KOOTENAI RIVER DISTINCT POPULATION SEGMENT OF THE WHITE STURGEON (*ACIPENSER TRANSMONTANUS*)

5-YEAR REVIEW: SUMMARY AND EVALUATION

U.S. FISH AND WILDLIFE SERVICE
NORTHERN IDAHO FIELD OFFICE

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U.S. Department of the Interior
Ken Salazar, Secretary

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Dan Ashe, Director

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5-YEAR REVIEW

Species reviewed: Kootenai River Distinct Population Segment of the White Sturgeon (*Acipenser transmontanus*)

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5-YEAR REVIEW
Kootenai River Population of the White Sturgeon
(*Acipenser transmontanus*)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office: Pacific Regional Office, Portland, Oregon

Lead Field Office: Northern Idaho Field Office, Spokane, Washington; Jason Flory, 509-893-8003

Cooperating Field Office(s):

Cooperating Regional Office(s): Montana Ecological Services Field Office, Helena, Montana

1.2 Methodology Used to Complete the Review:

New information was gathered and reviewed, and draft documents were developed by staff at the U.S. Fish and Wildlife Service's (Service) Northern Idaho Field Office. The main emphasis of this review was to reassess the status of the Kootenai River white sturgeon (Kootenai sturgeon) and potential threats to the population in view of new information that has become available since the 1994 listing determination. This review also reassesses the original distinct population segment (DPS) analysis for the Kootenai sturgeon (see section 2.1.4). The new information that forms the basis of this review is a combination of peer reviewed published literature; agency reports, monitoring data, and public databases; university theses; and meeting presentations, handout materials, and related notes of the Kootenai River White Sturgeon Recovery Team (KRWSRT).

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review:

April 8, 2010. Endangered and Threatened Wildlife and Plants; 5-Year Status Reviews of 69 Species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. 75 FR 17947.

1.3.2 Listing history

Final Listing
FR notice: 59 FR 45989
Date listed: September 6, 1994
Entity listed: Kootenai River Population of the white sturgeon (*Acipenser transmontanus*)

Classification: Endangered

1.3.3 Associated rulemakings:

Final Designation of Critical Habitat
FR notice: 66 FR 46548
Date issued: September 6, 2001

Designation of Critical Habitat: Interim Rule
FR notice: 71 FR 6383
Date issued: February 8, 2006

Critical Habitat Revised Designation: Final Rule
FR notice: 73 FR 39505
Date issued: July 9, 2008

1.3.4 Review History: N/A

1.3.5 Species' Recovery Priority Number at start of this 5-year review: 3C

1.3.6 Current Recovery Plan

Name of plan: September 1999 Recovery Plan for the Kootenai River Population of the White Sturgeon (*Acipenser transmontanus*)
Date issued: September 30, 1999
Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) Policy

2.1.1 Is the species under review a vertebrate?
__X__ *Yes*
_____ *No*

2.1.2 Is the species under review listed as a DPS?
__X__ *Yes*
_____ *No*

2.1.3 Was the DPS listed prior to 1996?
__X__ *Yes* (Listed September 6, 1994)
_____ *No*

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

____ *Yes*
__X__ *No*

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

__X__ *Yes* See Summary of Distinct Population Segment Review below
____ *No*

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

__X__ *Yes*
____ *No*

Summary of Distinct Population Segment Review

Pursuant to the 1996 DPS policy (61 FR 4722), three elements are considered in a decision regarding the status of a possible DPS as endangered or threatened under the Endangered Species Act of 1973, as amended (Act), which are: (1) the discreteness of the population segment in relation to the remainder of the taxon to which it belongs; (2) the significance of the population segment to the taxon to which it belongs; and (3) the population segment's conservation status in relation to the Act's standards for listing. The following discussion provides an updated DPS assessment of the first two elements for Kootenai sturgeon in light of new information that has become available since the 1994 listing determination. An update concerning the population's conservation status is addressed in section 2.3, below.

Discreteness

A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (quantitative measures of genetic or morphologic discontinuity may provide evidence of this separation); or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Physical Factors – Bonnington Falls in British Columbia, a natural barrier downstream from Kootenay Lake, has isolated Kootenai sturgeon since the last glacial advance roughly 10,000 years ago (Apperson 1992). Currently, the distribution of Kootenai sturgeon is separated by over 13.7 miles (22 kilometers) and five dams from the next closest white sturgeon population on the Columbia River (Figure 1). Based on the above information, white sturgeon within the Kootenai River are considered physically discrete from the remainder of the taxon.

Ecological Factors – The Kootenai River represents a unique ecological setting for the Kootenai sturgeon due to its different geologic and climatic components compared to the rest of the species' historic distribution (see Significance, below, for further discussion regarding ecological settings occupied by the species). However, because the Kootenai River population is entirely physically discrete from the remainder of the species distribution, it is unclear whether ecological factors alone would result in marked separation of populations of this species.

Genetic Factors – Genetic analysis indicates that Kootenai River white sturgeon are a unique stock and constitute a distinct interbreeding population (Setter and Brannon 1990). The measure of genetic variation determined for the Kootenai River population is much lower compared to white sturgeon in the lower Columbia River (Setter and Brannon 1990). Based on these comparisons, Setter and Brannon (1990) concluded "...we find adequate evidence to distinguish these fish as a separate population...." This is consistent with the geographic isolation of the population since the last glacial age. Based on the above, the Kootenai sturgeon is considered genetically discrete from the remainder of the taxon.

Behavioral Factors – Kootenai sturgeon exhibit a unique ecological adaptation with most spawning activity occurring near 50° F (Paragamian et al. 1997). Kootenai sturgeon are also more active at 42.8 ° F, several degrees cooler than the activity threshold for Columbia and Snake River sturgeon (Paragamian and Kruse 2001).

Physiological, Behavioral, and Morphological Factors – Currently there are no known physiological or morphological differences between Kootenai sturgeon and other populations of the taxon.

