Rainbow Trout of the Sutherland River in the Babine Lake Watershed, British Columbia, and Risks Associated with the Proposed Northern Gateway Pipeline

A SUBMISSION TO THE ENBRIDGE NORTHERN GATEWAY PROJECT JOINT REVIEW PANEL

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BACKGROUND

Enbridge's proposed Northern Gateway pipeline, currently undergoing environmental assessment by the National Energy Board, traverses major watersheds whose fish values are of enormous economic, ecological, recreational, and cultural value to Northern British Columbia. In addition to anadromous (sea-going) salmon populations, non-anadromous fish stocks are also of high value to the province. One such stock is the Babine Lake rainbow trout population that utilizes the Sutherland River system for spawning and rearing. These rainbow trout are a distinct large-bodied ecotype that are relatively rare in North America. The pipeline route traverses through the upper reaches of the core spawning and rearing habitats of these fish.

The Sutherland River is located approximately 30 km from Fort St. James, and 40 km from Fraser Lake, British Columbia, and flows into Babine Lake's southeastern end (Figure 1). Approximately 20 km of the proposed Northern Gateway Pipeline traverses the relatively pristine upper Sutherland River watershed, and includes crossings of the mainstem Sutherland River and its major tributary Duncan Creek.

The Sutherland River is a small stream[1] that has a mainstem length of approximately 70 km between Sutherland Lake and Babine Lake. The lower 7 km of Duncan Creek also provides key rearing habitat for Sutherland rainbow trout. The majority of the watershed is protected within either the Class A Sutherland River Provincial Park or the Sutherland River Protected Area (Figure 1). Despite the small size of the area, conservation values in the park and protected area have been rated very high by the Provincial Protected Areas Team - amongst the highest in Skeena Management Region. This is due to the presence of rare plant communities, diverse and high value habitats for wildlife including moose, grizzly bears, reptiles, and waterfowl, and the critical fish habitat for Babine Lake rainbow trout that were recognized to be of provincial significance by the BC Ministry of Water, Land, and Air Protection (MWLAP 2003).

Fish habitat in the Sutherland River watershed is complex and of high quality, with abundant instream wood and overhead vegetation providing cover, abundant low velocity rearing areas owing to ideal gradient and stable flows, and a lack of habitat degradation (Figure 2). Road access to the river is extremely limited (Hagen 2008), and boat access restricted to the vicinity of the mouth only. Existing habitat threats to this highly valuable rainbow trout population have been low and mainly associated with logging in the headwater areas. The pipeline, with the risk associated with leaks or ruptures, poses a threat to the core habitats in this watershed.

[1] mean annual discharge at the mouth roughly estimated to be 4 m^3/s; Hagen 2008

