Draft, Project Management Plan FY2013 Intake Diversion Larval and Juvenile Fish Sampling

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Study Title: Larval and Juvenile Fish Sampling Survey at the Intake Diversion, Yellowstone River, Montana

Study Summary

Beginning in April of 2012, a new screened headworks was placed into operation at Intake, MT. The design of the screening systems, with 12 cylindrical drums through which water flows passively into the canal headworks, was selected following extensive study during the NEPA process. Each drum screen measures approximately 2 meters (6.5 feet) in diameter and 7.6 meters (25.2 feet) in length. The screens have a maximum mesh size of 1.75 mm with a profile bar of 2.38 mm woven wire. Maximum approach velocity in front of the screen is designed at 0.12 meters per second (0.4 feet per second), which will provide an even velocity distribution across the rotating screens. Water gravity flows from low in the riverine water column through the screens, and passes through the slide gates where it enters the canal. The new screened diversion will divert between 600 – 1,380 cfs from the Yellowstone River into the main canal during the irrigation season, depending on weather and crop demands. The fish screens were designed to meet salmonid criteria established by the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA) and were designed with the intent of preventing entrainment of fish greater than 40mm in length.

Monitoring History

Reclamation previously completed fish entrainment investigations from 1996-1999. These were performed immediately behind the headworks within the Intake Canal and were used to quantify fish entrainment at the diversion. These investigations were targeting fish that could be collected in ½ inch mesh nets; larval stages or small juveniles were not part of the monitoring. The total estimated number of entrained fish in 1996 was 537,459 ±198,908. In 1997 and 1998, fish entrainment was estimated at 382,609 ± 24,487 and 809,820 ± 154,000 respectively.

Native species-stonecat, flathead chub, sturgeon chub, goldeye and sauger---comprised the highest numbers collected. Average entrainment in 1996 and 1997 was 1.75 and 0.99 fish per

acre-foot, respectively for non-larval stages. Entrainment rates of individual species varied with month, time of day, and turbidity, over the irrigation season when with entrainment flows into the canal were relatively constant. Diel differences in entrainment for many of the native fish were most pronounced later in the irrigation season when river clarity increased. The 1998 entrainment netting collected 4,529 fish which included 744 sturgeon chub. Surprisingly, shovelnose sturgeon accounted for a noticeable high percentage (8 percent) of fish in 1998.

In late summer of 2008 and 2009 several larval fish monitoring trips were performed as part of a larger planned study to determine quantifiable techniques for collecting larval fish in the Intake Canal behind the headworks, and to provide a baseline of data for future reference. Data was again collected during the summer of 2012 following the start of operation of the new intake structure. For all larval sampling, nets were strung from a bridge over the canal several hundred feet downstream of the intake diversion itself. In 2008, sampling occurred the weeks of June 24-26, July 8-10 and 23-25, 2008. Three dominant families of fish were identified, Hiodontidae, catostomidae and cyprinidae. In June, samples were mostly comprised of catostomids (31%) and cyprinids (31%), followed by hiodontidae (7%) and 30% were unknown due to damage to the sample or identifiers inexperience with larval ID. Composition in early July was mostly comprised of catostomids (51%), followed by cyprinids (17%) and hiodontidae (6%). Late July collections were comprised mostly of catostomids (58%) followed by cyprinids (35%) and Hiodontidae (1%)**.** Data collected in 2009 are expected worked up and available as a report sometime in early 2013. Enumeration of larval samples collected during 2012 is being contracted out, and it is anticipated that data for that will be available sometime in mid-2013.

Proposed 2013 Sampling

As a result of a meeting in late summer 2012 with Reclamation, USFWS, Montana FWP and irrigation personnel, a revised sampling plan was developed that incorporated structural design changes to the diversion dam in early 2013, and is presented here.

The lower Yellowstone River has a diverse assemblage of native fishes. River flows, water temperatures and other spawning triggers can produce varied and protracted spawning in addition to species specific timing. Larval and juvenile fishes are present all spring and most of the summer. Similar to other years we are proposing a sampling program to try to increase the probability of capturing pulses in larval and juvenile fish. The only way to ensure not missing anything would be to sample continuously. However, given the logistics and costs of such a program, and current budgetary constraints this would not be possible.

Larval sampling using nets suspended off the bridge in the manner they had been fished previously will be done again in 2013 providing data directly comparable to that collected prior to construction of the new intake. Given that there are populations of adult fish residing in the canal year round, it is recognized this methodology could have bias due to the potential contributions from fish spawning in the afterbay of the intake structure.

With design modifications, including the addition of box culverts to each of the gates, it is now

possible to directly sample the incoming water with entrainment nets for larger fishes (>40mm), and minimize collection of fish already residing within the canal. Previously this would not have been feasible due to the recessed nature of the gates in the structure.

2013 Objectives

1) Determine seasonal fish entrainment of all fishes greater than 40mm in length into the canal through the screens.
2) Determine seasonal presence of larval fishes within the canal.
3) Establish catch estimate probability curves.

Scope of work

For 2013, sampling will be conducted twice monthly (every other week) with a collection threshold target of 48 samples per event for larval fish. For fish larger than 40mm we are targeting 24 samples per trip. Both sets of samples will be equally distributed between night and day. The proposal is to start work during May, 2013 and extend through August or September of 2013. The final end date could be extended or contracted based on budget considerations and the presence or absence of fish in the system.