International Boundary – Kootenai sturgeon occur in Idaho, Montana, and British Columbia and are restricted to approximately 167.7 river miles (RM) of the Kootenai River extending from Kootenai Falls, Montana (31 RM below Libby Dam, Montana), downstream through Kootenay Lake to Corra Linn Dam, which was built on Bonnington Falls at the outflow from Kootenay Lake in British Columbia (RM 16.3). Approximately 45 percent of the species' range is located within British Columbia. In summer 2006, the Canadian federal government officially listed the Kootenai population in British Columbia as Endangered under the Species At Risk Act (SARA). However, with Kootenai sturgeon there are no differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms that are significant in light of section 4(a)(1)(D) of the Act.

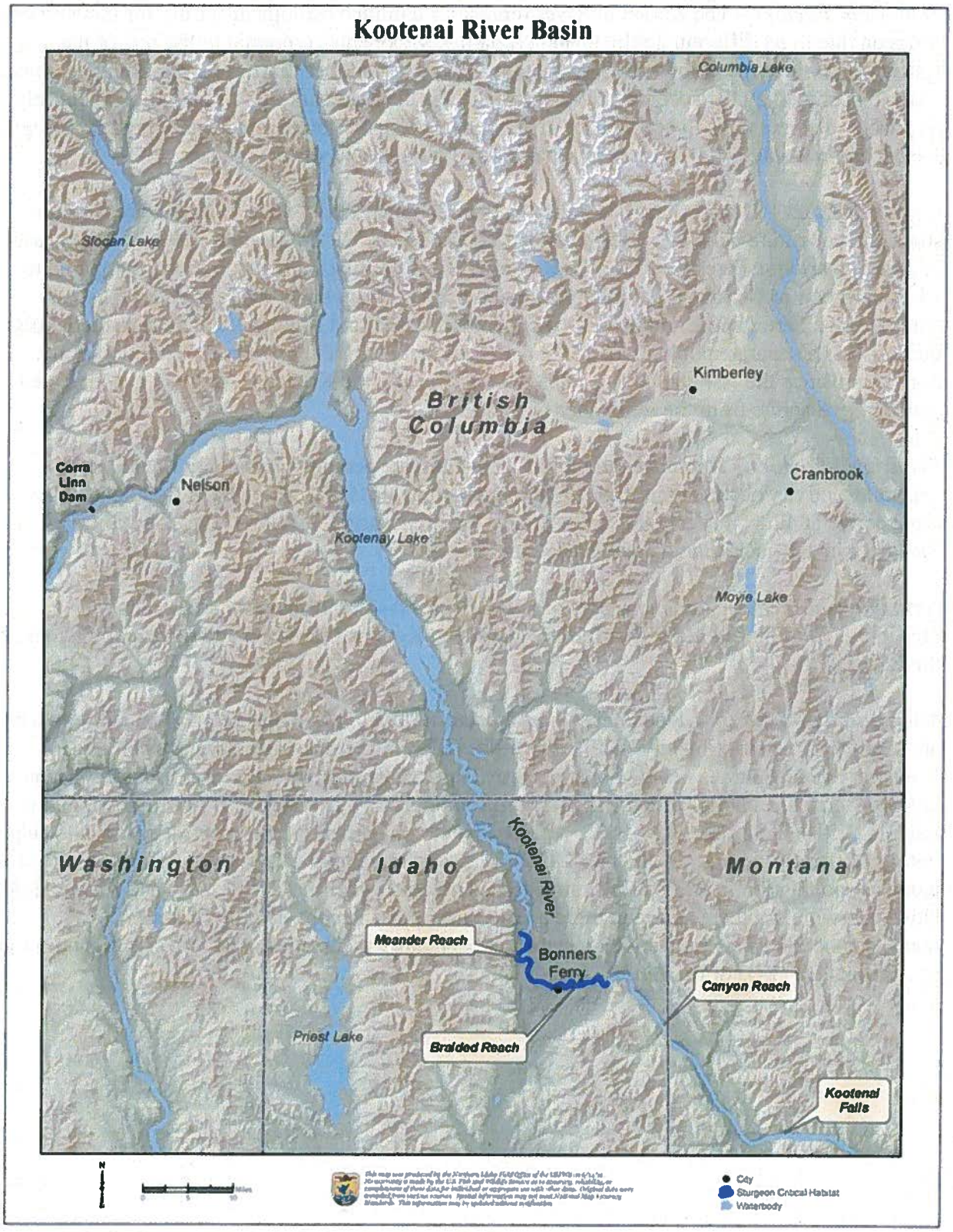

Figure 1 Kootenai Basin and important reaches of the Kootenai River.

Significance

The types of information that may demonstrate the significance of a discrete population segment to the remainder of its taxon include, but are not limited to: (1) persistence of the population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the population segment would result in a significant gap in the range of the taxon; (3) evidence that the population segment represents the only surviving natural occurrence of the taxon that may be more abundant elsewhere as an introduced population outside its historic range; and (4) evidence that the population segment differs markedly from other population segments of the taxon in its genetic characteristics. The following significance factors have bearing on the Kootenai sturgeon.

Unique Ecological Setting – White sturgeon are endemic to the Pacific coast of North America and its tributaries west of the Rocky Mountain continental divide, from central California to the Gulf of Alaska and the Aleutian Islands (Scott and Crossman 1973, in KTOI and MFWP 2004). White sturgeon are typically an anadromous species. However, the Kootenai sturgeon constitute a unique headwater population that has been isolated from the ocean and other downstream Columbia River populations for over 10,000 years (KTOI and MFWP 2004). Being a headwater river system, water temperatures during spring freshets on the Kootenai River are colder than other sturgeon-bearing waters in the Columbia River. Kootenai sturgeon have evolved in response by spawning at colder river temperatures than their Columbia River counterparts.

