

Columbia River Project Water Use Plan
Monitoring Program Terms of Reference
KINBASKET RESERVOIR
FISH AND WILDLIFE INFORMATION PLAN

- **CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment**

24 October 2007

Terms of Reference for the Columbia River Project Water Use Plan Monitoring Programs Kinbasket Reservoir Fish and Wildlife Information Plan

1.0 OVERVIEW

This document presents Terms of Reference for monitoring programs under the Kinbasket Reservoir Fish and Wildlife Information Plan (Table 1). These programs will evaluate the potential effects of Mica Dam and Kinbasket Reservoir operations on fish habitat and fish populations, wildlife habitat and wildlife populations.

This document provides detailed Terms of Reference for the following programs:

- 1) CLBMON-1 Mica Dam Total Gas Pressure Monitoring and Abatement Program: a 2-year study to determine dissolved gas supersaturation with synchronous condense operation of Units 3 and 4 in relation to Units 1 and 2, which have been previously monitored.
- 2) CLBMON-2 Kinbasket and Revelstoke Reservoirs Kokanee Population Monitoring: a 12-year program to monitor trends in the biological characteristics, distribution and abundance of kokanee populations in Kinbasket and Revelstoke reservoirs, and provide information required to link the effects of reservoir operation to population levels.
- 3) CLBMON-3 Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program: a 12-year study to define the trophic web mechanisms and dynamics of Kinbasket and Revelstoke reservoirs, and determine if changes in pelagic productivity are associated with reservoir operations.
- 4) CLBMON-4 Kinbasket Reservoir Fish Stranding Assessment: a 3-year study to qualitatively evaluate the extent of fish stranding caused by the annual drawdown of Kinbasket Reservoir.
- 5) CLBMON-5 Kinbasket Reservoir Burbot Life History and Habitat Use Assessment: a 3-year study to obtain baseline data on the biological characteristics of burbot populations in Kinbasket Reservoir, and provide information to evaluate potential effects of reservoir operation on burbot population productivity
- 6) CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment: a 3-year study to obtain baseline data on the life history and habitat characteristics of juvenile bull trout in Kinbasket Reservoir, and provide preliminary information to determine if reservoir operations could have an effect on bull trout populations.
- 7) CLBMON-7 Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment: a 3-year study to obtain baseline data on the biological characteristics of rainbow trout in Kinbasket Reservoir, and provide the information required to evaluate the impacts of reservoir water levels on the productivity of rainbow trout populations.
- 8) CLBMON-8 Kinbasket Reservoir Monitoring of the Valemount Peatland: a 3-year monitoring program to address key uncertainties regarding the relative contribution and importance of the current reservoir operating regime to the erosion processes affecting the

wetland, obtain an inventory of plant and wildlife species, and determine whether the long-term viability of the wetland, and associated plant and animal species, are being affected by erosion processes related to reservoir operations, and how these effects may be mitigated.

Table 1 Kinbasket Reservoir Fish and Wildlife Information 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	Leave to Commence
CLBMON-1 Mica Dam Total Gas Pressure Monitoring and Abatement Program	Schedule A: 5.a	Yes	No	24 October 2007	No
CLBMON-2 Kinbasket and Revelstoke Reservoirs Kokanee Population Monitoring	Schedule A: 5.b Schedule B: 1.a	Yes	No	24 October 2007	No
CLBMON-3 Kinbasket and Revelstoke Reservoirs Ecological Productivity Monitoring Program	Schedule A: 5.c Schedule B: 1.b	Yes	No	24 October 2007	No
CLBMON-4 Kinbasket Reservoir Fish Stranding Assessment	Schedule A: 5.d	Yes	No	24 October 2007	No
CLBMON-5 Kinbasket Reservoir Burbot Life History and Habitat Use Assessment	Schedule A: 5.e	Yes	No	24 October 2007	No
CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment	Schedule A: 5.f	Yes	No	24 October 2007	No
CLBMON-7 Kinbasket Reservoir Rainbow Trout Life History and Habitat Use Assessment	Schedule A: 5.g	Yes	No	24 October 2007	No
CLBMON-8 Kinbasket Reservoir Monitoring of the Valemount Peatland	Schedule A: 5.h	Yes	No	24 October 2007	No

2.0 MONITORING PROGRAM RATIONALE

Early on in the Columbia River Water Use planning (WUP) process, the WUP Consultative Committee (WUP CC) recognized that there was a great deal of uncertainty regarding whether the lack of constraints on operation of Kinbasket Reservoir was having a significant impact on fish and wildlife and associated habitat. A number of key hypothesized impacts were identified during the issue scoping phase (e.g., entrainment at Mica Dam, and interruption of natural sturgeon recruitment processes).

