited into the population. The most likely reason is that the drift distance from those spawning areas to Lake Sakakawea is too short. Up to 26 percent of the wild adults have been observed swimming further up the Yellowstone River, up to the Intake Diversion Dam. Beyond the weir are hundreds of miles of historical habitat including areas of known spawning habitat. In years with high enough flow a temporary side channel can provide limited access around the weir, but the channel does not flow enough water for passage every year and does not flow for the whole spawning period. Therefore, Intake Diversion Dam is effectively a complete barrier to further upstream movement.

Thousands of hatchery fish, produced from wild stock are present in the action area and will be reaching sexual maturity in the next few years and on into the next decade. In fact, this number of fish may represent a population larger than ever historically occurred in the Missouri and Yellowstone River near Intake Diversion Dam. As this large cohort of pallid sturgeon mature, they will naturally seek out spawning opportunities. Hatchery fish of spawning age have already been detected at the Intake Diversion Dam.

The proposed project is to provide a passage channel around Intake Diversion Dam to allow motivated fish to gain access to hundreds of miles of habitat above the weir. Because of design, length, position, flow depth and flow velocity, and longer period of availability the new bypass channel is expected to consistently pass an even greater percentage of fish than the temporary natural side channel is able to. This project is consistent with the goals of the recovery plan for the Yellowstone River and passage would eliminate the most evident barrier to potential successful spawning in the Yellowstone River.

Once spawning fish have access to spawning habitat above the Intake Diversion Dam, free embryos produced will have approximately 235 more miles of drift distance (than drift distance from current spawning sites below the weir) to mature before reaching potentially deadly conditions in Lake Sakakawea. This represents a substantial improvement for larval drift (and recruitment) than the current condition.

The Service finds that the total effect from the proposed action (water diversion, operation and maintenance of the current weir for 2-3 years, construction of an improved weir and a new fish passage channel and post-construction monitoring) to adult or early life stages of sturgeon is not likely to cause reduction in the reproduction, numbers, or distribution of the sturgeon in or near the action area. In fact, the project is likely to substantially improve the likelihood of survival and recovery of the species in the action area over the status quo, improving the likelihood of survival and recovery of the listed species. It follows then, that the proposed action will not appreciably reduce the likelihood of survival and recovery of the pallid sturgeon, at the listed entity scale.

Therefore, the Service finds that the proposed action is not likely to jeopardize the pallid sturgeon.

7.0 REINITIATION OF CONSULTATION

This concludes formal consultation on Reclamation's and the Corps' proposed action for the Lower Yellowstone Project: Intake Diversion Dam Fish Passage Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) If a new species is listed or critical habitat designated that may be affected by the identified action.

If, during implementation of the proposed action, changes in circumstances, situation, or information regarding this proposed action occur, Reclamation and the Corps will assess the changes and any potential impacts to listed species, review the re-initiation triggers above, coordinate with the Service's Prairie Mountain Regional Office (if needed) and make a determination as to whether re-initiation is necessary.

CONSERVATION RECOMMENDATIONS

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 information.

- The Service recommends that Reclamation and the Corps partner with the Montana Fish, Wildlife and Parks, Upper Basin Pallid Working Group, and the Service to identify and investigate other opportunities to improve fish passage or reduce entrainment at other Reclamation facilities.

- The Service recommends exploring particle-modeling efforts (such as recent USGS effort for the Fairview reach of the Yellowstone River), to examine transport and fate of pallid sturgeon free embryos in the Yellowstone River above the Intake Diversion Dam. Results might contribute information on impacts and success of fish passage at Intake.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, and federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service as an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering.

In those cases where the Service concludes that an action and the resultant incidental take of listed species will not violate section 7(a)(2) of the Act, the Service provides an "incidental take statement" with the biological opinion. The incidental take statement exempts the take anticipated as a result of the action. Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by Reclamation and the Corps so that they become binding conditions for any operation and maintenance activities implemented by the Lower Yellowstone Irrigation Project Board of Control, or other permittees for the exemption in section 7(o)(2) to apply. Reclamation and the Corps have a continuing duty to regulate the activities covered by this incidental take statement. If Reclamation or the Corps 1) fails to assume and implement the terms and conditions, or 2) fails to require the Lower Yellowstone Irrigation Project Board of Control or other permittees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Reclamation and the Corps must report the progress of the action and its impacts on the species as specified in the incidental take statement. 50 CFR § 402.14(i) (3).

Incidental Take Anticipated

Prior to completion of weir and bypass channel

Impairment of reproduction - All adult spawning sturgeon blocked from passing and spawning are taken in the form of harm (injury) by having their reproduction potential temporarily impaired. We estimate this harm to occur to up to 32 adult wild pallid sturgeon (or approximately 26% of the current estimated population of adult wild fish - See section 4.2.1). This harm is not expected to cause the death any individual sturgeon. It will occur annually for the next 2-3 years. A subset of 5-16 spawning adults (Section 4.2.3) will be impaired through blocked access to the natural channel during construction of the fish passage channel.