Significant Gap in Range – Kootenai sturgeon represent an isolated segment of the overall range of the taxon. Due to the Kootenai sturgeon's behavioral adaptations to the unique conditions in the Kootenai River, it would not be feasible that Columbia River white sturgeon could be transplanted successfully into the Kootenai River. A review of the demographic, geographic, and genetic information discussed throughout this review indicates that the loss of Kootenai sturgeon from the Columbia Basin would represent a significant gap in the range of the taxon, due to the loss of a conspicuous peripheral and isolated extension of its current and historic distribution.

Markedly Different Genetic Characteristics – The 1994 listing determination concluded that the Kootenai sturgeon had markedly different genetic characteristics compared to other Columbia River white sturgeon segments. These genetic results were also consistent with the geologic data, and suggested that Kootenai sturgeon became genetically isolated from the remainder of the taxon at least 10,000 years ago. Based on these results, the main conclusion drawn in 1994 was that the unique genetic characteristics of Kootenai sturgeon that evolved within the Kootenai River Basin represent an important component in the evolutionary legacy of the species and, therefore, are a genetic resource worthy of conservation.

Specifically, genetic surveys indicate that Kootenai sturgeon have lower genetic diversity than their counterparts in other river basins. Geographic isolation, population founding effects, demographic bottlenecks, and past harvest may all be contributing factors to this phenomenon (Setter and Brannon 1990; Anders et al. 2002). The first genetic studies of white sturgeon began during the mid-1980s (Bartley et al 1985, in KTOI and MFWP 2004; Setter 1988, in KTOI and MFWP 2004; Setter and Brannon 1992, in KTOI and MFWP 2004). Two later studies (Anders

and Powell 2002, in Anders 2002; Anders et al. 2002) evaluated population genetics of Kootenai River white sturgeon using two mitochondrial DNA (mtDNA) markers.

Results of the early genetic analyses (Bartley et al. 1985, in KTOI and MFWP 2004; Setter and Brannon 1992, in KTOI and MFWP 2004) indicated that Kootenai sturgeon had lower heterozygosities (H= 0.014) than their counterparts from the Columbia, Fraser, and Sacramento river systems (H= 0.049-0.069). Setter and Brannon (1992, in KTOI and MFWP 2004) also examined 29 loci and found that Kootenai sturgeon exhibited the lowest mean percentage of polymorphisms (27.6 percent) whereas white sturgeon from the Snake River, mid-Columbia River, and Lake Roosevelt were significantly higher (31.0 percent, 44.8 percent, and 55.2 percent, respectively).

Anders and Powell (2002) compared white sturgeon mitochondrial DNA markers among populations in the Columbia, Fraser, and Sacramento basins. The results indicated reduced haplotype diversity in Kootenai sturgeon compared to their counterparts in the other basins. These findings were subsequently supported with microsatellite analyses that included white sturgeon from the Kootenai River and numerous other populations in western North America. Rodzen et al. (2004) analyzed white sturgeon from eight different North American populations and found that the Kootenai/y samples had the lowest number of observed alleles.

The consensus conclusion among the comparative genetic work that has been conducted support the conclusion that Kootenai sturgeon constitute an isolated, distinct, and separate population of white sturgeon.

Conclusion

The 1994 listing determination concluded that the population of white sturgeon within the Kootenai Basin had been physically and genetically discrete from the remainder of the taxon for at least 10,000 years and is a unique stock that constitutes a distinct interbreeding population. Based on the above, we affirm that Kootenai sturgeon meets one or more of the discreteness criteria of the DPS policy, and that this population should continue to be considered discrete from the remainder of the taxon.

The 1994 listing determination concluded that genetic analysis indicated Kootenai sturgeon are a unique stock and constitute a distinct interbreeding population. The genetic data accumulated since the 1994 listing (described above) confirms this conclusion.

In light of the available new information summarized above, we affirm that the Kootenai sturgeon meets the discreteness and significance criteria encompassed by the DPS policy, and that this population segment is a valid DPS.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X__ *Yes*
____ *No*

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

____ *Yes*
__X__ *No*

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

____ *Yes*
__X__ *No*

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information

The Recovery Criteria from the 1999 Recovery Plan for the Kootenai River Population of the White Sturgeon are:

Recovery Criteria: Criteria required for reclassification or downlisting to threatened status include:

1. Natural production of white sturgeon occurs in at least 3 different years of a 10-year period; a naturally produced year class is demonstrated when at least 20 juveniles from a year class are sampled at more than 1 year of age.

2. The estimated white sturgeon population is stable or increasing and juveniles reared through a conservation aquaculture program are available to be added to the wild population each year for a 10-year period. Each of these year classes must be large enough to produce 24 to 120 sturgeon surviving to sexual maturity.

3. A long-term Kootenai River Flow Strategy is developed in coordination with interested State, Federal, and Canadian agencies and the Kootenai Tribe at the end of the 10-year period based on results of ongoing conservation efforts, sturgeon habitat research, and fish productivity studies. An important element of this strategy is demonstration of the repeatability of in-stream environmental conditions necessary to produce recruits (as described above) in future years.

The Recovery Plan (Service 1999) further states:

"Specific delisting recovery criteria have not been identified at this time, but will be developed as new population status, life history, biological productivity, and flow augmentation monitoring information is collected. However, recovery will not be

complete until there is survival to maturity and natural reproduction of juvenile white sturgeon added to the wild population from the conservation aquaculture program. This may take upwards of 25 years since that is the approximate period for juvenile female white sturgeon to reach sexual maturity and reproduce to complete a new generation or spawning cycle."

Recovery/Downlisting Criterion 1 – To date, there has been no detected significant natural reproduction in Kootenai sturgeon. Field crews annually conduct gill net sampling for juvenile sturgeon (Rust and Wakkinen 2010). While they do collect small numbers of unmarked juvenile sturgeon from each year class, most year classes contain fewer than 5 juveniles and none exceed 10 juveniles (Rust 2010). Thus, this recovery/downlisting criterion has not been met.

