# 4.0 EXISTING CONSERVATION MEASURES

## *4.1 Inventory & Research*

Relatively little was known about upper Columbia River white sturgeon until the last 10 years. Studies on Columbia white sturgeon in Canada were initiated in 1990 as part of a five-year B. C. Hydro inventory of fish composition, distribution, abundance, habitat use, and movements in the Columbia River below HLK (Hildebrand and English 1991). Based on initial findings of a skewed white sturgeon size and age-class composition, intensive annual studies commenced in 1992 on spawning, sex ratio, maturation, population size, and critical habitats (RL&L 1994a, 1995, 1996a). In 1995 B. C. Environment began coordinating studies on white sturgeon distribution and status throughout the Canadian portion of the Columbia River Basin to: 1) confirm the existence and determine population status of remnant populations of white sturgeon in Kinbasket, Revelstoke, Duncan, and Arrow reservoirs, as well as Slocan and Kootenay lakes; 2) monitor the status of the known population in the Columbia River below HLK; 3) monitor spawning frequency and success at the Waneta spawning site; and 4) radio or sonic tag pre-spawning females to determine locations of other possible spawning areas.

A variety of inventory and directed fish studies have been conducted in the U.S. from Lake Roosevelt to the U.S. border but most of this work has been concentrated in Lake Roosevelt on species other than sturgeon. Lake Roosevelt fisheries and limnology was inventoried by the U.S. Fish and Wildlife Service from 1980 to 1985 (Beckman et al. 1985). The Spokane Tribe has conducted an intensive research program on Lake Roosevelt since 1990 (Underwood 2000). Small, directed sturgeon studies have been conducted on four occasions. Sturgeon were collected from Lake Roosevelt for genetic analysis during the early 1980s (Brannon et al. 1985). A sonic telemetry study was conducted from 1988-1990 to track sturgeon movements (Brannon and Setter 1992). During 1998, 204 sturgeon ranging in size from 33 to 270 cm FL were captured from Lake Roosevelt to the U.S. border by the Washington Department of Fish and Wildlife and the U.S. Geological Survey using setlines, gillnets, and bottom trawls (Kappenman et. al. 2000). Finally, a gillnet survey for juvenile sturgeon in that same area was conducted by the Spokane Tribe in 2001.

## *4.2 Listings*

The federal committee on the Status of Endangered Wildlife in Canada (COSEWIC) first listed white sturgeon as Vulnerable in April 1990. In November 1991, the British Columbia Conservation Data Centre designated white sturgeon in the province as BLUE listed (S3 Ranking) (Cannings 1993). This designation identifies a species that is rare, uncommon or susceptible to large-scale disturbances (e.g., may have lost extensive peripheral populations). In December 1994, this ranking was upgraded to RED listed (threatened or endangered). At that time, white sturgeon were separated into four populations for monitoring purposes. These were the Fraser, Nechako, Kootenay, and Columbia populations. The Fraser River population was classed as S2 (imperiled). The Nechako, Kootenay, and Columbia stocks were classed as S1 (critically imperiled). At the time this plan was prepared, the Canadian federal government was considering legislation designed to protect and recover wildlife at risk of extinction in Canada. The proposed Species at Risk Act (SARA) would provide for the protection and recovery of designated species and their habitats. The listing of species under SARA would be based on status assessments and designations by COSEWIC.

In the United States, the U.S. Fish and Wildlife Service listed the Kootenay River population of white sturgeon as Endangered on September 6, 1994 (59 FR 45989) under the authority of the Endangered Species Act of 1973, as amended. Other upper Columbia River white sturgeon populations are not formally listed in the U.S. by Washington state or the Federal government.

