

COLUMBIA RIVER WATER USE PLAN UPDATE

MAY 2015

BC Hydro is pleased to provide highlights from the Columbia River Water Use Plan (WUP). Approved in 2007, the plan calls for a large number of monitoring programs and physical works projects to be implemented on the mainstem Columbia River from Kinbasket Reservoir in the north downstream to the Canada - United States border on the lower Columbia River over 12 years. These projects are expected to provide benefits to recreation, fisheries, wildlife, and archaeology.

BOAT RAMP IMPROVEMENTS

BC Hydro is committed to improving summer recreational boat access in Kinbasket and Arrow Lakes reservoirs as recommended by the Columbia River Water Use Plan.

Low spring water levels for Arrow Lakes Reservoir allowed significant progress on a number of boat ramp improvement



Building coffer dam at Nakusp to allow boat ramp panel installation.

projects to improve summer recreational boat access. The Nakusp boat ramp was extended as low as the water levels this year allowed. Ramp construction at Anderson Point, Edgewood, Syringa Creek Park, Burton South, and McDonald Creek Park was completed. Remaining work involves repositioning floating log breakwaters at both Anderson Point and Edgewood.

BOAT RAMP USE AND RECREATION USE STUDIES

BC Hydro is continuing to monitor recreationists' use of upgraded boat launch facilities on both the Kinbasket and Arrow Lakes Reservoirs through the use of vehicle counters and face-to-face surveys. While results to date suggest that upgraded boat launch facilities do not necessarily bring more recreationists to the area, or increase the number of repeat visits to the site, the results do show that user satisfaction has increased significantly with almost all facility



Day use at Syringa Creek Park on Arrow Lakes Reservoir.

upgrades. Study results also suggest that water levels have a modest effect on the number of recreationists that visit the Arrow Lakes reservoir, while other factors such as weather (i.e., precipitation, maximum daily temperature), the day of the week, and season have a greater influence on the number of recreationists using the area.

WOODY DEBRIS REMOVAL

BC Hydro continues to remove floating woody debris from Kinbasket and Arrow Lakes Reservoir and meets with Debris Management Committees in Nakusp, Golden, and Valemount to plan and prioritize work. Since 2007, BC Hydro has funded close to \$6 million of debris removal work on Kinbasket and Arrow Lakes Reservoirs.



Debris piles awaiting disposal on shoreline of Kinbasket Reservoir.

For Kinbasket Reservoir, it is anticipated that there will be very little spring work in 2015. Kinbasket Reservoir water levels are currently well above usual levels for this time of year due to the warm winter's reduced electricity demand and BC Hydro is currently forecasting high water levels this fall. Like other recent high water years, BC Hydro plans to implement a water-based debris removal program again in 2015 that will use tugs and barges to collect and corral woody debris using floating boomsticks. Last year, well over 30,000 cubic metres of debris was collected. On Arrow Lakes Reservoir, work continues as planned and spring 2015 work has already started between Deer Park and Edgewood on the lower Arrow Reservoir. In 2014, approximately 10,000 cubic metres of debris was collected and removed.

This year the provincial Comptroller of Water Rights will review the debris management programs for each reservoir and set the direction for the remaining three years of the programs under the Columbia River Water Use Plan (2016 to 2018). To inform this review, BC Hydro and the committees will meet to discuss program priorities and recommend strategies and annual budgets for the debris management programs moving forwards. For Kinbasket Reservoir, a joint Golden Debris Committee and Valemount Debris Committee is planned for the first time this spring to facilitate the discussion.

REVEGETATION

The goal of the revegetation program is to increase native plant cover and diversity in the drawdown zone of Arrow Lakes and Kinbasket Reservoirs to benefit wildlife, fish, archaeological site protection and shoreline stability. The large-scale planting in these reservoirs, focused on sedge, cottonwood and other native plant species, is largely complete. Monitoring to date of planted



Eastern kingbird perched on planted cottonwood stake.

sites shows mixed results for sites in Arrow Lakes Reservoir and generally poor results for Kinbasket Reservoir sites.

In December 2014, BC Hydro held a technical review of the revegetation program with representatives from First Nations, government agencies and contractors. The technical review discussed another possible approach for Kinbasket Reservoir to increase plant diversity. This approach would involve building small islands with woody debris and reservoir substrate that could then be planted with native vegetation that would provide some additional habitat for birds, insects, mammals, and amphibians. BC Hydro is evaluating this approach and planning is underway to conduct a small scale trial.

COLUMBIA RIVER FISH STUDIES

BC Hydro continues to conduct annual surveys on fish abundance, distribution and life history in the Columbia River below Revelstoke Dam and Hugh L. Keenleyside Dam to better understand the effects of dam operations on fish populations. The Lower Columbia River large river fish indexing program completed its seventh year of monitoring in 2013. Key species monitored include rainbow trout, mountain whitefish and walleye.

