LBN Recreational Sockeye Fishery Management Plan

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1 Overview

This document outlines procedures for monitoring and protecting migrating sockeye salmon (*Oncorhynchus nerka*) in the section of Babine River between the *Tse Tesli* counting fence and the Nilkitkwa River confluence. Wild Babine salmon (*talok*) populations are critically depressed. Lake Babine Nation (LBN) has, over many years, observed the adverse impacts of high water temperatures and intensive recreational fishing pressures in this section of the Babine River on *talok* during their migration.

The Lake Babine Nation is required to take urgent action for the protection of this vitally important social, cultural and ecological resource, in accordance with our law and stewardship obligations.

This document details the ecological concerns, monitoring procedures and management actions that LBN will follow to mitigate ongoing adverse effects to migrating sockeye salmon as they attempt to return to their natal streams to spawn. Careful consideration and attention have been given to both western scientific research and LBN Indigenous knowledge to inform a fulsome understanding of the issues and to develop effective mitigation measures. Since time immemorial, LBN has actively protected and managed our *yintah*[1]; this document and the procedures outlined within represent a continuation of that stewardship.

In the event that a mean weekly maximum temperature of 15.5°C, or a maximum daily temperature of 17.5°C is recorded at the *Tse Tesli* fence by LBN Fisheries staff, the LBN Fisheries Director will be empowered to close the recreational fishery on the Babine River between the *Tse Tesli* fence and the Nilkitkwa confluence.

2 Background and Rationale

LBN are a salmon people and the long-term health and abundance of *talok* populations is essential for thriving LBN social, cultural and political systems. LBN is also the original and rightful steward of its *yintah*, which includes the Babine Lake, Babine River, and the surroundings lakes, mountains, passes, and rivers and all of the fisheries they support.

Over 93% of Skeena River sockeye salmon originate from and return to the Babine Lake and its tributaries. However, wild Babine salmon stocks are critically depressed and may be on the brink of collapse. Under Canada's own Wild Salmon Policy, a recovery plan should already exist for these invaluable keystone species, however no such plan has been developed. This management plan is enacted to help prevent the catastrophic ecological, economic and social impacts that Lake Babine Nation, and central and northern BC as a whole, would experience from the collapse of these populations. This management plan aims to promote and implement a sustainable salmon fishery in Lake Babine Territory that will benefit the residents, economy and ecology of the entire Skeena region.

As stewards of salmon since time immemorial, LBN possesses abundant Indigenous Knowledge regarding the behaviour and management of Babine *talok*. Both LBN Indigenous

[1] *yintah* is the *Nat'oo'ten* word for Lake Babine's Territory and all the natural resources that it sustains.

Knowledge and western scientific literature were considered in the development of these management procedures.

The following sections outline the unique importance of this resource to Lake Babine Nation, the scientific understanding of temperature and sockeye salmon physiology, and the issues requiring immediate management attention in the Babine River below the *Tse Tesli* fish fence.

2.1 Significance of Sockeye Salmon to LBN

LBN Territory supports many culturally important species of fish that members harvest, but above all the Lake Babine Nation have always been a salmon people. Over 93% of Skeena River sockeye salmon return to the Babine Lake and its tributaries to spawn in the fall. In the spring, fry migrate to Babine Lake and live in its waters for their first year. The Babine Lake is both the homeland of the Lake Babine Nation and this tremendous sockeye run.

The annual return of sockeye to Babine Lake has sustained the LBN people for millennia, and in return LBN has nurtured healthy and abundant salmon populations. Historically, Lake Babine Nation dried and smoked salmon in vast quantities, enough to last not just until the next year's harvest (or longer, if needed), but also enough to sustain a vibrant economy and commercial trade.

To this day, salmon remain a foundational part of LBN food security, culture and society. The health and abundance of wild Babine salmon populations is essential to the physical, emotional and spiritual well-being of Lake Babine people. *Talok* represents a traditional and significant source of food for our Nation and is required for our physical and mental health. *Talok* harvesting activities strengthen our inter-generational connections, encourage youth to be active on and deeply connected to the *yintah*, and protect our rich body of Indigenous knowledge relating to fisheries. *Talok* is also an integral component of Lake Babine ceremonial life, and the legal and governance structures rooted in the *balhats*.

Despite the imposition of colonial law, including the destruction of our *k'ondze*, the Lake Babine Nation has maintained our sovereign authority and responsibility to manage the salmon in our Territory. This responsibility is especially pronounced for the critically depressed wild Babine stocks, which have a special connection to our ancestors and our heritage.

2.2 Physiological Demands and Thermal Tolerance of Sockeye Salmon

Salmonid species are cold water fish and vary in their thermal tolerance, but generally thrive in a narrow thermal range. Thermal tolerance varies within species according to the developmental stage with the most sensitive stages occurring generally during the incubation and spawning periods for most species (Andrusak et al. 2019; Stiff et al. 2019; Martins et al. 2012; Sullivan et al. 2000; McCullough et al. 2001). Proceeding discussion of thermal tolerance is focused exclusively on sockeye salmon (*Oncorhynchus nerka*) during the migration period, as this is the species and life stage addressed by this document.