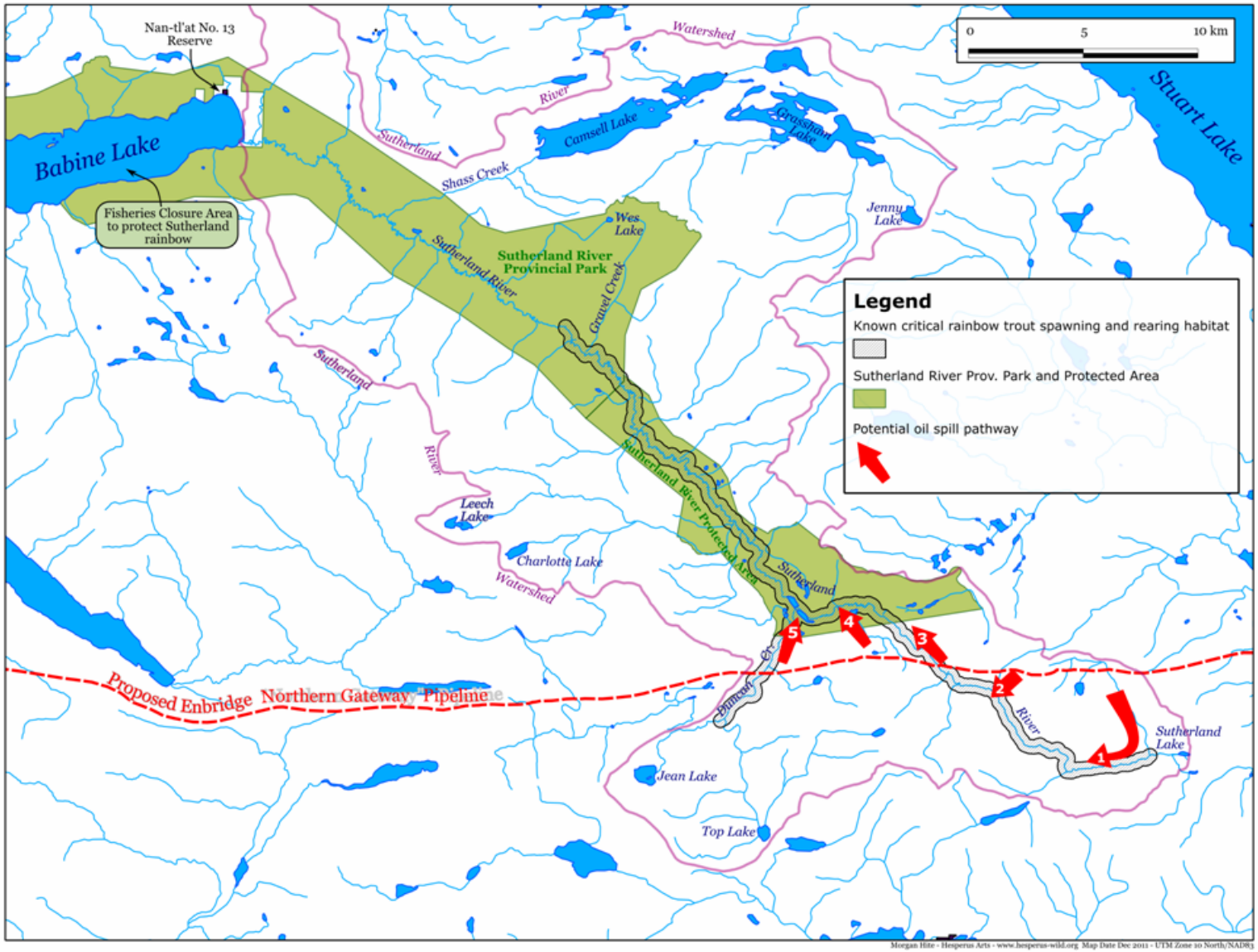

Figure 1. Critical rainbow trout spawning and rearing habitat, protected areas, the proposed Enbridge Northern Gateway pipeline route and potential oil spill pathways and in the Sutherland River watershed, British Columbia.

The goal of this report is to review existing information in order to identify 1) the unique nature and life history of the Sutherland River's rainbow trout population, 2) the importance of the population to the Babine Lake fishery and the Yekooche First Nation, 3) current population status, and 4) to what extent the population is threatened in the event of a significant pipeline leak or catastrophic pipeline rupture and spill into the Sutherland River or Duncan Creek.

LIFE HISTORY AND HABITAT USE OF SUTHERLAND RIVER RAINBOW TROUT

Life history, habitat use, and population spatial structure of Sutherland River rainbow trout have been investigated in four previous studies. Juvenile rainbow trout abundance estimates for the Sutherland system were developed from sampling in 1988 (Bustard 1989) and 2008 (Hagen 2010; Figures 2 and 3). Tissue samples collected during the latter study were utilized in the genetic analyses of Koehler (2010) to evaluate population spatial structure within the Sutherland and Babine Lake watersheds. A netting/radio telemetry study, conducted during the spring spawning migration, sampled spawners at the mouth of the Sutherland River for length and age data, identified spawning locations upstream, and developed a rough estimate of adult rainbow trout abundance (Bustard 1990).

Based on the radio telemetry data of Bustard (1990), Sutherland River spawners appear to mill about in the southeast end of Babine Lake during late April and early May. Fish enter the Sutherland River for spawning from mid-May to early June, and spawning occurs between mid-May and the end of June. The majority of fish radio-tagged in 1989 spawned in Duncan Creek and the Sutherland mainstem downstream from Duncan Creek. Only a single spawner utilized the Sutherland upstream from Duncan Creek, suggesting that beaver dams located in this reach were obstacles to migrating spawners (Bustard 1990). However, during juvenile sampling in 2008, redds[2] were identified by Hagen (2010) in the upper Sutherland mainstream well above Duncan Creek. Use of the upper Sutherland by Babine Lake fish was confirmed by the genetic analysis of tissue samples taken from young-of-the-year trout located approximately 50 km from Babine Lake (Hagen 2010; approximately 60 km measured along the stream). Redds observed in Duncan Creek in 2008 suggested Babine Lake spawners utilize at least 6 km of this stream (Hagen 2010). The route of the proposed Enbridge Northern Gateway pipeline crosses through these critical spawning and rearing sections of the Sutherland River and Duncan Creek (Figure 1).