Recovery/Downlisting Criterion 2 – All population estimates for Kootenai sturgeon indicate that the wild population continues to decline (Paragamian et al. 2005; Beamesderfer et al. 2010). The actual estimate of wild adults in the population is under evaluation and will be discussed later in this review. Hatchery origin Kootenai sturgeon have been released into the Kootenai River since 1990. Releases from 1990 to 1993 were largely experimental and were made up of small year classes. Since 1995, the Kootenai Tribe of Idaho's Kootenai sturgeon aquaculture program has released over 170,000 hatchery origin juvenile sturgeon into the Kootenai basin. Typically between 10,000 and 35,000 juveniles representing as many as 18 family groups are released each year. The larger releases have primarily occurred since 2004. Recapture data indicates that hatchery juvenile Kootenai sturgeon survive at high rates after release, with 60% survival the first year after release and 90% the following years (Ireland et al. 2002). However, an analysis by Justice et al. (2009) showed that hatchery origin Kootenai sturgeon released at <9.84 inches (roughly corresponding to age-2 juveniles) survived at significantly lower rates than those released at larger sizes. In response, the KRWSRT recommended that hatchery origin Kootenai sturgeon be released at only age two and above.

Calculating the annual release sizes of hatchery origin Kootenai sturgeon and their survival rates over the past 10 years, indicates that each year class is large enough to be capable of producing between 24 to 120 sexually mature sturgeon. Even the year classes that were made up of mostly age-1 releases and survived at very low rates contained enough age-2+ releases to meet the criterion. Thus, this recovery/downlisting criterion has been met. However, it remains to be demonstrated if these hatchery origin sturgeon will contribute to future in-river recruitment.

Recovery/Downlisting Criterion 3 – The issue of flow management in the Kootenai basin has been contentious and controversial, starting in 1995 with the issuance of the Service's Biological Opinion on the Effects of the Federal Columbia River Power System on Five Endangered or Threatened Species (Service 1995). That opinion contained a jeopardy conclusion for the effects of Libby Dam operations on Kootenai sturgeon. The Reasonable and Prudent Alternative (RPA) issued in the opinion laid out a specific prescribed sturgeon flow operation at Libby Dam for the 1995 water year. Specifically, the RPA called for peak flows during the sturgeon spawning period of full powerhouse capacity (~25,000 cubic feet per second (cfs)) plus spill of "the maximum extent possible while not exceeding total dissolved gas supersaturation in excess of state water quality standards" (110% total dissolved gas (TDG)). The RPA also stipulated that these peak flows be maintained for 42 days. However, releases at Libby Dam in 1995 peaked at

approximately 20,000 cfs from the powerhouse (less than full capacity) and no water was spilled over the spillway. Peak releases were maintained for 40 days.

The 1995 RPA also stipulated that in water years 1996-1998, sturgeon operations at Libby Dam consist of maximum releases from the powerhouse (25,000-27,000 cfs) and spill of "the maximum extent practicable to achieve the 35,000 cfs total discharge at Bonners Ferry". The RPA also required these maximum flows to be maintained for 42 days, or until sturgeon spawning had ceased. Again however, between 1996 and 1998, the action agencies did not spill water over the spillway although the flow target of 35,000 cfs at Bonners Ferry was achieved each year.

In 2000, the Service issued a new opinion on the effects of the Federal Columbia River Power System (FCRPS), including the effects of Libby Dam operations on Kootenai sturgeon (Service 2000). Like the 1995 opinion, the 2000 opinion also reached a jeopardy conclusion for Kootenai sturgeon. The RPA formally adopted the "tiered" sturgeon volume approach, called for sturgeon operations in excess of 25,000 cfs at Libby Dam (at least 10,000 cfs above powerhouse capacity), and called for implementation of variable flow (VARQ) flood control procedures by October 2002. The additional 10,000 cfs was to be provided either via the spillway, or in the event the 10,000 cfs couldn't be spilled without violating Montana's water quality standards, via the addition of two turbines at Libby Dam.

After the issuance of the 2000 FCRPS opinion, a spill test at Libby Dam was conducted between June 25, 2002 and July 7, 2002, after most Kootenai sturgeon spawning had ceased. The purpose of the study was to evaluate the resulting TDG levels. As the test began, unforeseen weather circumstances resulted in the operation becoming a flood control spill event, with over 15,000 cfs being spilled. The resulting data showed that Montana's TDG limit was exceeded at the U.S. Army Corps of Engineers (Corps) TDG monitoring station at approximately 1,600 cfs of spill (Corps 2003).

Between 2001 and 2005, sturgeon operations were managed according to the approach outlined in the 2000 FCRPS opinion, with the exception of the additional 10,000 cfs. The 2002 spill showed that the spillway could not provide additional flows without violating Montana's TDG standard and the action agencies did not install the additional turbines. The post-2001 period is often referred to as the "Biological Opinion flows", referring to the above.

In February 2003, the Center for Biological Diversity (CBD) sued the Corps for failure to implement the RPA in the 2000 FCRPS opinion. In July 2003, the Service and the Corps agreed to reinitiate consultation and by June 2004, the District Court issued a stay of CBD's claims pending completion of the reinitiated consultation.

On February 18, 2006 the Service issued its Biological Opinion on the Effects of Libby Dam Operation on the Kootenai River White Sturgeon, Bull Trout, and Kootenai Sturgeon Critical Habitat (Service 2006). Like its predecessors, the 2006 opinion reached a jeopardy conclusion on the effects of Libby Dam operations on Kootenai sturgeon. The RPA adopted a "performance based approach" in that it listed a suite of attributes that reflected the best available scientific information regarding what is necessary to adequately provide for successful Kootenai sturgeon

spawning, and natural in-river reproduction. The attributes included timing and duration of flows, velocity, temperature, depth, substrate, and frequency of occurrence. The RPA allowed the action agencies flexibility in how to achieve these attributes. Specific to frequency of occurrence, the RPA required a flow test of 10,000 cfs above powerhouse capacity during the sturgeon spawning and migration period, in three out of the ensuing 10 years. The 2006 RPA also required the action agencies to develop a flow plan implementation protocol that addressed sturgeon flow releases.