Monitoring - All juvenile and adult sturgeon captured, and tagged as part of the proposed monitoring for the proposed action are taken in the form of capture and harm. The capture occurs through the use of nets or other capture devices. The harm occurs through temporary injury of handling and invasive marking procedures. Though rare, the Service anticipates that up to two adults and five juveniles (Section 2.4.6) may be injured or die as a result of handling and tagging. This take is separate from any purposeful or incidental take anticipated and permitted by existing 10(a)(1)(a) permits or the section 6 agreement with the state of Montana.

Following completion of weir and bypass channel

Note: The incidental take described below for free embryos will only occur in the future after the weir and bypass channel are complete and then only after successful passage of spawning adults and successful spawning above the weir.

Passage – Incidental take is anticipated in the form of harm. Harm (non-lethal) will result from motivated spawning adults that swim to the Intake Diversion Dam and do not pass through the bypass channel. Not passing above the weir will impair the breeding for those adults for that year.

Entrainment -Incidental take of sturgeon free embryo is anticipated. It will be in the form of harm from injury and death by free embryo passage through the screens.

Downstream drift - Incidental take of free embryos will occur during downstream drift past the screens and weir. This take will be in the form of harm from injury or death from passing over the weir and impacting rocks below and by impingement of sturgeon free embryos from the river side of the screens.

Monitoring - Incidental take of sturgeon free embryos is anticipated by capture and harm during monitoring for level of incidental near the front of screens and at the weir. Harm will result from temporary injury during capture and some mortality from capture and handling. Incidental take of adults and juveniles may occur during capture and marking (see previous subsection).

Amount or Extent of Incidental Take

Adult

Based on past monitoring results, the Service estimates that annually for the next 2-3 years, up to 32 sturgeon (or 26% of the adult wild population) will be taken, in the form of harm by injury through impairment of reproduction (non-lethal). In the effects section (4.2.1) we explained that this number was extrapolated from information for the percentage of the population that has been detected through telemetry at the Intake Diversion Dam and its numerical relationship to the current estimated total wild adult population.

For take monitoring during the construction phase, because the population may change, the 32 sturgeon will be represented by a percentage of the telemetered population. Based on past observation we assume that up to 26 percent of the telemetered population (assumed to also represent 26 percent of the total current wild adult population) could be detected at intake in any given year. A detected portion of the telemetered population at the weir greater than 26 percent would mean that a larger portion of the population is present and are impeded from passing above the weir. This would represent greater take (non-lethal) of pallid sturgeon than anticipated.

During the post-construction phase, take of adult spawning pallid sturgeon from failure to use the bypass channel and pass upstream to spawn is likely to occur. The Service estimates that of the total number of telemetered fish detected at the Intake Diversion Dam, annually up to 59% of those may not pass upstream and may be taken through impairment of breeding. In the effects section we explain that this estimate of fish not passing is likely an overestimate because the bypass channel characteristics will be better than the natural channel for passing fish. We also recognize that fish not passing is likely due to many different factors, not just the presence of the new weir, however the Service does not have a way to ascribe amounts to all of the possible factors and thus cannot reduce the total estimate. The Service also notes the difficulty in accurately monitoring this percentage due to the number of telemetered maturing juveniles that may be detected at the Intake Diversion Dam, but not have a desire to pass above the weir.

Take of adult pallid sturgeon from monitoring the effects of the Intake project is expected to be rare. The Service has estimated a maximum of up to two adults taken in the form of harm from death during capture, handling and tagging.

Juveniles

Take of juvenile pallid sturgeon from monitoring the effects of the Intake project is expected to be rare. The Service has estimated a maximum of up to five juveniles taken in the form of harm from death during capture, handling and tagging.

Free embryos

Free embryos of the pallid sturgeon are the only age class that the Service has predicted will be killed or injured during the proposed action. Calculating the exact number of free embryos taken by an action in the future is extremely difficult and even speculative. This is because the free embryos are less than an inch long, the amount of water moving past the project site is millions of cubic feet, and the pallid sturgeon free embryos will be mixed with millions of shovelnose free embryos. Pallid free embryos cannot be differentiated from shovelnose sturgeon in the field. Likewise in the field, it would be nearly impossible to count all the free embryos injured, killed, or alive after passage over the weir. For example, it would take 700 feet of fine mesh nets arranged below the weir, held in place against the current, and then monitored for at least a week to count the number of free embryos that pass over the weir. Such comprehensive netting attempts are logistically impractical and potentially dangerous to monitoring crews operating in boats below the weir. For this reason we will use a sampling methodology.

In the effects section the Service explained that rather than speculate about specific pallid numbers, we would instead use the shovelnose sturgeon as a surrogate to approximate a magnitude or scale of loss. We chose the shovelnose sturgeon because it is the most biologically similar fish to the pallid sturgeon in the action area and because its population appears stable even without the benefit of a replacement weir, weir notch, or bypass channel.

We believe that impacts to shovelnose sturgeon from the screens, weir, and bypass channel are likely to represent the same type of effects experienced by the pallid sturgeon. Though the sampled shovelnose sturgeons will be more numerous, we believe that impacts to shovelnose and pallid will be proportionally similar. This is why the shovelnose sturgeon can act as a reasonable surrogate for pallid sturgeon.