[2] nests excavated into the gravel by female trout.

Figure 2. Juvenile rainbow trout sampling site in the upper Sutherland River above Duncan Creek, September 2008.

Figure 3. Juvenile rainbow trout captured in the Sutherland River, September 2008.

Juvenile rainbow trout dominate stream habitats in the Sutherland River system, with approximately 300,000 fish between 0 and 3 years of age estimated to be present in 2008 (Hagen 2010). Most of this rearing occurs upstream of the meandering, silty lower reach of 25.5 km (Reach 1 in Bustard 1989; Figure 4). Mountain whitefish, coho salmon, and sculpins have a patchy distribution and occur only at low abundances. Spawning sockeye salmon (lower Sutherland and Shass Creek) and kokanee (up to Duncan Creek) are also present (Hagen 2010).

Most rainbow trout appear to remain in the Sutherland system for three years. Young-of-the-year densities were highest in the Sutherland mainstem downstream from Duncan Creek (Hagen 2010; Bustard 1989; Figure 5), corroborating radio telemetry data (Bustard 1990) suggesting this is an important stream reach for spawning. However, older juvenile age classes (e.g. Figure 3) were more evenly distributed (Hagen 2010; Bustard 1989), suggesting that these larger, more mobile fish may re-distribute themselves along the length of the Sutherland system. Alternatively, the more consistent densities may be the result of density-dependent survival acting over an additional year or two of stream life. Although the lowermost 25.5 km of the Sutherland (Figure 4) cannot be sampled effectively for juvenile trout, it appears that this reach is less important for rearing rainbow trout and few juveniles utilize the river near its mouth (Bustard 1989).

In Babine Lake, rainbow trout that have migrated from the Sutherland River rear to adulthood in pelagic (offshore, open-water) habitats and are thought to be primarily piscivorous (fish-eating; DeGisi 2002). Scale samples (which can be utilized to estimate the ages of rainbow trout) taken from Sutherland rainbow trout spawners in 1989 suggested that they grow more rapidly than the average for Babine Lake as a whole (Bustard 1990). Adult, Sutherland River rainbow trout spawners are also relatively old before returning to the system to spawn. All fish sampled by Bustard (1990) were age 6 or older, with most spawners being 7 and 8 and the oldest being 10 years old. Sutherland rainbow trout spawners are large (Figures 6 and 7). The 1989 sample ranged from 45-83 cm and 1.2-7.3 kg, and averaged 57 cm and 2.6 kg, respectively. Anecdotal reports have indicated that rainbow trout up to 12 kg have been captured in the past (Bustard 1990).

Figure 4. Meandering, silty lower reach of the Sutherland River (Reach 1 of Bustard 1989).

Figure 5. Upper Sutherland River downstream of Duncan Creek, which supports high densities of young-of-the-year rainbow trout.

Figure 6. Adult male rainbow trout, captured at the mouth of the Sutherland River in spring, 1989 (from Bustard 1990). The radio tag antenna can be seen protruding from this fish's mouth.

Figure 7. Adult female rainbow trout, captured at the mouth of the Sutherland River in spring, 1989 (from Bustard 1990).

IMPORTANCE TO THE YEKOOCHE FIRST NATION

Dean Joseph, Fisheries Manager for the Yekooche First Nation, was interviewed in order to identify traditional First Nations use of the watershed and present and future management activities.

Traditional use of Sutherland rainbow trout and importance to Yekooche First Nation. Members of the Yekooche First Nation have fished for Sutherland rainbow trout for generations, and occupied IR #13 (Figure 1), one of the four reserves of the Yekooche (Sutherland, Cunningham Lake, Whitefish Lake, Yekooche-Stuart Lake), seasonally during the spring-fall period in each year. In addition to fishing for rainbow trout in the spring, the First Nations traditional economy in the Sutherland watershed includes gathering, hunting, and fishing for salmon. Members of other Carrier-Sekani Tribal Council First Nations made use of the Sutherland watershed as well. This was agreeable to the Yekooche provided that the watershed and its resources were treated with respect. Stewardship of natural resources and fishery management by the Yekooche have traditionally been based on traditional knowledge and long experience in the watershed.

