

**Columbia River Project Water Use Plan
Monitoring Program Terms of Reference**

**COLUMBIA RIVER WHITE STURGEON
MANAGEMENT PLAN**

- **CLBMON-21 Mid Columbia River Juvenile Sturgeon Detection and Habitat Program and Tracking of Existing Sonic Tagged Sturgeon**

June 15, 2007

Terms of Reference for the Columbia River Project Water Use Plan Monitoring Programs Columbia River White Sturgeon Management Plan

1.0 OVERVIEW

This document presents Terms of Reference for the effectiveness monitoring programs and physical works for the Columbia River White Sturgeon Management Plan (Table 1). These programs will provide essential baseline data against which to monitor outcomes of the recommended operational changes in addition to providing information on which to base future operating decisions. This document provides detailed Terms of Reference for the following programs:

Monitoring Programs:

- 1) CLBMON-19 Kinbasket Sturgeon Inventory and Habitat Use: A 3-year program to determine if white sturgeon are present in Kinbasket Reservoir, what the status of that population is, and what habitat attributes exist in the reservoir to support white sturgeon.
- 2) CLBMON-20 Mid Columbia River Spawning Habitat Assessment: A 2-year program to establish spawning flows and spawning habitat requirements for possible habitat rehabilitation.
- 3) CLBMON-21 Mid Columbia River Juvenile Sturgeon Detection and Habitat Program and Tracking of Existing Sonic Tagged Sturgeon: A 10-year program to detect and monitor juvenile white sturgeon presence and habitat use in the mid Columbia River. The program is also intended to determine whether sufficient habitats exist to allow for recruitment of larvae and evaluate whether seasonal flow releases provide for suitable habitat for successful recruitment.
- 4) CLBMON-23 Mid Columbia River Sturgeon Egg Mat Monitoring and Feasibility Study: A 10-year program to assess the distribution of sturgeon eggs, and assist in setting a seasonal minimum flow and evaluating the impacts of this flow on egg and larval stranding.
- 5) CLBMON-24 Mid Columbia River Sturgeon Genetics: A 1-year study to further investigate stock differentiation of the Arrow Lakes Reservoir and Lower Columbia River white sturgeon.
- 6) CLBMON-25 Kinbasket Juvenile Sturgeon Detection and Habitat Use: A 6-year program to monitor patterns of habitat use by juvenile white sturgeon in Kinbasket Reservoir
- 7) CLBMON-26 Kinbasket Sturgeon Recolonization Risk Assessment and Habitat Suitability: A 3-year program to investigate the ecological risks of conservation aquaculture for white sturgeon in Kinbasket Reservoir.
- 8) CLBMON-27 Mid Columbia River Sturgeon Incubation and Rearing Study: A 2- year study to evaluate the impacts of low water temperature on sturgeon egg and larval development.
- 9) CLBMON-28 Lower Columbia River Adult Sturgeon Population Monitoring: A 13- year study to monitor the abundance, biological characteristics, and reproductive status of white sturgeon in the lower Columbia River to determine operational factors influencing population processes and to ensure that implementation of any physical works does not decrease their abundance.

- 10) CLBMON-29 Lower Columbia River Juvenile Sturgeon Monitoring: A 10-year study to monitor the relative abundance, distribution, and patterns of habitat use of juvenile white sturgeon in the lower Columbia River in relation to discharges from Hugh Keenleyside Dam.
- 11) CLBMON-30 Lower Columbia River Opportunistic Assessment of High Flow Events: A 2-year study to create a plan and assess on an opportunistic basis the high flow events in the lower Columbia River on egg, larval, and juvenile sturgeon survival.

Physical Works:

- 1) CLBWORKS-24 Mid Columbia Experimental Aquaculture: An experimental aquaculture program to provide juveniles for assessing flow treatments on larval and juvenile sturgeon survival and impacts of Arrow operations on juvenile habitat availability, suitability, and survival.
- 2) CLBWORKS-25 Mid Columbia Sturgeon Conservation Aquaculture: Conservation aquaculture to support the sturgeon population until such a time as stock abundance/age structure and habitat conditions can support a self-sustaining population
- 3) CLBWORKS-26 Mid Columbia Sturgeon Upgrade Hatchery: upgrade existing facilities at the Kootenay Hatchery to support CLBWORKS-24 and CLBWORKS-25 above.
- 4) CLBWORKS-27 Lower Columbia Sturgeon Physical Works: Physical works options to address sturgeon recruitment failure in the lower Columbia River.
- 5) CLBWORKS-28 Planning and Assessment of WSG Turbidity: a feasibility study to recommend physical works options to address credible hypotheses for sturgeon recruitment failure in the lower Columbia River
- 6) CLBWORKS-34 Lower Columbia Sturgeon Aquaculture Program: Conservation aquaculture to support the sturgeon population until such a time as stock abundance/age structure and habitat conditions can support a self-sustaining population

Table 1 Columbia River White Sturgeon Management Plan Monitoring Program Terms of Reference Submission Information