NORTHERN PIKE INVASION



Massive northern pike captured by Clint Tarala near Castlegar during the 2015 Northern Pike Derby. Photographer is Jeremy Baxter

Number of Northern Pike captured and/or observed by the Lower Columbia River Fish Population Indexing program each year.

YEAR	# OBSERVED	# CAPTURED	TOTAL #
Prior to 2010	0	0	0
2010	3	4	7
2011	1	8	9
2012	10	1	11
2013	90	45	135

BC Hydro is continuing field surveys during flow changes to assess current fish protection flow protocols. Juvenile fish are at risk of being stranded during flow reductions during the summer period when they are typically found in shallow, warm productive inshore areas. BC Hydro is also continuing to conduct yearly rainbow trout



Rainbow trout eggs.

spawning assessments in the lower Columbia River to assess the effectiveness of rainbow trout protection flows. Rainbow trout are a key sportfish in the mainstem Columbia River downstream of Hugh L. Keenleyside Dam, and typically spawn in March, April and May. Key spawning areas are Norn's Creek, and Norn's Creek Fan.

Rainbow trout eggs are vulnerable to reductions in water flows until the fry hatch about six to eight weeks later. Since 1999, BC Hydro has managed Columbia River flows downstream of the Hugh L. Keenleyside Dam to protect rainbow trout spawning locations (redds) from dewatering. Discharge flows from the facility are lowered during the peak rainbow trout spawning period to encourage the trout to spawn in deeper areas and reduce the chance that incubating eggs will be exposed. Yearly spawning assessments to assess whitefish spawning locations and timing in the lower Columbia River were completed in 2014. The main areas

of whitefish spawning documented by the fieldwork appear to be in the Kootenay River downstream of Brilliant Dam and near CPR Island in the Columbia River mainstem. A model based on these data will predict the potential number of whitefish eggs impacted by changes in Hugh L. Keenleyside discharges and help inform BC Hydro's operations.



Young whitefish captured near Genelle Islands

WHITE STURGEON

BC Hydro is working in cooperation with First Nations, federal and provincial Government partners, industry partners, and other stakeholders to help restore Columbia River white sturgeon populations under the Water Use Plan. BC Hydro is conducting several studies to better understand white sturgeon spawning, egg incubation, growth, and survival throughout the Columbia River. Results have shown sturgeon are spawning at multiple locations throughout the Columbia River including downstream of Revelstoke Dam, downstream of Hugh L. Keenleyside Dam and the Arrow Lakes Generating Station, near Kinnaird Rapids, downstream of Waneta Dam, and in the United States. A study to estimate the number of white sturgeon in the Columbia River between Hugh L. Keenleyside and Grand Coulee Dams continued in 2014. This study will provide a preliminary



Juvenile white sturgeon.

estimate of population size in 2015 and this will be used as a baseline for recovery planning.

BC Hydro continues to fund rearing of white sturgeon at the Wardner Fish Hatchery for release into the Columbia River. In recent years the young sturgeon have been grown to larger sizes before release to determine if it helps them to survive as very few juvenile sturgeon have been captured in the Arrow Lakes Reservoir to date. For the first time in 2014, over 5,000 sturgeon eggs were also collected from the wild and reared in a streamside white sturgeon conservation aquaculture facility on the Columbia River near the Waneta spawning site. This program is expected to improve the genetic diversity of hatchery released juveniles and expose eggs and larvae to more natural rearing conditions during incubation.

A considerable amount of effort has been put into estimating survival, abundance, and dietary preference of juvenile sturgeon in the lower Columbia River and Lake Roosevelt. Preliminary estimates suggest that survival of juvenile white sturgeon released from the hatchery is much higher than previously thought (up to 80 per cent compared to about 25 per cent). Work focused on describing the diet of juvenile White Sturgeon found that prey selection was variable and juveniles fed opportunistically on up to a dozen different prey types with the dominant ones being caddisflies, mysid shrimp, and snails. New juvenile survival estimates, along with long-term population targets, will be used to adjust, and likely reduce, the numbers of juvenile white sturgeon that will be released in future years.

HELP RELEASE WHITE STURGEON



Are you interested in releasing a juvenile white sturgeon? Come out to this year's white sturgeon release events hosted by the Upper Columbia White Sturgeon Recovery Initiative, and organized by the Fish and Wildlife Compensation Program.

For more details about these events, please contact Angus Glass

Fish and Wildlife Compensation Program

250 352 1300

Angus.glass@bchydro.com

DATE	LOCATION	DETAILS	TIME
May 5	Trail	Gyro Park	3:00 pm to 5:30 pm
May 7	Shelter Bay Provincial Park	50 km south of Revelstoke on Hwy 23	11:30 a.m. until 1:30 p.m.