Rainbow trout of the Sutherland have been important to the Yekooche First Nation in part because of their unique run timing relative to Pacific salmon (spring versus fall). Because salmon runs of the Babine and Stuart watersheds can undergo large fluctuations, Sutherland rainbow trout have represented a consistent source of fish for the Yekooche at the end of the winter period.

Present and future management. The First Nations harvest of Sutherland River-origin rainbow trout continues, although current levels of fishing activity and harvest are lower than historically undertaken. In addition to the continued use of traditional knowledge, the Yekooche intend on developing the capacity for modern techniques in fishery management including population monitoring. Members of the First Nation have actively participated in past scientific research in the Sutherland watershed. Yekooche band members' recaptures of adult rainbow trout tagged during the study of Bustard (1990), and their reporting of these recaptures, permitted the development of a mark-recapture population estimate of approximately 500 fish. During the molecular genetic study of rainbow trout population structure in the Babine Lake watershed conducted by the BC Ministry of Environment and University of Windsor (Koehler 2010), Yekooche fishers captured the Sutherland River spawners that were utilized in the study.

IMPORTANCE OF THE SUTHERLAND RIVER TO BABINE LAKE

Babine Lake supports the largest recreational fishery for rainbow trout (Figure 8) in British Columbia Management Region 6 (Gislason et al. 2009). During a 1988 study, Bustard (1989) examined all potential rainbow trout spawning tributaries to Babine Lake including the Sutherland system. Thirty-four tributaries comprising 175 km of accessible stream were identified as potential contributors of rainbow trout to Babine Lake. Of the total estimated abundance of juvenile rainbow trout of age 1 or older in these streams, approximately 60% were in the Sutherland River system. This estimate has been corroborated by the recent, molecular genetic analysis of Koehler (2010), which indicated that Sutherland-origin fish were distributed throughout Babine Lake, including the locally-famous sport fishery at "Rainbow Alley" at the northern outlet of the lake, and comprised approximately 65% of the fish caught overall. Significantly, no other population of large-bodied, piscivorous rainbow trout has been identified in the Babine Lake watershed, indicating the Sutherland River is the key to the Babine Lake trophy rainbow trout sport fishery.

Figure 8. Babine Lake rainbow trout recreational fishery

RARITY OF THE PELAGIC, PISCIVOROUS RAINBOW TROUT ECOTYPE

Babine Lake rainbow trout utilizing the Sutherland River for spawning belong to the 'pelagic, piscivorous rainbow trout' ecotype (DeGisi 2002). An 'ecotype' is a population or group of populations with unique physical and ecological characteristics that are unique relative to all other potential ecotypes. The descriptors 'pelagic' and 'piscivorous' indicate, respectively, that these fish 1) utilize open-water, lake environments and 2) prey primarily on other fish. Pelagic, piscivorous rainbow trout are found only in large lakes >10,000 ha that also have kokanee salmon present as a prey fish base, and their adaptations to this niche include advanced age and large body size at maturity (Figures 6, 7), as well as morphological adaptations including a larger mouth (Keeley et al. 2005; DeGisi 2002).

Native populations of the pelagic, piscivorous rainbow trout ecotype are known from 13 natural lakes in British Columbia (and one in Washington State) and two hydroelectric reservoirs formed following flooding of large, natural lakes (another 10 unconfirmed populations may exist; DeGisi 2002), indicating that this ecotype is exceptionally rare in North America with known populations having high priority for protection (Keeley et al. 2005). As a consequence, British Columbia's Conservation Data Center (CDC) considers the pelagic, piscivorous rainbow trout ecotype to be an evolutionarily significant form of the rainbow trout, and in future the status of these fish in British Columbia will be tracked separate from the species as a whole. The first comprehensive status assessment of the ecotype by the CDC is currently under way (J. DeGisi, BC MNRO Smithers, pers. comm.).