Name of Monitoring Program	Order Clause Fulfilled	Submitted with this Package	Previously Submitted To CWR	Submission Date
CLBMON-19 Kinbasket Sturgeon Inventory and Habitat Use	Schedule F: 1.a	No	No	
CLBMON-20 Mid Columbia River Spawning Habitat Assessment	Schedule F: 1.b	No	No	
CLBMON-21 Mid Columbia River Juvenile Sturgeon Detection and Habitat Program and Tracking of Existing Sonic Tagged Sturgeon	Schedule F: 1.c and 1.d	Yes	No	June 2007
CLBMON-23 Mid Columbia River Sturgeon Egg Mat Monitoring and Underwater Videography Feasibility	Schedule F: 1.e	Yes	No	June 2007
CLBMON-24 Mid Columbia River Sturgeon Genetics	Schedule F: 1.f	No	No	
CLBMON-25 Kinbasket Juvenile Sturgeon Detection and Habitat Use	Conditional	No	No	

CLBMON-26 Kinbasket Sturgeon Recolonization Risk Assessment and Habitat Suitability	Conditional	No	No
CLBMON-27 Mid Columbia River Sturgeon Incubation and Rearing Study	Schedule F: 1.g	No	No
CLBMON-28 Lower Columbia River Adult Sturgeon Population Monitoring	Schedule F: 1.h	No	No
CLBMON-29 Lower Columbia River Juvenile Sturgeon Monitoring	Schedule F: 1.i	No	No
CLBMON-30 Lower Columbia River Opportunistic Assessment of High Flow Events	Schedule F: 1.j	No	No
CLBWORKS-24 Mid Columbia Experimental Aquaculture	Schedule F: 3.a	No	No
CLBWORKS-25 Mid Columbia Sturgeon Conservation Aquaculture	Schedule F: 3.b	No	No
CLBWORKS-26 Mid Columbia Sturgeon Upgrade Hatchery	Schedule F: 3.c	No	No
CLBWORKS-27 Lower Columbia Sturgeon Physical Works	Conditional	No	No
CLBWORKS-28 Planning and Assessment of WSG Turbidity	Schedule F: 2.a	No	No
CLBWORKS-34 Lower Columbia Sturgeon Aquaculture Program	Schedule F: 3.b	No	No

Monitoring Study No. CLBMON-21 Mid Columbia River Juvenile Sturgeon Detection and Habitat Use and Tracking of Existing Sonic Tagged Sturgeon

2.0 MONITORING PROGRAM RATIONALE

2.1 Background

Columbia River white sturgeon were listed as endangered under the Species at Risk Act (SARA) in 2006. The population being examined in monitoring study CLBMON-21 resides within Arrow Lakes Reservoir and the small section of riverine habitat below Revelstoke Dam and is currently estimated to number approximately 50 individuals (Golder Associates Ltd. 2006). All of the population appears to be older than the 1968 year class. Based on the small size and the advanced age of these individuals, there appears to be a total lack of recruitment into this population. One of the hypotheses proposed by the Upper Columbia White Sturgeon Recovery Initiative Technical Working Group (UCWSRI TWG) is that juvenile rearing habitat for sturgeon spawned in the Revelstoke area is critically limited as a function of the construction and operations of the Hugh L. Keenleyside and Revelstoke dams, and the resulting hydraulic conditions and habitat changes in the mid Columbia (Figure CLBMON-21-1). A minimum flow of 142 m³/s (5 kcfs) proposed for the mid Columbia River, in part for development of a self-sustaining sturgeon population in Arrow Lakes Reservoir, is expected to provide better conditions for juvenile survival.

Revelstoke Dam is operated as a load-following facility. As a result, discharge from the dam can vary over a 24-hour period from minor leakage, when no water is passing through the generating units, to 1700 m³/s (60 kcfs) when all units are operating at full capacity (Figure CLBMON-21-2). With the installation of a fifth unit at Revelstoke, maximum discharge will increase to 2123 m³/s (75 kcfs). Hydraulic conditions in the riverine section below Revelstoke Dam are therefore highly variable and complex. Adding to this complexity is a backwatering effect caused by Arrow Lakes Reservoir (Figure CLBMON-21-3). This flooding effect is greatest from mid June through to mid August when the reservoir is near or at full pool level, extending over 40 km from Shelter Bay to approximately the confluence of the Jordan River. If the water surface elevation of Arrow Lakes Reservoir exceeds 438 m, the segment from the Jordan River to Revelstoke Dam can also be influenced by backwatering. Any potential juvenile sturgeon rearing habitat in the mid Columbia River will therefore be affected by both discharge from the dam and reservoir water surface elevation. In this Terms of Reference the term juvenile is meant to include any sturgeon under the age of 10 years and includes any releases from the aquaculture program (e.g. sub-yearling, post hatch and 0+ fish).

Although construction and operation of dams has been implicated in the decline of white sturgeon in the Columbia River, the precise mechanisms responsible for recruitment failure remain uncertain. Hypotheses are wide-ranging (UCWSRI 2002), not necessarily mutually exclusive, and in general, are difficult to test due to the species' longevity and its occurrence in difficult-to-study habitats. During development of the Columbia River Water Use Plan (WUP), this uncertainty made it difficult for the WUP Consultative Committee (WUP CC) to evaluate the benefits of