On May 2, 2006, the Service was sued over the 2006 opinion by CBD; interveners included the State of Montana and the Kootenai Tribe of Idaho (KTOI). On September 17, 2007, the Corps was added as a defendant. On September 2, 2008, a settlement agreement between the parties was announced. On September 11, 2008, the Federal District Court in Missoula, MT issued an order dismissing the case.

The settlement agreement (CBD et. al. 2008) calls for the Service to clarify portions of the Libby opinion RPA. The Service clarified the RPA on December 29, 2008 and is currently working with the parties to implement the terms of the settlement agreement. The clarified RPA has a particular focus on Libby Dam operations in the near term (Service 2008). Under the terms of the agreement and RPA, if 2008 and 2009 operations at Libby Dam for sturgeon are not deemed successful (not meeting criteria outlined in the agreement), the State of Montana will grant a waiver of their TDG standards, which will allow for spill tests to be conducted at Libby Dam in 2010-2012. The goal of the tests is to provide additional flows to facilitate Kootenai sturgeon migration and spawning success. After coordinating with a regional team of sturgeon biologists, the Service issued its determination of "not successful" for 2008 Libby Dam sturgeon operations on April 20, 2009, and issued a "not successful" determination for 2009 operations on December 16, 2009. The "not successful" determinations were based on the following suite of "success criteria" in the settlement agreement:

- Migration of 40% of the tagged F4 fish in the river to the Hwy 95 bridge or above; and
- Presence of those fish in the reach of river at or above the Hwy 95 Bridge for 5 or more days; and
- Capture of > 5 unmarked juveniles of the same cohort in 2009 from 2006 or 2007 year classes, when improved temperature control and a descending limb were integral components of sturgeon operations at Libby Dam.

The Montana Department of Environmental Quality issued a waiver on March 24, 2010. A spill test was conducted at Libby Dam between June 10 and 16. Due to low water conditions and TDG issues, the spill test did not achieve the anticipated river stages. Preliminary data indicates the Kootenai sturgeon did not alter their migration or spawning behavior (Rust 2010). No impacts to resident fish below Libby Dam were detected. Currently, the Service and other parties are in the process of planning for the 2011 spill test.

To date, none of the above flow management strategies have succeeded in providing conditions necessary for Kootenai sturgeon to produce a detected increase in recruitment.

Beyond the attributes listed in the 2006 opinion RPA, there is not a long-term Kootenai River Flow Strategy in place. That plus the extensive and evolving history of sturgeon flow management at Libby Dam, as well as the continuing lack of in-river natural recruitment, leads us to conclude that recovery criterion 3 has not been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Spawning location – At the time of the 1994 listing determination, the primary cause of recruitment failure was identified as the suffocation of fertilized eggs as a result of spawning taking place over sand and silt substrates in the meander reach of the Kootenai River. This threat remains. However, at that time sturgeon managers believed the sand and silt was covering rocky substrates that had only become inundated since the construction and operation of Libby Dam. The view that increased flows would flush away the sand and silt and expose the underlying rocky substrates is reflected in the Service's 1995 and 2000 FCRPS biological opinions, the 1999 recovery plan, and the 2001 critical habitat designation. Subsequent coring and other data from the meander reach revealed that lacustrine clays lie underneath the sand and silt in the meander reach, indicating that the reach has always been comprised of substrates atypical for successful white sturgeon spawning and incubation (Barton 2004). A few isolated pockets of gravel were identified at the mouths of Deep Creek and Myrtle Creek. It is unlikely that these areas of gravel were sufficient to sustain the entire original population of Kootenai sturgeon.

Additionally, pre-Libby Dam reports and documents unanimously state that the spawning location of Kootenai sturgeon was in a stretch of the river just downstream of Kootenai Falls. A Corps of Engineers environmental statement (Corps 1971) states, "Little is known about the spawning habitat requirements of the white sturgeon, which spawns downstream from Kootenai Falls in Montana." A 1974 report by Montana Fish Wildlife and Parks (MFWP 1974) states, "Sturgeon from the Kootenai River in Idaho or Kootenay Lake, British Columbia spawn in the Kootenai River in Montana in the vicinity of Kootenai Falls." The report also predicted, "A changed flow regime reducing high spring flows may eliminate spawning runs of this fish into Montana and may reduce population numbers in the downstream areas." All other currently available historical reports and documents give similar descriptions of the pre-Libby Dam spawning location of Kootenai sturgeon and that construction and operations of the dam would negatively affect Kootenai sturgeon's spawning behavior and success (FERC 1980; MFWP 1983).

In 2010, the University of Idaho Social Science Research Unit conducted a survey of documents, articles, personal accounts, and other information relating to pre-Libby Dam behavior and distribution of Kootenai sturgeon. The results of the survey provided mixed results on spawning location, with the biologists agreeing that Kootenai sturgeon spawned in the Kootenai Falls area

and some local residents reporting seeing Kootenai sturgeon spawning in the Bonners Ferry area (Kane 2010). The survey also concluded that the "sturgeon population in Montana has decreased more rapidly than the sturgeon populations in Idaho and British Columbia". However, there is no data at this point that indicates Kootenai sturgeon are made up of different populations as the report described.

The overall conclusion from the substrate data and the historical information is that it's likely at least a portion of the Kootenai sturgeon population spawned in the canyon reach of the Kootenai River, most likely in the vicinity of Kootenai Falls. However, this new information does not address what actions would be necessary, or if it is even possible to restore this migration and spawning behavior in Kootenai sturgeon. The new information indicates that the earlier view that "flushing flows" were the primary action needed to restore recruitment in Kootenai sturgeon were incorrect.