RESERVOIR PRODUCTIVITY

BC Hydro is continuing with programs to investigate links between reservoir productivity and our operation of Kinbasket and Revelstoke Reservoirs. These programs are focusing on learning how the aquatic food webs work and whether we could make changes to our reservoir operations to improve biological production.

The food webs start with how nutrients such as phosphorus and nitrogen are made available to phytoplankton (algae) and then on up the food chain to zooplankton and kokanee populations. Field sampling for water and plankton is conducted from May to October and kokanee populations are assessed in late summer and fall. Moored temperature monitoring stations were installed in the reservoirs in 2012 to provide more continuous data on how water, and thus nutrients, move through the system.

While low in productivity, both Kinbasket and Revelstoke Reservoirs support short, efficient food chains that have resulted in relatively good kokanee populations. Kokanee numbers can vary widely by year as they are dominated by fry (up to 86 per cent). Numbers of all other ages have remained relatively consistent over the years, averaging about 2 million in Kinbasket Reservoir and 200,000 in Revelstoke Reservoir.



Launching reservoir productivity research vessel on Revelstoke Reservoir.

REVELSTOKE DAM MINIMUM FLOW

BC Hydro is continuing a suite of aquatic studies under the Revelstoke Flow Management Plan (RFMP) in the mid-Columbia River to determine whether minimum flows at Revelstoke Dam will provide expected fisheries benefits. BC Hydro began operating Revelstoke Dam to provide a minimum flow of 142 cubic metres per second in December 2010. Discharge flows over the last four years have varied throughout the day and typically been maintained

well above the minimum flow level. In February 2014, the RFMP underwent a technical review comprised of BC Hydro, agencies and contractors to discuss the status of each project. Participants at the review agreed that the projects were on track and that minor edits on how some data are collected would help BC Hydro achieve the RFMP's objectives. BC Hydro will be implementing those changes in 2015. The data collected so far have not shown any changes in fish distribution or diversity.

UNDERSTANDING EFFECTS OF RESERVOIR OPERATIONS

A key component of the Columbia River Water Use Plan is to better understand how BC Hydro's Arrow Lakes Reservoir operations affect fish, wildlife, vegetation, recreation and archaeology. A number of studies are underway to gather this information that will be used to better inform future decision making. A five-year burbot study and a five-year tributary access for spawning fish study were completed in 2013.

NESTING BIRDS

The drawdown zones of Kinbasket and Arrow Lakes Reservoirs provide important nesting habitat for as many as 60 bird species. Most bird nests are at risk from predators, including snakes,



Spotted sandpiper nest. Photo by Vicky Prigmore

mammals, and other birds. Birds nesting in reservoir drawdown zones (below the high water mark) also face the risk of flooding. Since 2008, BC Hydro has been examining the patterns of habitat use by nesting birds in Kinbasket and Arrow Lakes Reservoir drawdown zones to understand the impact of reservoir operations on bird nests and the significance of nest flooding to bird populations.

With almost 2,500 nests located since 2008, it is clear that both the number of species nesting, and the total number of nests, is greater at higher elevations within the drawdown zones because the drawdown zone habitat is more complex near the full pool elevation. Significantly, the risk of nest flooding decreases near full pool elevations. Species that nest at lower elevations are at greater risk of nest flooding. Nest flooding is uncommon in Kinbasket Reservoir and more of a concern in Arrow Lakes Reservoir due to the respective timing of reservoir operations at these two reservoirs. At the latter reservoir, nest flooding is a source of nest failure for both ground nesting species (e.g., Killdeer, Savannah Sparrow) and for birds that nest above the ground in shrubs or trees. Removal of shrubs at low elevations could reduce incidence of nest flooding, but would also reduce nesting opportunities.

A recent analysis suggested that the inundation of nesting habitat can reduce nest predation levels at shrub nests when these nests become surrounded by water. Nest survivorship rates for both Yellow Warbler and Willow Flycatcher remained about the same when the habitat was flooded, despite nest flooding. It was concluded that the positive impact of reservoir operations (reduced predation) was sufficient to offset losses from flooding. Further analysis is being conducted this year to understand if habitat flooding poses additional risk to fledglings.

BIRD MIGRATION

BC Hydro has two studies underway that specifically examine how reservoir operations affect stop-over habitat for birds during the spring and fall migrations. During the migration season, there is no better place to find waterfowl and shorebirds in the Revelstoke area than the drawdown zone of the Arrow Lakes Reservoir. Near year-round monitoring to count and determine the distribution of waterfowl has been ongoing since 2008. Analysis of this dataset aims to understand how reservoir water levels impact overall usage by migrant wetland birds.