However, a general lack of data on the relative abundance, distribution, life history and seasonal patterns of habitat use and supporting ecosystem processes in the upper Columbia River and Kinbasket Reservoir, precluded incorporation of these concerns into Water Use Plan assessments.

The WUP CC explored alternative ways of operating Kinbasket Reservoir to provide benefits to fish and wildlife by imposing minimum elevation constraints. However, the ability to track the performance of the alternatives was limited to use of habitat-based measures (pelagic productivity), which were developed based on limited site-specific data and professional judgment. Initial modeling results showed that some improvements to pelagic productivity could be achieved through a minimum elevation constraint, but that this constraint would incur a high cost in foregone power generation. While the WUP CC agreed to stop exploring water management options for Kinbasket Reservoir for more cost-effective non-operational works, it was acknowledged that this decision was based on a number of uncertain assumptions about reservoir ecology and the influence of reservoir operations. The WUP CC underscored the need for better information to support future decision-making as a key outcome of the Columbia River Water Use planning process.

The operational link for many of the proposed monitoring studies, developed to address current data gaps, was considered tenuous given that there were no operational changes being considered for Kinbasket Reservoir. However, the WUP CC recognized that a large obstacle to recommending operational or physical works for the reservoir was the lack of quantitative data on fish and wildlife populations. Therefore, the proposed monitoring studies were accepted as meeting the Water Use Plan monitoring criteria, because they are the only tool available to validate the assumptions made by the WUP CC when deciding on operational changes.

Although no operating changes were considered for Revelstoke Reservoir, the WUP CC recommended that some of the fish-related studies in Kinbasket be linked to studies in Revelstoke to provide a comparison of trends to inform on operational impacts.

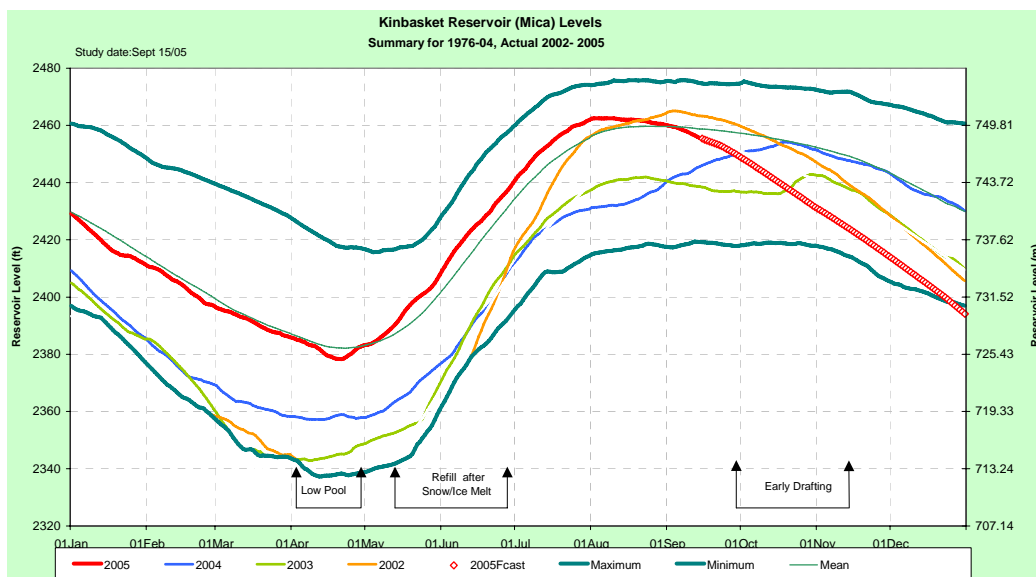


Figure 1 Seasonal pattern of water level drawdown and refill for Kinbasket Reservoir