### *4.3 CITES*

A Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides umbrella protection against illegal or unsustainable international trade. In 1998, parties to CITES including Canada and the U.S. placed all of the world's previously unlisted sturgeon and paddlefish species in Appendix II in response to increasing demands of the international caviar trade and collapse of Caspian sea sturgeon fisheries. Commercial trade in Appendix II species across international borders is subject to regulation and allowed only if permits are obtained stating that trade is non-detrimental to the species' survival in the wild and that the species to be exported was legally acquired. A review process can result in country or species-specific recommendations for measures to maintain the species in its native range (TRAFFIC International, 2001). Implementation of CITES falls under the responsibility of the U.S. Fish and Wildlife Service and the Canadian Wildlife Service's CITES Office. Fish transplants within British Columbia are coordinated by a Federal-Provincial Introductions and Transfers Committee that acts as an advisory body to decision makers in both levels of government. Fish Transplants in Washington are regulated by the Washington Department of Fish and Wildlife.

CITES primarily affects the upper Columbia River white sturgeon recovery effort by requiring appropriate permits for moving white sturgeon across the border. For instance, CITES paperwork has been required to move Kootenay hatchery sturgeon to the Kootenay trout hatchery. This constraint requires significant lead time in planning any inter-boundary transplants.

### *4.4 Fishery Regulation*

The recreational sturgeon fishery in the Canadian portion of the upper Columbia River basin has been severely limited since 1960 and closed completely in 1996 (Table 3). Limited take was permitted until 1993. In 1994, commercial and sport harvesting of sturgeon became illegal in British Columbia, and many First Nations people voluntarily stopped their sustenance harvests. Catch and release fishing was permitted at this time. The Columbia River from HLK to the Canada-U.S. border was closed to all sturgeon fishing including catch and release after 1 April 1996. The closure included the Kootenay River downstream of Brilliant Dam and the Pend d'Oreille River downstream of Waneta Dam.


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**Table 3. White sturgeon angling regulations in B.C. for the Columbia River from HLK downstream to the Canada-U.S. border.**

| Period | Regulation |
|---|---|
| 1960s to 31 March 1978 | yearly quota of one, by permit only (no size restriction) |
| 1 April 1978 to 31 March 1992 | yearly quota of one, by permit only (none under 100 cm TL) |
| 1 April 1992 to 31 March 1993 | yearly quota of one, by permit only (none under 100 cm or over 150 cm TL) |
| 1 April 1993 to 31 March 1996 | catch-and-release only |
| 1 April 1996 to present | catch-and-release fishery closed; complete angling ban |

In the portion of the Columbia River in Washington (U.S. border to Grand Coulee Dam), recreational angling and harvest regulations prior to 1995 allowed the harvest of one sturgeon per day within a slot limit of 1.22 m (48 in.) to 1.68 m (66 in) total length, to an annual limit of 10 fish. Sturgeon retention was prohibited beginning in 1995 but catch and release fishing was allowed. Catch and release fishing in the Washington portion of the upper Columbia River was prohibited in 2002 by the Washington Fish and Wildlife Commission.

## *4.5 Water Management*

Investigations are underway on the effects of Pend d'Oreille River flow management on sturgeon spawning in the Columbia River downstream from Waneta Dam. The program provides for minimum flow releases during the June to July spawning period of 10,000 cfs during the day and 5,000 cfs during the night. The day-time minimum is expected to provide the mean column velocity of 0.8 m/s or greater believed necessary to stimulate spawning. The night-time minimum is expected to achieve target mean column velocities of 0.4 m/s or greater expected to reduce predation on deposited eggs. The program should provide a more stable spawning and incubation regime, particularly during low water years and promote earlier spawning that would reduce the incidence of spawning and egg incubation at temperatures above the optimal development range. Cominco Ltd. committed funds for a minimum five-year monitoring study beginning in 1996 as a condition of approval for their upgrade project at Waneta Dam.

Similar flow augmentation efforts have been attempted in the Kootenay River system but their failure to date to increase wild recruitment demonstrates the multivariate nature of controlling factors. Flows from Libby Dam have been increased during the spawning period from 1991 through 1997. Augmented flows were greater than would otherwise have been expected to occur but were less than historic levels. Results of flow augmentation have been consistently limited. Few to many eggs are obtained each year but with few viable larvae (USFWS 1999).