The primary larval fish sampling protocol will use a 500um plankton nets suspended off the bridge approximately 300 yds downstream of the intake structure. This is the same location used for collections for previous larval studies. The net contains a calibrated flow meter used to determine the volume of water filtered, and is weighted down to ensure it rides at the proper depth below the water surface. Larval nets will be fished for approximately 30 minutes at a time over a 24 hr diel period. Nets will be set both near surface and near bottom, similar to how sampling was conducted in previous years. If funding allows this season, during at least three weeks, larval nets will be operated concurrently at the gate outlets on the diversion. This data will be used to determine if sampling at the bridge indeed is representative of what is being entrained to the canal.

For sampling larger fish the historical Intake studies employed half –inch mesh nets suspended directly in front of the intake gate outlets to the canal. Modifications being made to the structure which include the box culverts being put in place will again allow staff to directly fish the inflows during the 2013 sampling season. For 2013 the objective is to quantify entrainment of fish larger than 40 mm, which does differ from the previous studies and will require the use of a smaller net size. Because the study objectives are different, this date is not meant to be directly comparable to previous netting studies looking at overall entrainment. Nets using a 1/8” mesh with the stretch dimension parallel to the water flow (smaller net hole size) will be used to sample the inflows. Nets will be attached to a 4’ wide x 6’ high steel frame which can be lowered down over the culvert opening on guide cables attached to eyebolts embedded in the lower corners of the culverts. Nets will be fished on both ends of the intake structure and one

of the gates in the middle for 30 minute intervals. If significant differences in catch rates are found among the different openings, a revised program the following season will be used to test which gates are prone to higher entrainment rates, or if it a linear progression of increase.

To determine larval net efficiency and develop a probability curve of larval capture we propose to employ two methods. First we will release known numbers of colored polyacrylamide gel beads (Floral Supply, Seeley Lake, MT) that are near neutral buoyancy, as a surrogate for larval fish. The gel beads average 9.5 mm in diameter (range 8.5–11.0) with a specific gravity averaging 1.19 grams per cubic centimeter (range 1.02–1.43) in tap water. Known numbers of beads will be placed in the water immediately downstream of the headworks, at sites on either end, and near the middle of the structure. Different colored beads will be released near surface and near bottom to examine differences in capture probability based on release position. Nets being fished for larval fish sampling will be used to collect beads. Captured beads will be enumerated and a catch estimate probability curve generated. Based on the catch proportion and variance at the bridge, we can then do a power analysis to provide an estimate of larval numbers that would have to be entrained during experimental studies to allow us a reasonable degree of statistical confidence. It is recognized beads may not be a suitable replacement for larval fish and that differences in capture probabilities could be a function of the bead behavior. Beads must also be released at the outlet works as they cannot fit through the screen.

For the second method we hope, at some point during the study, to obtain sufficient pallid or shovelnose larvae to repeat this test using live fish. Since fish released to the canal are presumably lost to the system it would make sense to use the more readily available shovelnose larvae. These larvae would have to be marked in a way that makes them readily identifiable from wild larvae if our releases coincide with the presence of larger numbers of wild fish. Larvae would be released outside the headworks near three gate intakes being used for the study. Fish will be released in replicate groups over diel periods to look at differences in capture probability. How close larvae need to be released to the screen will be determined based on a dye study and visual observation of dye entrainment. Due to the design of the screen we anticipate the point having to release larvae almost directly against the screen to ensure a high probability of entrainment. For larval releases we propose to lower filled bags or small buckets of larvae into the water column next to the screen for release.

Since young larvae grow rapidly, and at the same time differ greatly in swimming ability with age this study would include replicates by age group. The numbers of replicates and age spread would have to be determined by the numbers of larvae available, and this would be planned for 2014.

Sample Processing and Identification:

Immediately following collection, each sample will be stained using Rose Bengal to make larvae and small fish more observable, and preserved in 5-10% buffered formalin. At the time of collection large debris will be removed prior to preservation of the sample. Separating larvae

and eggs from smaller debris will be done once samples have been returned to a laboratory setting.

Reclamation has larval keys developed from the previous collections and intake and can do the work in house, but due to time required to train personnel, and the difficulties associated with identifying many of the larva fishes from the Yellowstone, we will be contracting out the identification and counting of larval fishes. Samples of larger fish (those greater than 40mm) will be analyzed in house by Reclamation staff.

Statistical Processing:

All data analysis will be done using the SAS statistical program. Based on catch rate, larval fish numbers will be scaled to number of larvae per unit volume of water to allow an estimate of total entrainment in the system. Prior to statistical tests data will be checked for normality and transformed appropriately to avoid violating statistical assumptions. Any differences in fish numbers between gate locations will be assumed to be a linear function unless further testing of additional gates indicates some other pattern. Within each season we will compare differences in night vs. day entrainment, seasonal differences in numbers and species present as well as spatial differences in entrainment based on intake location.

Timeline:

Larval samples will be stockpiled through the end of the field season at which time personnel could begin the process of sorting and identification. If resources are available during the summer this process will be accomplished sooner. We anticipate having all 2012 samples enumerated by June 2013, and a draft data summary of 2013 data available no later than September 1, 2013.

Figure 1. Generalized diagram of net attachment and operation at Intake.