Monitoring Study No. CLBMON-6 Kinbasket Reservoir Bull Trout Life History and Habitat Use Assessment

1.0 MONITORING PROGRAM RATIONALE

1.1 Background

Bull trout were identified by the Columbia River Water Use Plan Consultative Committee (WUP CC) as a key fish species of concern in Kinbasket Reservoir because of their importance as a sport fish and the potential for links between reservoir operations and bull trout population productivity. Bull trout are also blue listed (Species of Special Concern) by the BC Conservation Data Centre due to their sensitivity to habitat loss or degradation, over-exploitation and competition from other salmonids (CDC 2006). However, adfluvial bull trout populations are presently considered to be doing well in Kinbasket Reservoir (RL&L 2001), where they form a major component of the reservoir's sport fishery (Pole 1996, RL&L 2001).

The habitat use patterns of immature bull trout in lakes are largely unknown, and there has long been a gap in the understanding of bull trout life history (Muhlfeld and Marotz 2005). Although the life history and habitat use characteristics of immature bull trout in Kinbasket Reservoir have not been investigated, studies from other adfluvial bull trout populations suggest that emigration from natal streams to lakes occurs at age class 2+ or 3+, and sexually maturity is reached at age 4+ or 5+ (McPhail and Baxter 1996; Fraley and Shepard 1989; Mogen and Kaeding 2005). Recent work in Arrow Lakes Reservoir has shown that some bull trout in the Columbia do not reach maturity until 8+ or more (Bray and Mylechreest, in preparation). Riehle et al. (2005) observed seasonal variation in the rates of juvenile bull trout emigration from a stream to a lake, which occurred from April through October with a peak in May and June.

The WUP CC hypothesized that the greatest potential impact of reservoir operations on the productivity of bull trout populations is entrainment of immature bull trout through Mica Dam. While juvenile bull trout have not been recorded or noted in fish salvage operations at Mica Dam, and entrainment will be addressed separately by BC Hydro's Fish Entrainment Strategy, there is a data gap with respect to stream emigration and reservoir habitat use by juvenile bull trout. To address this data gap, the WUP CC recommended that a bull trout life history and habitat use assessment be undertaken in Kinbasket Reservoir. The objectives of the monitoring program are to examine the early life history and habitat use of juvenile bull trout to infer potential effects of reservoir operations. The program will include monitoring the size, age, and seasonal timing of juvenile emigration to the reservoir and assessment of nearshore habitat at time of out migration to determine use of these habitats.

Management Questions

The fundamental management questions to be addressed through the bull trout life history and habitat use assessment are:

- 1) What are the basic life history and habitat use characteristics of juvenile bull trout in Kinbasket Reservoir (e.g., distribution, age structure)?
- 2) What are the potential effects of reservoir operation on juvenile bull trout, given the seasonal timing, age, and size of juveniles emigrating to the reservoir?
- 3) Can modifications be made to the operation of Kinbasket Reservoir to protect or enhance juvenile bull trout populations?

1.3 Management Hypothesis

The primary management hypothesis to be evaluated by the monitoring program is:

H₀: Operation of Kinbasket Reservoir has no effect on juvenile bull trout, given the seasonal timing and size/age of juveniles emigrating to the reservoir.

1.4 Key Water Use Decision Affected

The proposed monitoring program will provide information required to support more informed decision-making with respect to the need to balance storage in Kinbasket Reservoir with impacts on fish populations in the reservoir. Specifically, it will provide the information that is required to support future decisions around maintaining the current operating regime or modifying operations through adjusting the drawdown schedule or minimum elevation to protect juvenile bull trout populations.

2.0 MONITORING PROGRAM PROPOSAL

2.1 Objectives and Scope

The primary objectives of this monitoring program are to obtain baseline data on the life history and habitat characteristics of juvenile bull trout in Kinbasket Reservoir, and to provide preliminary information to determine if reservoir operations could have an effect on bull trout populations.