SUTHERLAND RAINBOW TROUT POPULATION STATUS – ABUNDANCE, TREND, EXISTING THREATS

Given the limited history of fisheries research within the Sutherland River watershed, assessing the current status of the rainbow trout population is difficult. Hagen (2010) compared 1988 and 2008 juvenile sampling data, which indicated similar levels of abundance. These results suggested two possible scenarios. Either spawner abundance (estimated to be approximately 500 in 1989; Bustard 1990) had not declined between the two sampling periods, or spawner abundance may or may not have been the same, but remained high enough to seed available juvenile rearing habitats. The latter scenario was supported by a relatively good fit of the 2008 juvenile abundance data to the output of a mathematical model predicting maximum fish density as a function of their body size and water quality variables (Hagen 2010). Taken together, the rough estimate of spawner population size, which is small enough to merit concern for conservation, along with the stable juvenile abundance over sampling periods

separated by two decades suggest a small but viable population under the existing management and habitat conditions (Hagen 2010).

Populations of large, piscivorous rainbow trout in British Columbia are all relatively small (DeGisi 2002; Keeley et al. 2005; Hagen et al. 2010), and it is possible that none have a spawner population size that is consistently greater than 1000 annually.[3] Because these populations also attract heavy exploitation pressure from recreational anglers, stringent angling regulations have been imposed on easily-accessible lakes in BC inhabited by this ecotype (Keeley et al. 2005).

The Yekooche First Nation gillnet fishery has been previously estimated to have had an exploitation rate of approximately 10% in 1989 (Bustard 1990), and is now estimated to be low relative to historical levels (see 'Importance of Sutherland Rainbow Trout to the Yekooche First Nation' above). The Yekooche First Nation remains committed to sustainable management of their Sutherland River rainbow trout fishery as part of their policy of respect for the natural resources of their traditional territory (Dean Joseph, Yekooche FN fisheries manager, pers. comm.). The BC Ministry of Natural Resource Operations (MNRO) has demonstrated a willingness to monitor the status of the Sutherland River population (Bustard 1989, 1990; Hagen 2010). This fact, taken together with active steps by MNRO to keep exploitation relatively low in recreational fisheries (a Fisheries Closure Area for the southeast end of Babine Lake has been designated) and the relatively low exploitation in the Yekooche food fishery, suggest that this stock is currently being sustainably managed.

THREAT POSED BY THE PROPOSED ENBRIDGE NORTHERN GATEWAY PIPELINE

Pipeline failures (leaks and ruptures) may be the result of pipeline degradation over longer time scales, or may result from catastrophic events such as floods and landslides. Mountainous and unstable terrain prone to catastrophic landslides is extensive along the proposed route of the Northern Gateway pipeline. Such landslides have resulted in ruptures of the natural gas pipeline on four occasions since 1978, as well as destruction of sections of the highway and even loss of human life, suggesting that ruptures of the Northern Gateway pipeline are highly likely over its proposed life span (Schwab 2011). Although it did not cross the proposed route of the Northern Gateway pipeline, a catastrophic landslide located in the Sutherland River watershed in 2005 traveled 1.45 km and involved an estimated 3 million m^3 of rock (Blais-Stevens et al. 2007).

A detailed prediction of the effects of a rupture of the Sutherland portion of the proposed Enbridge pipeline is beyond the scope of this report and beyond the expertise of the author.

[3] With the possible exception of the Gerrard rainbow of Kootenay Lake (Hagen et al. 2010).

The effects of previous spills of petroleum products into fish bearing waters, however, have been reviewed elsewhere (Levy 2009).

What we do know is the contents of the twin Enbridge pipelines, diluted bitumen and a return flow of the condensate used for the dilution, are highly toxic to fish and aquatic life (Levy 2009) and pose a severe threat to fish in the event of a pipeline rupture. Immediate fish kills and chronic toxicity resulting from a spill of oil into aquatic environments has the potential for major fish population impacts. Studies have indicated that salmon embryos exposed to polycyclic aromatic hydrocarbons (PAHs) had higher mortality, metabolic problems, and deformities (Levy 2009). PAHs are a component of crude oil that can persist in the environment for long periods of time. In addition to these chronic effects of an oil spill, acute toxicity (fish kills) can also be severe. A spill of approximately 500 m^3 of oil into the Pine River in northern BC (Enbridge 2010) resulted in a fish kill of approximately 50-70% of the fish present in the first 30 km downstream of the spill site (Baccante 2000; Alpine 2001).