Capture and monitoring of shovelnose and pallid sturgeon free embryos (and opportunistically other life stages) will establish a rate of occurrence, injury and death from the screens and new weir structure. After project completion, when pallid sturgeon are confirmed to pass above the replacement weir and spawn, capture and monitoring data on rate of occurrence, injury and death of pallid sturgeon will be compared to data on shovelnose. Based on our assumptions described earlier regarding surrogacy, we expect the rate to be similar and consistent with our predicted level of effects. Stated another way, we expect the occurrence of pallid sturgeon free embryos (dead, injured or alive) at the monitoring sites to be proportionally the same as the shovelnose sturgeon.

For example if a monitoring site's samples produced 130 shovelnose free embryos and they were distributed as 100 live, 10 dead and 20 injured, then we would expect the total number of pallid free embryos at that site to be distributed very similarly (i.e. a total of 20 pallid free embryos, would be expected to be distributed as 15 live, 2 dead, and 3 injured).

A statistically significant deviation in the survival, death or injured rates between pallid and shovelnose would indicate that the Service's rationale may be invalid and exceed the ITS requiring reinitiation of consultation. We also believe that using a comparative rate of impact, rather than a specific number will accommodate year to year changes in environmental conditions and changing numbers of spawning individuals.

Effect of Incidental Take

The Service believes that the effects to free embryos and adults, resulting in the described level of anticipated incidental take, is not likely to jeopardize the continued existence of the pallid sturgeon. Our rationale for this conclusion can be found in the jeopardy discussion and conclusion section.

REASONABLE AND PRUDENT MEASURES AND THEIR IMPLEMENTING TERMS AND CONDITIONS

The Service has identified the following reasonable and prudent measures and their implementing terms and conditions to reduce the impacts of the incidental take identified above. In order to be exempt from the prohibitions of section 9 of the Endangered Species Act, Reclamation or the Corps must comply with the following, non-discretionary terms and conditions. The Service realizes Reclamation and the Corps may develop alternative methods to meet the goal of the reasonable and prudent measures outlined below. In the event of that occurring, Reclamation and the Corps may request that the Service amend this document.

Reasonable and Prudent Measure 1

Work with appropriate parties (including the Service) to establish monitoring plan for incidental take monitoring.

Term and condition 1

Before February 1, 2017, Reclamation and the Corps will meet with the Service to discuss goals, strategy and logistics of monitoring shovelnose and pallid sturgeon

Monitoring will include.

- Monitoring behind the headworks screens to sample shovelnose and pallid sturgeon

- Monitoring within the influence of the river side of the screen to sample shovelnose and pallid sturgeon

- Monitoring below the future weir to sample shovelnose and pallid sturgeon

- Sampling each monitoring site with techniques appropriate to enumerate species and injury, death rate.

Term and condition 2

Based on the monitoring in term and condition 1, if the impacts are different than anticipated, Reclamation and the Corps shall immediately convene an interdisciplinary group (biologists, engineers, etc.) to examine and implement actions from the adaptive management plan to reduce those impacts and will evaluate whether they need to reinitiate consultation.

Term and condition 3

Reclamation will compile information enumerating how many telemetered pallid sturgeon are present at the Intake Diversion Dam.

Term and condition 4

Reclamation will compile information from partner agencies enumerating how many telemetered pallid sturgeon pass into the Yellowstone River from the Missouri River.

Term and condition 5

Report results of monitoring and project progress to the Service on an annual basis by March 1, beginning March 1, 2018.

Reasonable and Prudent Measure 2 [14]

As part of the monitoring program for interim operations, Intake Diversion Dam fish passage construction, and until the bypass channel is finished, relocate motivated adult and juvenile pallid sturgeon above the current weir.

Term and condition 1

Before February 1, 2017, Reclamation and the Corps will meet with the Service to discuss goals, strategy and logistics of moving motivated spawning adults and juveniles above Intake Diversion Dam.

The plan will include.

- Developing a rule set to determine how and when to safely capture, transport and release motivated spawning adults above Intake Diversion Dam
- Developing a rule set to determine how and when to safely capture, transport and release motivated juveniles above Intake Diversion Dam
- Monitoring released individuals to determine movements up and down river (including path past Intake Diversion Dam)
- Monitoring to detect evidence of spawning by adults
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- Monitoring to detect free embryos at the fish screen and weir

Term and condition 2

Report results of monitoring and project progress to the Service on an annual basis by March 1, beginning March 1, 2018.

[14] The Service realizes that by implanting the RPM to reduce the take of spawning sturgeon, any free larvae produced by spawning above the weir will be subject to exposure to the fish screens and weir. Any take resulting from this exposure is consistent with that already analyzed in the biological opinion and is considered exempt from section 9 of the ESA. Monitoring pursuant to RPM 1 will be implemented if adults are transported above the weir in the interim before bypass channel completion. Knowledge gained from the transport and release will be valuable information in implementing this proposed action and potential for recruitment.

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