A second survival bottleneck – As discussed in Section 2.2.3, Recovery Criterion 3 above, hatchery sturgeon recapture data indicates that hatchery origin Kootenai sturgeon released at <9.86 inches survive at far lower rates than those released at larger sizes (Justice et al. 2009). Further, since 2005 sturgeon managers have released either fertilized eggs or free-embryos into reaches of the Kootenai River that have more suitable rocky substrates. Annually, over one million fertilized eggs or free-embryos are released, yet to date these experimental releases have not produced a detected increase in captured unmarked juvenile Kootenai sturgeon (Rust 2010).

These data have led sturgeon managers to hypothesize that Kootenai sturgeon are experiencing a second survival bottleneck at the larval-to-age-2 stage (the first bottleneck being suffocation of eggs and free-embryos from sand and silt in the braided reach). It is generally thought that the cause of this bottleneck is nutrient/food related, in that there is an insufficient food supply in the Kootenai River for larval and age-1 sturgeon.

Adult population estimate – The 1994 listing determination stated that Kootenai sturgeon had "declined from an estimated 1,194 fish (range 907 to 1,503) (Partridge 1983), to approximately 880 fish (range 638 to 1,211) (Apperson and Anders 1991). The Bonneville Power Administration, commenting on the proposed rule, believes that "the population has further declined in 1993 to an estimated 785 individuals (range 569 to 1,080)". In 1997, Paragamian et al. (1997) estimated that there may be 1,468 adult sturgeon remaining in the Kootenai River population. By 2005, Paragamian et al. (2005) stated "the wild population now consists of an aging cohort of large, old fish. Jolly-Seber population estimates have declined from approximately 7,000 white sturgeon in the late 1970s to 760 fish in 2000. At the current mortality rate of 9 percent per year, fewer than 500 adults remain in 2005 and there may be fewer than 50 remaining by 2030." However, in recent years field crews have not noticed an increased difficulty in capturing unmarked sturgeon, as would be expected with such a small population and with what should be a high proportion of marked/tagged fish. Field crews also noticed a higher proportion of unmarked sturgeon in Kootenay Lake and the delta than in the Kootenai River. In 2008, the Kootenai Tribe of Idaho contracted with Cramer Fish Sciences (CFS) to review the mark-recapture data and evaluate existing population estimates and mortality rates. In July 2009, Ray Beamesderfer from CFS presented the KRWSRT a draft report and a presentation of preliminary results of the review (Beamesderfer et al. 2009). The review

indicated that due to differences in capture probabilities between sturgeon in Kootenay Lake and sturgeon in the Kootenai River, earlier population estimates were biased and as a result, underestimated the adult population and overestimated the mortality rate. The draft report estimated the existing adult Kootenai sturgeon population to be approximately 1,000 fish, with a 95% confidence interval of 800 to 1,400. The draft report also revised the estimated annual rate of decline to 4%.

Service staff reviewed the draft report from CFS and submitted their comments in August 2009. In August 2010, CFS issued a second draft in response (Beamesderfer et al. 2010). Service staff in the Vancouver Fisheries Office and the Northern Idaho Field Office reviewed the second draft and submitted their comments in January 2011. In general, the Service agrees with the draft report that recapture biases have skewed previous population estimates and that there are likely more adult Kootenai sturgeon than previously estimated. However, due to choices of models, issues regarding tag loss, and other questions, the Service feels the revised estimate is not yet robust enough to be cited as "best available science" for the estimated population of adult Kootenai sturgeon. Service staff is currently working with CFS staff on the report.

Early life stage behavior – At the time of the 1996 listing, little was known about the behaviors and habitat requirements of early life stage (embryo, free-embryo, larval) Kootenai sturgeon. Since 1996, a wealth of information has been accumulated on these subjects.

Upon hatching the embryos become "free-embryos" (that life stage after hatching through active foraging larvae with continued dependence upon yolk materials for energy). If adequate cover is available, free-embryos swim into the inter-gravel spaces in the substrate, which provide shelter and cover during this "hiding phase". In the absence of adequate cover, free-embryos will seek out cover by swimming up into the water column where they are passively redistributed downstream by the current (Kynard and Parker 2006; Kynard et al. 2007, 2008, 2009, 2010). Further lab studies by Kynard et al. (2009) showed that Kootenai sturgeon free-embryos will use any size rocks, but prefer smaller rocks (1.2-2.4 inch diameter) for hiding.

As the yolk sac is depleted, free-embryos begin to develop into the next life stage—free-swimming, foraging larvae—which are entirely dependent upon forage for food and energy. At this point the larval sturgeon are no longer highly dependent upon rocky substrate or high water velocity for survival (Kynard et al. 2008). The timing of these developmental events is dependent upon water temperature. With water temperatures typical of the Kootenai River, free-embryo sturgeon may require about 10-12 days post-hatching to develop a mouth and be able to ingest forage. Thus, by 11 or more days, Kootenai sturgeon free-embryos have consumed most or all of the energy from yolk materials, and develop into foraging larvae that initiate a major downstream dispersal.

Working with Kootenai sturgeon in artificial streams, Kynard et al. (2010) found that the larvae exhibit a "long, slow dispersal style" in a slow current (mean, 0.16 feet per second (ft/s)), but later studies in faster current (up to 0.75 ft/s) (Kynard et al. 2007, 2008) found a strong 14 day peak dispersal followed by a slow dispersal that lasts until larvae develop into the juvenile life stage at about 60 days. These faster currents are about one-half of the bottom current measured on the Kootenai River (Kynard et al. 2007). Thus, larvae in the Kootenai River likely have a

strong 14 day peak downstream dispersal. Kynard et al. (2007) suggested the lab results may be an indication of a summer-long dispersal pattern with the lower river or Kooteanay Lake being the sturgeon's ultimate destination. All observations on Kootenai sturgeon larvae in artificial streams indicate larvae actively swim downstream during dispersal and are in the lower three feet of the water column, where they can alternate swimming downstream just above the bottom with returning periodically to the bottom to forage (Kynard and Parker 2006; Kynard et al. 2007, 2008, 2009, 2010). Further lab studies by Kynard et al. (2009) showed that once Kootenai sturgeon developed into larvae, substrate size had no impact on downstream movement or swimming height. The same study also found larvae tended to move downstream slower in artificial streams with large rocks (rubble) than in streams with high proportions of pebble or gravel, suggesting the slower bottom velocities created by the large rocks provided better foraging habitat and velocity refuge for fish.