Road access to the Sutherland River system is extremely limited (Hagen 2010), meaning it would be very difficult or impossible to mount a rapid response to a spill into the river, or to engage in subsequent cleanup. Furthermore, high habitat complexity (numerous log jams and beaver ponds), relatively high water velocities, and ice cover for a significant portion of the year would all make effective containment of a diluted bitumen spill entering the river difficult or impossible.

Wood debris present in the Sutherland River (Figure 5) provides habitat for exceptional densities of juvenile rainbow trout (at or near predicted maximum potential density; Hagen 2010). In the event of a major diluted bitumen spill, large amounts of this wood debris could wind up covered in hydrocarbons. Given the importance of wood debris as fish habitat, any attempt at large-scale removal of contaminated wood debris would result in serious habitat degradation.

Tributaries to the upper Sutherland River, and also the pipeline crossings of the Sutherland River and Duncan Creek, provide pathways along which oil from a pipeline rupture could enter the key rainbow trout spawning and rearing areas of the Sutherland system (Figure 1). Based on Pine River observations discussed above (Baccante 2000; Alpine 2001), an immediate fish kill in the 30 km downstream could be expected to occur following a significant spill into the river. Key rainbow trout habitat includes the lower 7 km of Duncan Creek and approximately 44 km of the Sutherland mainstem located between Sutherland Lake and the deep, silty reach near Babine Lake (lower 25.5 km; Reach 1 in Bustard 1989; Figure 6). Oil spills entering the Sutherland River or Duncan Creek at any of the points identified in Figure 1 threaten the core spawning and rearing habitats of the rainbow trout population located in this critical upper section of the Sutherland system.

The effect of high mortality rates in areas affected by chronic and acute toxic effects may be severe enough to threaten the long-term viability of the Sutherland River rainbow trout population itself. Recreational and First Nations fisheries in Babine Lake that depend on these fish would likely have to be closed or severely curtailed. This is because the Sutherland population of piscivorous, pelagic rainbow trout ecotype, like most such populations in BC, is small. When populations are driven to very low numbers undesirable demographic and genetic effects can result that reduce their chance of recovery, including increased vulnerability to chance fluctuations in the environment and demographic factors, inbreeding, and permanent loss of the genetic diversity necessary for long-term adaptation. Given that the 1988 estimate of spawner abundance was 500 (Bustard 1990), the Sutherland population should be considered highly vulnerable to any threat that has the potential to greatly reduce the adult population size.

CONCLUSION

The Sutherland River rainbow trout population has been an important traditional food to the Yekooche First Nation for hundreds of years, and currently is the major contributor to Skeena Region's largest fishery for rainbow trout on Babine Lake. The population is also of high conservation value, being one of only 15 confirmed, native populations of the pelagic, piscivorous rainbow trout ecotype in British Columbia, and one of only two such populations in the Skeena drainage. The loss of this unique population, or any severe depletion of it, would therefore have significant cultural, economic, and recreational impacts on this area of northern BC, and also be a major loss to the province's evolutionary heritage. Recognition of these values has led the BC Government and Yekooche First Nation to commit to sustainable management of this population, and has contributed to the protected status of most of the watershed.

Like most populations of the pelagic, piscivorous rainbow trout ecotype, the Sutherland River rainbow trout population is thought to be relatively small. A major depletion of an already small population can seriously compromise 1) its ability to recover, 2) the genetic diversity necessary to adapt to a changing environment of avoid inbreeding, and even 3) its likelihood of persisting into the future.

Severe population impacts are likely if an undetected leak or major rupture of the Northern Gateway pipeline occurs within the Sutherland watershed and toxic petroleum products enter the Sutherland River or Duncan Creek. Potential pathways of spilled petroleum product into the Sutherland system are near the upstream end of known, critical spawning and rearing areas. The majority of the population of rearing juveniles, which includes three age classes,

would likely be threatened regardless of particular pathways a major spill took before reaching the river. It is my opinion that the ability to undertake a quick and effective spill response to hydrocarbons once they enter the Sutherland River is unrealistic. A significant leak or rupture of the proposed Northern Gateway Pipeline in the Sutherland Watershed poses a risk to the long-term viability of the Sutherland River rainbow trout, and would have a direct impact on Yekooche First Nations traditional use of these fish and the Babine Lake sport fishery.

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