Water management recommendations of the present recovery plan will be an important consideration of the Water Use Planning (WUP) process in the Canadian portion of the Columbia Basin. This program was developed by the B. C. provincial government to evaluate and refine the operations of water use projects throughout the province. At the direction of the provincial government, B. C. Hydro has undertaken WUP processes for all of its facilities, including those in the Columbia Basin. Given that WUP processes are a means of examining and modifying system operations to address various interests in the watershed, including fisheries, the Columbia WUP process represents an important mechanism for consideration and implementation of Upper Columbia white sturgeon recovery measures related to water management.

### *4.6 Water Quality Protection & Restoration*

A ruling against the U.S. Environmental Protection Agency in 1994 prompted a process for dealing with total maximum daily loads (TMDLs) in imperiled (303(d) listed) water bodies throughout Oregon, Washington, and Idaho. A TMDL is a written, quantitative assessment of water-quality problems and contributing pollutant sources (EPA 2002). It specifies the amount of a pollutant or other stressor that needs to be reduced to meet water-quality standards, allocates pollution-control responsibilities among sources in a watershed, and provides a basis for taking actions needed to restore an imperiled water body. TMDL's address point, non-point and naturally occurring sources and are developed to provide an analytical basis for planning and implementing pollution controls, land management practices, and restoration projects needed to protect water quality.

The States of Idaho, Oregon, and Washington, and the U. S. Environmental Protection Agency (EPA) are working in coordination with the Columbia Basin Tribes to develop Total Maximum Daily Loads (TMDL) for temperature and Total Dissolved Gas (TDG) on the Columbia River (EPA 2002). States must develop TMDLs that will achieve water quality standards, allowing for seasonal variations and an appropriate margin of safety. Completion of a TMDL typically takes three to five years and each of the states and territorial water quality agencies are responsible for implementing the TMDL process. In Washington State, the Department of Ecology has been charged with TMDL development.

### *4.7 Pollution Control*

There are several sources of contaminants to the Upper Columbia River watershed in British Columbia and the United States, including Cominco Ltd. at Trail, B.C., Celgar Pulp Company at Castlegar, B.C., municipal sewage treatment plants, abandoned mines, and tailing dumps. Many of these sources have made substantial effort to establish cleaner operating procedures within the last 25 years; however, a great deal of contaminant input occurred prior to these upgrades and potential effects to sturgeon are unknown.

Cominco has been operating since 1906 (MacDonald Environmental Sciences Ltd. 1997). However, over the past 25 years, the industry has initiated a long-term program to modernize and expand its operations at the Trail plant. Some of the major improvements include an effluent treatment plant, zinc electrolyte stripper, mercury removal plant, drainage control system, heat exchanger, elimination of phosphate-based fertilizer plant, and a slag containment facility. These modernization projects have significantly reduced loading of metals to the Columbia River. Accidental discharges currently comprise the majority of contaminant inputs. Between January 1987 and January 1993, there were a total of 56 spills from Cominco Ltd., into the Upper Columbia River. These spills released multiple tons of compounds containing sulphuric and phosphoric acid, zinc (various forms), gypsum, mercury, copper sulphate, ammonia, coal dust, furnace and compressor oils, sodium bisulphite, phosphate, ammonium sulphate, arsenic, cadmium oxide, chlorine, lead, slag, oxide dust, and various undetermined solutions.

Celgar Pulp Company facility is permitted to release up to 135,000 $m^3$ of treated effluent and cooling water per day (MacDonald Environmental Sciences Ltd. 1997). The effluent is discharged into the river in the reach between the HLK Dam and the community of Castlegar. The characteristics of the industrial effluent have changed dramatically since the plant expansion and upgrade which included a new wastewater treatment system. Loadings of biological oxygen demand and total chlorinated organics have decreased by 93% and 88% respectively between 1989 and 1994. Total suspended solids were reduced by 37% after 1993 and solid composition shifted from fiber and lime in nature to a low-impact bacteria composition (B. Duncan, personal communication.) Technological improvements at the mill have also resulted in decreased loading of phosphorus, nitrogen, chlorophenols, resin acids, and phenolics.