Thermal stress during adult migration of sockeye salmon to natal streams can result in cascading negative effects that include catastrophic levels of pre-spawn mortality and can lead

to long-term negative impacts to fish stocks (Jeffries et al. 2013; Hinch et al. 2012; Jeffries et al. 2012; Martins et al. 2012; Farrell 2009; Farrell et al. 2008). Thermal stress can result in increased mortality to migrating sockeye salmon due to a combination of impacts directly related to increased water temperatures. Warm temperatures increase energy use in sockeye salmon and can result in exhaustion of energy reserves prior to completion of spawning (Rand et al. 2006 as cited in Martins et al 2012). Pathogenic pressure increases with increased water temperature, causing additional physiological stress, decreased mobility and disease (Martins et al. 2012). Aerobic scope in sockeye salmon is drastically reduced by increasing temperature beyond optimal ranges for a given stock; this limits allocation of energy to critical tissues during migration (Eliason et al. 2011).

Water temperatures that produce thermal stress are highly variable within a relatively narrow range for sockeye salmon and are tied to adaptation to typical thermal regimes by antecedent generations of fish in a given system (Martins et al. 2012; Farrell 2009; Eliason et al. 2008). For example, Jefferies et al. (2012) found significant physiological stress during holding trials of Fraser River sockeye salmon when held at 19°C for a seven-day period. This same study found that below 14°C, no genetic markers of stress were present during that same period. Hinch et al. (2012), found that temperatures a few degrees beyond the normal range produced catastrophic mortality (exceeding 90%) in migrating sockeye salmon in the Fraser River watershed. Stiff et al. (2019) postulates that exposure of sockeye salmon to elevated seasonal mean water temperatures in the range of 14.9-15.2°C only slightly elevated from the seasonal mean of 14.4°C observed during another season, produced significantly elevated levels of pre-spawn mortality among sockeye salmon in Auke Creek, Alaska. Because these are seasonal mean temperatures, it is not clear whether short duration peaks were responsible for observed mortality.

Both temperature and duration of exposure to warm water drive effects to sockeye salmon and the relationship between these factors and their effects to sockeye salmon are very well described in the literature (McCullough et al. 2001; Martins et al. 2012). Sockeye salmon are very adept at behavioural thermoregulation, moving to cool water refugia areas throughout their migration and most especially when their migration includes large cold lakes (Mathes et al. 2001) such as those of Babine watershed.

2.3 Temperature and Migration Observations

LBN Fisheries has managed the *Tse Tesli* fish counting fence on the Babine River between Nilkitkwa Lake and Babine Lake for well over a decade. River temperatures are recorded daily throughout the counting season and temperatures above 15°C are regularly recorded in this section of the river and temperatures approaching 20°C are not uncommon during the summer months when sockeye salmon are actively moving through to their natal streams.

This section of the Babine River is an extremely busy area for recreational fisherman targeting migrating sockeye salmon during years of adequate escapement. Staff and citizens of LBN regularly observe dozens of fisherman lining both sides of the river during periods when the fishery is open. During these periods of intense recreational fishing, staff and citizens of LBN notice a marked difference in the behaviour of migrating sockeye salmon that directly affect the LBN food fishery and the movement of these stocks to their natal spawning areas.

2.3.1 Observed Effects

Intense recreational fishing below the *Tse Tesli* counting fence regularly stops the movement of sockeye salmon through the *Tse Tesli* fence. This directly impacts the ability of salmon to migrate to their natal streams, and impedes LBN's food, social and ceremonial *talok* harvest, as roughly 75% of our entire Nation's *talok* FSC harvest occurs at the *Tse Tesli* fence. Holding of fish in the warm waters of this section of Babine River causes considerable stress to LBN citizens due to the adverse physiological damage inflicted upon the salmon. Long term negative impacts to struggling sockeye stocks within the Babine system are likely as fish are delayed for extended periods in the warm waters of the Babine River.

2.3.2 Predicted Physiological Effects

Increased mortality is predicted as a result of the intensive recreational fishery below the *Tse Tesli* fence during periods of elevated water temperatures. Both delayed movement of sockeye to areas of thermal refugia in Nilkitkwa and Babine lakes, and catch and release of migrating sockeye during fishing activity will increase overall mortality. Considering the depressed state of many of the wild sockeye stocks within the Babine system (Price 2011), mitigative measures are required to prevent increased mortality of these threatened stocks.

Delayed migration and holding below the *Tse Tesli* fence as a result of intensive recreational fishing, especially during periods of warm water, will adversely affect migrating sockeye salmon; these effects are well understood and detailed in the scientific record. Based on the literature, it is reasonable to predict that prolonged delays to the migration through this section of river may result in increases to pre-spawn mortality or otherwise reduce the effectiveness of spawning if it still occurs. These effects, including the causal relationships between increasing temperature and decreased survival are well documented and thoroughly detailed in the literature cited in this report.