In the fall, neotropical migrant songbirds also use foraging habitat in the Arrow Lakes drawdown zone. Some songbirds may migrate past the study area, while others choose to stop and 'fatten up' before travelling further down their migratory route. Study results show that water depth changes the probability of finding songbirds at different elevations in the drawdown zone.



Killdeer foraging in drawdown zone. Photo credit Jeannine Randall

An analysis of three years of data from birds captured at a site positioned high in the drawdown zone (Machete Island), indicated that there was no difference in the fattening rates of songbirds among years with different water regimes. Wilson's Warbler tended to fatten up more than the other species examined, which could indicate that drawdown zone habitats are more important for this species than others. Analyses of the multi-year data set will inform habitat management decisions and identify whether minor changes to reservoir operations can improve habitats for provisioning migrant birds during this energetically demanding time in their life history.

REVELSTOKE WILDLIFE ENHANCEMENT PROJECT

In response to concerns raised by the public, BC Hydro commissioned an independent detailed impact assessment of two proposed wildlife habitat enhancement projects south of Revelstoke at Cartier Bay in 2014. The proposed projects involved filling gaps in the abandoned railbed with engineered dykes to protect and expand the existing Cartier Bay wetland and create a new adjacent wetland. The assessment concluded that the Cartier Bay area, particularly the existing wetlands, already have high ecological values and the proposed projects may put those at

risk. BC Hydro is currently reviewing the assessment report and implications for the proposed enhancement projects. An update will be provided when available.

AMPHIBIANS AND REPTILES

BC Hydro is conducting an amphibian and reptile monitoring program every two years in the drawdown zones of Kinbasket and Arrow Lakes reservoirs. The objective of the program is to understand how amphibians and reptiles are using the drawdown zone. For Arrow Lakes Reservoir, surveys are conducted in Revelstoke Reach (Airport Marsh, Montana Slough, Cartier Bay), Beaton Arm, East Arrow Park and Burton Creek, and near Edgewood (north and south of Eagle Creek). In Arrow Lakes Reservoir, four species of amphibians (Long-toed Salamander, Western Toad, Columbia Spotted Frogs and Pacific Chorus Frog) and six species of reptiles (Northern Alligator Lizard, Western Painted Turtle, Common Garter Snake, Western Terrestrial Garter Snake, Western Skink, and Rubber Boa) have been found. For Kinbasket Reservoir, surveys are conducted in Canoe Reach (Valemount Peatland and Ptarmigan Creek area) and Bush Arm. So far fewer species have been found and these species include Western Toad, Columbia Spotted Frog, Long-toed Salamander, and Common Garter Snakes.

A key question for both reservoirs is to understand how amphibians and reptiles use the drawdown zone habitat that is only seasonally available when reservoir water levels are below

full pool. Researchers have outfitted a number of amphibians and reptiles in Kinbasket and Arrow Lakes Reservoir with radio-tracking devices so they can record their movements over a range of reservoir water levels over the summer and late into the fall.



Northern Alligator Lizard.

Work also continues on a study to understand the life history of Western painted turtles living in the Upper Arrow Lakes Reservoir near Revelstoke. Visual surveys and radio telemetry of tagged turtles along with environmental monitoring will continue to understand turtles' distribution, habitat use, abundance, and productivity.

UNDERSTANDING WESTERN TOAD MOVEMENTS



A radio-tagged Western Toad in Arrow Lakes Reservoir. Photographer is Virgil Hawkes.

Western Toads are listed as a Species of Special Concern by the federal Species At Risk Act. Study results so far from the amphibian and reptile monitoring program suggest that Western Toads migrate to the reservoir drawdown zones to breed between late April and early May. Toads stay in the drawdown zone for two to three weeks and then after breeding, most toads move back to adjacent upland summer and fall habitat. Researchers caught numerous toads and garter snakes in the Arrow Lakes Reservoir and Kinbasket Reservoir drawdown zones. Some toads were equipped with radio transmitters to track their movements. Tracking data showed that one individual toad moved from Montana Slough in the Arrow Lakes Reservoir drawdown zone to a ski run at Revelstoke Mountain Ski Resort, a distance of over 1.5 kilometres, over roughly a five-week period.



Lazuli bunting in Arrow Lakes Reservoir. Photo credit: Russell Cannings

HOW TO GET MORE INFORMATION

Copies of the Columbia River Water Use Plan, study terms of reference, reports, performance measures, Columbia River WUP Consultative Committee report, and other water use planning information are available at bchydro.com/planning_regulatory/water_use_planning.html.

CONTACT A BC HYDRO COMMUNITY RELATIONS REPRESENTATIVE

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