There are two major municipal discharges to the Columbia River between HLK and the US border. The City of Castlegar (population 7,002) discharges secondary treated sewage to the Columbia River at Castlegar. The cities of Trail, Warfield and Rossland as well as the communities of Rivervale and Oasis (total population 13,600) collect and discharge their primary treated sewage by outfall into the river near Trail. Primary treatment facilities physically remove wastes that may be screened, float to the top or settle to the bottom. Secondary treatment facilities remove remaining organic particles through bacterial action in aeration basins. Neither treatment removes all polluting chemicals such as metals and organic compounds that may interfere with endocrine function (Raloff 1998). Little information pertaining to organic and metal content of effluents is available for these sewage treatment plants or from other non-point sources of drainage, runoff, or septic tank seepage. Therefore, little has been done to abate contaminant input from these sources. However, efforts are now being focused on both sides of the border to address these issues using a "watershed approach" to environmental protection.

There are numerous abandoned mines and inactive mining districts throughout the Upper Columbia River watershed (Raforth et al. 2000). Inactive and abandoned mines, waste rock dumps, and tailings can be a source of contaminated water, including acid rock drainage, that has the potential to severely impact nearby streams. Almost no data are available to evaluate the extent of the problem; however, the British Columbia government, U.S. EPA and the Washington Department of Ecology are beginning to address some of these issues through investigations and studies, some of which are being conducted under existing legislative mandates.

During the past 10 years, several studies have been conducted to assess impacts of existing levels of contaminants on fish in Lake Roosevelt and the Upper Columbia River (Bortleson et. al. 1994; CRIEMP 1994; Munn et. al 1995; Raforth et. al 2000; Sedar et al. 1997; Era and Serdar 2001; G3 Consulting Ltd. 2001; EPA 2002). During 1991-1993, a Columbia River Integrated Environmental Monitoring Program (CRIEMP) was initiated to define the status of the aquatic environment between HLK and the International Boundary. This survey incorporated water, sediment, and biological indicator parameters to identify influences of chemical constituents. The CRIEMP survey also set the stage for development of water, sediment, and tissue standards and monitoring objectives for the Upper Columbia River in Canada (MacDonald Environmental Sciences Ltd. 1997).

Although TMDLs primarily focus on parameters such as dissolved gas, suspended solids, pH and temperature, the Upper Lake Roosevelt watershed has also been slated for assessment of PCBs, arsenic, dioxins and sediment bioassays. These assessments will be used to establish and/or revise tissue and sediment guidelines as well as establish current distribution and effects on the aquatic environment.

### 4.8 Reservoir Fertilization

Fertilization projects undertaken in Kootenay Lake and Arrow Reservoir may benefit sturgeon as well as other members of the aquatic community. Fertilization of Kootenay Lake was initiated in 1992 as a mitigation technique to restore the nutrient balance and assist in the recovery of salmonid populations which had suffered from a lack of forage. Phytoplankton populations at sampling stations closest to the fertilization zone responded positively (up to 4 times mean biomass) to fertilizer loading. Zooplankton and mysid populations increased in abundance and biomass with high fertilization loading (1992-1996). Kokanee populations increased in both escapement and in-lake abundance to levels previously observed in the late 1970's. In years when fertilizer loading was reduced (1997-2000), phytoplankton, zooplankton and kokanee populations began to decline. Total kokanee escapement to Meadow Creek has increased from a mean of 678,844 (1969-1991) to a mean of 787,920 (1992-2001). Mean female kokanee spawner length at Meadow Creek has also increased from a mean of 21.6 cm (1969-1991) to mean of 23.1 cm (1992-2001). Monitoring has shown that phytoplankton and kokanee abundances appear to track the fertilizer loading fairly closely (i.e., decreased fertilizer loads causes reduced phytoplankton and kokanee abundances).

A fertilization operation was initiated on the Arrow Lakes Reservoir in 1999 in response to dramatic declines in kokanee escapement, spawner size, and low in-lake abundance. After only three years of fertilization, phytoplankton, zooplankton, and mysid densities have increased from pre-fertilization levels. Initial changes in kokanee populations have been similar to changes observed in Kootenay Lake with improvements to in-lake abundance, escapement, spawner size, and fecundity. Spawner size increased in the first year of fertilization, but has declined with increased fish abundance in Year 3. In Year 2 of fertilization, kokanee in-lake abundance was considerably higher (11.6 million) than the long-term average of 3.2 million (1988-1998). In Year 3 of fertilization, in-lake kokanee abundance showed a further increase. Escapement increased in fertilization years from 101,000 kokanee in 1999 to 137,000 in 2000 and 142,000 in 2001, compared with the years preceding fertilization (mean of 76,000 kokanee in 1994-1998).