In sum, a great deal has been learned about Kootenai early life stage behaviors and requirements since the 1994 listing determination. This information is playing a vital role in recovery efforts.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends

As noted above, the population estimate for wild adult Kootenai sturgeon is currently under review and is likely higher than previous estimates. Likewise, the estimate of the rate of decline is also under revision and is likely lower than previous estimates. However, the overall trend of the wild population remains downward due to a lack of significant recruitment in the wild. While hatchery origin sturgeon are generally surviving at high rates, their ultimate contribution to the spawning population has yet to be determined. In the absence of restoration of successful spawning and recruitment in the wild, hatchery origin Kootenai sturgeon are bound to suffer the same fate as their wild counterparts.

The wild population of Kootenai sturgeon remains a declining, aging population that continues to experience effective recruitment failure.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Genetic data acquired since the 1994 listing determination, and summarized in the DPS Summary above, indicates that Kootenai sturgeon have lower genetic diversity than their counterparts in other river basins. Geographic isolation, population founding effects, demographic bottlenecks, and past harvest may all be contributing factors to this phenomenon (Setter and Brannon 1990; Anders et al. 2002).

Anders et al. (2000) compared five different mitochondrial length variants between the wild population and adults used as broodstock for the hatchery program. The results showed no significant difference between the two, indicating that the hatchery program is adequately capturing the genetic diversity present in wild Kootenai sturgeon.

2.3.1.4 Taxonomic classification or changes in nomenclature:

There have been no changes to the taxonomic classification or nomenclature of Kootenai sturgeon since the 1994 listing determination.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

There have been no changes in the spatial distribution of the Kootenai sturgeon since the 1994 listing determination.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

An experimental river fertilization project began in the Kootenai River just downstream from the Idaho-Montana border in 2005. The project was initiated in response to nutrient poor conditions in the Kootenai River due to the loss of the historic floodplains and the trapping of nutrients behind Libby Dam. A solar-powered nutrient addition system is used to provide a low dose of dissolved nutrients (2.6 to 10.6 gallons/hour; liquid agricultural grade ammonium polyphosphate) that varies with river discharge to maintain a constant in-river total phosphorus concentration. Dosing of ammonium polyphosphate solution occurs annually for the summer growing season with approximately 13 to 18 thousand gallons of 10-34-0 fertilizer injected into the Kootenai River each year since 2005.

Field monitoring and statistical analyses indicates positive results in the canyon reach (e.g. increased periphyton and algal biomass, edible diatoms and green algal densities, chlorophyll accrual and primary production rates, invertebrate abundance, biomass, and species richness) (Holderman et al. 2009a, 2009b, 2009c; Hoyle 2005-2009). However, the injected nutrients do not appear to affect production in the meander reach of the Kootenai River, where most juvenile sturgeon occur.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) –

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Since the 1994 listing determination, new information has been collected pointing to a second survival bottleneck related to lack of nutrients and food for larval and age 1 sturgeon, as discussed in section 2.3.1.1 above. Also, since the 1994 listing new information has been collected regarding the existence of rocky substrates in the current spawning reach of the Kootenai River as discussed in section 2.3.1.1 above.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Since the 1994 listing determination, there has been no new information on overutilization for commercial, recreational, scientific, or educational purposes of Kootenai sturgeon.

2.3.2.3 Disease or predation:

Since the 1994 listing determination, there has been no new information on disease or predation of Kootenai sturgeon.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Since the 1994 listing determination, there is no new information regarding the inadequacy of existing regulatory mechanisms with regard to Kootenai sturgeon.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Since the 1994 listing determination, there is no new information regarding other natural or manmade factors affecting the continued existence of Kootenai sturgeon.

2.4 Synthesis

The available new information assessed in this 5-year review indicates that one of the five threat factors identified in section 4 of the Act have increased in immediacy and magnitude since our 1994 listing determination (see sections 2.3.2.1). This threat factor, described in section 2.3.1.1 and summarized below involves a lack of nutrients in the Kootenai River necessary for survival of larval to age-2 Kootenai sturgeon.

Negligible survival of larval to age-2 Kootenai sturgeon continues to be a serious concern for sturgeon managers. Beginning in 2008, U.S. Geological Survey crews have been conducting surveys and inventories of the Kootenai Basin and have found that in the Kootenai River, there is very little zooplankton and macroinvertebrate production, relative to abundances in Kootenay Lake (Parker, pers. comm. 2010). Although modest efforts at nutrient restoration in the Kootenai River are ongoing (see section 2.3.1.6), they appear to be insufficient.

The KTOI is in the planning phase of the Kootenai River Ecosystem Restoration Project, which involves actions specifically targeted at remedying the lack of nutrients and food available for Kootenai sturgeon (KTOI 2009). Reconnecting floodplains, restoring side channels, restoring kokanee populations, and restoring riparian functions in the Kootenai basin are all included in the planned project and, if successfully implemented, are anticipated to increase the primary productivity in the Kootenai River. Whether this will be sufficient to support a self-sustaining population of Kootenai sturgeon remains to be seen.

Additionally, the Corps in partnership with the KTOI, are conducting a feasibility study under

Section 1135 of the Water Resources Development Act to evaluate habitat restoration opportunities in the Kootenai River. Restoration measures specific to restoring suitable spawning and early life stage habitats to address the primary bottleneck for the reproduction and survival of the species and avert the potential near-term extinction of the species are being considered.

Considering the available new information and our conclusion that one of the identified threats to the population has increased in its immediacy and magnitude, we recommend that the Kootenai sturgeon continue to be classified as 'endangered' under the Act (see section 3.1). We also recommend that the recovery priority for the Kootenai sturgeon remain at 3C (see section 3.2).