The scope of this study will be to assess the life history and habitat use characteristics of juvenile adfluvial bull trout in Kinbasket Reservoir. The study will aim to determine timing and duration of juvenile bull trout emigration to the reservoir and to collect data on habitat use of out migrants within the reservoir to determine if nearshore habitats are used by juveniles.

The study will be conducted over a 3-year period, and will be initiated in Year 8 of implementation of the Columbia River Water Use Plan (2015).

2.2 Approach

The approach of the monitoring and assessment program will be to systematically sample tributary streams to Kinbasket Reservoir to determine emigration timing and size/ages of outmigrants as well as making an assessment of some nearshore habitats at the time of emigration to detect if juveniles are using this habitat.

2.3 Tasks

2.3.1 Task 1: Project Co-ordination

Project co-ordination will involve the general administration and technical oversight of the assessment study, which will include, but not be limited to: 1) budget management; 2) study team selection; 3) logistics co-ordination; 4) technical oversight in field and analysis components; and 5) facilitation of data transfer among other relevant programs.

A safety plan must be developed and submitted to the BC Hydro contact, for all aspects of the study involving field work, in accordance with BC Hydro procedures and guidelines. Specific safety training may be required.

2.3.2 Task 2: Sampling Plan and Field Implementation

A detailed sampling plan will be prepared to outline sampling protocols, locations, field schedule and logistics, and data collection standards based on the management questions and objectives in Sections 1.2 and 2.1. The plan will also describe data management protocols and data analysis tools, techniques, and methods. The following methodologies are suggested only as possibilities and have been used as the basis for establishing the budget. Alternative methodologies may be proposed during the contracting process. It is assumed for planning purposes that the first two years of the study will be required for exploration and emigration assessment and during the third year the study team could focus on investigating nearshore habitats via snorkeling or baited minnow traps, etc. Depending on annual conditions, nearshore assessments could be included each year.

Sampling of juvenile bull trout emigrants from a few tributary streams may be undertaken based on several factors, including: ease of access expected; abundance of bull trout; and suitability to available sampling methods. Tributaries with road access near their confluence and high expected bull trout densities may be included (e.g., Encampment Creek, and Hugh Allen Creek in the Canoe Reach (Oliver 2001)). Suitability of streams to available sampling methods will need to be assessed in the field. Methods may include: smolt fences; fyke nets; rotary screw traps; or inclined plane traps, depending on stream depth and velocity. Stream discharge (or water level), temperature, and turbidity should be measured as conditions warrant. Assessments of nearshore habitats for presence of and use by out migrants may be conducted by a combination of snorkel surveys and baited traps and will depend on site conditions.

2.3.3 Task 3: Data Analysis and Reporting

Brief technical reports will be prepared after the first and second years of the monitoring program. These reports will summarize the general biological characteristics of captured bull trout, as well as the age and seasonal timing of juvenile emigration to the reservoir. A final report will be prepared at completion of the study to summarize the results of the 3-year study, which will outline how the results relate to the ecological hypothesis and key management questions.

Reports will follow the standard format that is being developed for WUP monitoring programs. All reports will be provided in hard copy and as Microsoft Word and Adobe

Acrobat (*.pdf) format, and all maps and figures will be provided either as embedded objects in the Word file or as separate files.

2.4 Interpretation of Monitoring Program Results

The proposed monitoring program will provide a baseline dataset to quantitatively establish the basic biological characteristics of juvenile bull trout in Kinbasket Reservoir. This baseline dataset will provide information on potential factors affecting bull trout productivity to assess potential response of these populations to future changes in reservoir operations.

2.5 Schedule

The monitoring program will be initiated in Year 8 (2015) of implementation of the Columbia River Water Use Plan, and will be conducted over a 3-year period. Note that conditions on and around Kinbasket Reservoir can be dangerous and unpredictable, and the sampling program may be altered, interrupted or curtailed in any given year. Therefore, the program may not be concluded within a 3-year time frame.

2.6 Budget

The total annual budget for the monitoring program is estimated at \$114,193 (in 2004 dollars). The estimated budget breakdown by task and year is provided below in Table CLBMON-6-1.

3.0 REFERENCES

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