### 4.9 Kootenay River Sturgeon Recovery Program

A formal recovery plan adopted for Kootenay River white sturgeon in 1999 provides a blueprint for many of the measures included in this plan for the upper Columbia River. Recovery of the Kootenay River white sturgeon was deemed contingent upon re-establishing natural recruitment, minimizing additional loss of genetic variability to the population, and successfully mitigating biological and physical habitat changes caused by the construction and operation of Libby Dam. Conservation or enhancement measures being investigated or implemented by the USFWS for the recovery of this population include:

1) experimental flow manipulations of the Kootenay River to stimulate spawning and enhance spawning success;
2) operation and maintenance of an experimental white sturgeon hatchery by the Kootenay Tribe of Idaho at Bonners Ferry, Idaho;
3) fertilization of Kootenay Lake to increase biological productivity and thereby increase the potential prey base for white sturgeon;
4) development of a computer model to assess the effects of Libby Dam operations and develop Integrated Rule Curves (IRC's) to balance competing water demands

5) continued research and monitoring to identify environmental factors limiting the population and to recommend appropriate conservation and management actions.

The Kootenay sturgeon hatchery is designed to help preserve wild genetic variability, help rebuild the natural age-class structure, and prevent extinction until natural recruitment can be restored. Experimental releases of hatchery-reared offspring (age 1-4) and subsequent recaptures have provided valuable information on movements, habitat use, survival, and growth of juveniles. The Kootenay Trout Hatchery operated by the British Columbia Ministry of Water, Land, and Air Protection at Fort Steele provides a failsafe rearing facility for Kootenay River sturgeon spawned at the Kootenay River sturgeon hatchery. Juvenile sturgeon are reared at the Kootenay Trout Hatchery to ensure brood year production is not lost if problems arise at the Bonners Ferry facility. Failsafe fish are released in Kootenay Lake to experimentally determine lake suitability and capacity for sturgeon, released in the Canadian portion of the Kootenay River to seed available habitat, or sacrificed where in excess of recovery or research needs.

### *4.10 Upper Columbia River Sturgeon Conservation Hatchery Program*

A pilot hatchery for Columbia white sturgeon has been developed by modifying an existing provincial trout hatchery (Hill-Mackenzie Creek Hatchery) located at Galena Bay, north of Nakusp, British Columbia. Broodstock collection and spawning began in 2001 and juveniles were released in 2002. The hatchery provides holding facilities for up to 12 adult sturgeon, incubation capacity for 4-6 families of sturgeon, and rearing capacity to produce 1,000-2,000 fish per family. Sturgeon are reared in quarantine/isolation - no other fish are reared at the site. Water sources are ground water and creek water. Heated water is available for adult holding, incubation and rearing facilities. Hatchery equipment includes an adult transport tank and trailer to move fish from capture location to the holding facilities. The hatchery also includes an adult spawning facility.

Total cost of hatchery modifications for sturgeon was approximately CAD $600,000 and all funds were provided by B. C. Hydro. Capital work completed at the hatchery included:

1) Assessment of existing buildings and process systems including: mechanical, electrical, water systems and controls.
2) Structural, mechanical and electrical alterations to the existing generator and aeration building to incorporate: new propane water heating system; new aeration columns; new head tanks; distribution piping; electrical service and controls.
3) Structural, mechanical and electrical alterations to existing hatchery building including: construction of an "isolation wall" between adult holding and incubation/fry rearing areas; construction of a spawning room; removal of existing raceways; installation of circular ponds; removal and replacement of water supply system; relocation of process water drains.
4) Construction of effluent water infiltration pond.
5) Acquisition of various fish culture equipment required for the culture of sturgeon at the site including transport and rearing equipment.