3.0 RESULTS

3.1 Recommended Classification:

_____ **Downlist to Threatened**
_____ **Uplist to Endangered**
_____ **Delist**
_____ *Extinction*
_____ *Recovery*
_____ *Original data for classification in error*
__X__ **No change is needed**

3.2 New Recovery Priority Number: N/A

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1 – Continue efforts to establish a self-sustaining, naturally-reproducing population of Kootenai sturgeon through the release of hatchery origin sturgeon. This recommendation addresses recovery action 2 (Refine, implement, and evaluate a genetically should white sturgeon conservation aquaculture program) in the current final recovery plan for Kootenai sturgeon.

As stated in section 2.3.1.3, the current conservation aquaculture program for Kootenai sturgeon is adequately preserving the genetic diversity of the wild population. Further, as discussed in section 2.3.1.1, hatchery origin sturgeon released at age 2 and above are surviving at very high rates. These results, plus the continued lack of in-river recruitment among Kootenai sturgeon justify the continuation, and possible expansion, of the existing conservation aquaculture program.

2 – Continue research and monitoring of Kootenai sturgeon. This recommendation addresses recovery action 3 (Conduct research on basic life history and monitor the level of recruitment, survival, and recovery of Kootenai sturgeon) in the current final recovery plan for Kootenai sturgeon.

As described in section 2.3.1.1, research and monitoring of the Kootenai basin and on Kootenai sturgeon has revealed new information vital to recovery efforts. More remains to be discovered

about early life stage behaviors and requirements, and it's likely that the information gathered will also be vital to future recovery efforts. Further, continued monitoring for wild juvenile sturgeon is important as recovery actions continue to be implemented. Should an action prove "successful", i.e. result in a detectable increase in recruitment, it will be crucial to be able to identify the success as quickly as possible and tie it to a specific action.

3 – Continue to manage flows from Libby Dam to benefit Kootenai sturgeon. This recommendation addresses recovery action 1 (Restore natural recruitment using flow augmentation to the Kootenai sturgeon) in the current final recovery plan for Kootenai sturgeon.

As described in section 2.2.3, flow management from Libby Dam has an extensive history. However, to date no specific flow management measure has produced a detected increase in in-river recruitment in Kootenai sturgeon. Currently, sturgeon managers are in the midst of three years of mandated spill tests, and it is still unclear if the additional flows, higher river stages, and targeted temperature management will produce positive results. Further, once the required three years of spill tests are over, neither the Libby biological opinion nor the settlement agreement lay out a specific flow management strategy. Once the spill test period has ended, it will be important for sturgeon managers to compile the resulting data and devise a long-term flow strategy for Kootenai sturgeon that is compatible with other recovery actions, most importantly the KTOI's ecosystem restoration project.

4 – Continue to support the KTOI's ecosystem restoration project. This recommendation addresses action 4 (implement conservation and recovery of Kootenai sturgeon) in the current final recovery plan for Kootenai sturgeon.

Section 2.2.3 describes the history that led to the Libby biological opinion settlement agreement. Included in that agreement is a provision that the federal agencies "cooperate in good faith with and support" the KTOI's ecosystem restoration project. The Libby opinion RPA, as clarified in 2008, also reflects this requirement. The restoration project is crucial in that as currently planned, it addresses multiple threats to Kootenai sturgeon as well as multiple hypotheses for how to minimize them. The KTOI released the Kootenai River Ecosystem Restoration Project Master Plan in July, 2009 (KTOI 2009). The plan describes the purpose of the project as:

- Restore and enhance Kootenai River habitat by addressing ecological limiting factors and constraints related to river morphology, riparian vegetation, aquatic habitat and river management. The desired result is a more resilient ecosystem, capable of sustaining diverse native plant and animal populations, and tolerant of natural disturbances and altered regimes.

- Restore and maintain Kootenai River habitat conditions that support all life stages (i.e. migration, occupancy, spawning, incubation, recruitment and early rearing) of endangered Kootenai River white sturgeon (*Acipenser transmontanus*) and other aquatic focal species; and

- Restore the Kootenai River landscape in a way that sustains Tribal and local culture and

economy and contributes to the health of the Kootenai subbasin as both an ecological and socio-economic region.

As described in section 2.3.1.1, there is now evidence that at least some Kootenai sturgeon spawned upstream of the current spawning reach, likely as far upstream as the Kootenai Falls area. However, management actions (primarily flows) intended to coax spawning sturgeon into those areas have been unsuccessful in this regard. Sturgeon managers are somewhat divided on whether to improve conditions in the current spawning reach, or to attempt to coax spawning sturgeon to migrate to upstream habitats. As currently planned, the KTOI and Corps restoration projects address both approaches by including actions for improving conditions in the spawning reach (e.g. rock placement and side channel improvements) and coaxing spawning sturgeon to migrate to upstream habitats (e.g. deepening the channel in the straight and braided reaches). Other actions such as floodplain reconnection, riparian restoration, and tributary restoration will address the lack of nutrients and food described in section 2.3.1.1. For these reasons, it is very important that the Service fully support the ecosystem restoration project.

5 – Revise existing recovery plan. This recommendation addresses action 6 (assess the overall success of implementation of the recovery plan and revise accordingly) in the current final recovery plan for Kootenai sturgeon.

The current final recovery plan for Kootenai sturgeon was finalized in 1999. Given the wealth of new information described in this review, the existing recovery plan is out of date and in need of revision. As such, we recommend that the current recovery plan be revised to account for the new information and evolving conservation strategies for the Kootenai sturgeon.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the Kootenai River Distinct Population Segment of the White Sturgeon (*Acipenser transmontanus*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
__X__ No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable:_____

Review Conducted By: Jason Flory, Northern Idaho Field Office, Spokane, Washington

FIELD OFFICE APPROVAL:

_____ Date 8/9/11
Lead Field Supervisor, Fish and Wildlife Service