The literature is clear that recreational catch and release of salmonids during elevated water temperatures can result in significant increases to mortality (Wilkie et al. 1997 & Meka and McCormick 2005 as cited in Andrusek et al. 2019). In addition to delayed movement of fish through the Babine River and the *Tse Tesli* fence, the recreational fishery includes a large component of catch and release as fisherman select fish in good condition and return more mature fish back to the river. This repeated harassment of fish during this most critical life stage is expected to further affect survival and overall stock health.

Because many of the sockeye stocks migrating through this section of the Babine River are also depressed and LBN is unable to identify what stocks are moving through at any given time, LBN could stand to lose some of these critically depressed stocks altogether if they are continually delayed in their migration and subjected to thermal stress. Indeed, exposure of migrating sockeye salmon to warm water was predictive of over 90% pre-spawn mortality in some Fraser River stocks (Hinch et al. 2012).

2.4 Summary of Issue

Recreational fishing along the Babine River below the *Tse Tesli* fence is causing migrating sockeye salmon to hold in the warm water and delay their migration to the spawning grounds. Migration delays alone are of considerable concern to LBN as these fish are using critical energy reserves necessary for successful reproduction. Holding during periods of warm water significantly exacerbates an already poor situation. Because intensive recreational fishing routinely results in delayed migration, this activity must be managed to prevent potentially catastrophic impacts to migrating sockeye salmon during periods of warm water. Additionally, catch and release of migrating fish through the recreational fishery during periods of warm water will likely result in increased mortality and reduced fecundity, actively threatening depressed wild sockeye stocks of the Babine.

3 Thermal Triggers and Monitoring Protocols

Biologically relevant thermal triggers are outlined in this section as the basis for management actions aimed at reducing significant adverse effects to sockeye salmon in the Babine River. As noted in Section (2), intensive recreational fishing pressure in this small section of the Babine River, between the *Tse Tesli* fish fence and the Nilkitkwa confluence, results in prolonged exposure of migrating sockeye salmon to water temperatures likely to cause significant adverse effects to individual fish that pose a significant risk of causing pre-spawn mortality and population level effects that negatively impact the culture, heritage and food security of LBN and the ecology, economy, and residents of the Skeena region as a whole. Because observational evidence over a number of years demonstrates a direct correlation between recreational fishing pressure and migration of fish through the fence, LBN is confident that closure of the recreational fishery during periods of high water temperatures will allow fish to migrate more rapidly to areas of cooler water in Nilkitkwa and Babine Lakes, effectively limiting physiological stress and associated adverse effects to these diminished stocks.

3.1 Closure Thresholds

The Government of British Columbia recently developed provincial fisheries management guidelines for drought conditions with recommendations regrading thermal triggers for various salmonid species (Andrusak et al. 2019). Appendix 1 of Andrusak et al. (2019) summarizes optimal temperature ranges for salmonids and other species and advises that temperatures of one-degree celsius beyond this range may result in significant adverse effects. According to Andrusak et al. (2019), the optimal temperature range for migrating sockeye salmon is 7.2–15.6°C. It is not clear what stocks were used in the development of this guideline range and the precise optimal temperature range for the numerous sockeye stocks migrating through the Babine River is unknown. Therefore, a certain level of uncertainty exists regarding the applicability of the guideline range found in Andrusak et al. (2019) to various migrating sockeye salmon stocks in the Babine River. As previously noted, lower thermal tolerances were observed in stocks from colder systems. Based on the observations of Stiff et al. (2019) from an Alaskan system, the top end of this optimal range may be considerably lower for northern stocks like those of the Babine River.

Andrusak et al. (2019) recommend identifying temperature triggers based on a mean weekly maximum value to provide for practical application during periods of fluctuating water temperatures. In light of the lack of available stock level optimal temperature data, we have followed the precautionary principle to adopt a mean weekly maximum temperature (MWMT) of 15.5°C and a maximum daily temperature of 17.5°C as our triggering thresholds for closing the recreational fishery on the Babine River between the *Tse Tesli* fence and the Nilkitkwa confluence. A MWMT of 15.5°C provides some additional protection in the event that the sockeye stocks of the Babine system have developed lower temperature thresholds more in line with those observed for other northern stocks due to the lower typical temperature conditions of this system compared to southern systems such as the Fraser River.

Table 1: Stress induced (MWMT) temperature thresholds for closing of the recreational sockeye salmon fishery in the Babine River below the Tse Tesli fence.

Species	**MWMT Threshold (°C)**	**Maximum Daily Threshold (°C)**
sockeye salmon (*Oncorhynchus nerka*)	15.5	17.5

3.2 Monitoring Procedures

Water temperatures are monitored and recorded at the *Tse Tesli* fence by LBN fisheries staff on a twice daily basis. This temperature data will be used to track the MWMT in the Babine River and inform management actions through this plan.

3.3 Closure Decision Procedures

In the event that water temperatures in the Babine River exceed the thresholds in Table (1) the LBN Fisheries Director will evaluate the necessity for a recreational fishing closure. If, in the opinion of the LBN Fisheries Director, water temperatures are likely to remain elevated, then LBN will begin with implementation of closure actions identified in Section (3.4).

3.4 Recreational Fishery Closure Procedures

If the LBN Fisheries Director deems a recreational fishing closure necessary, LBN will notify the public of the closure by:

- Posting notifications along major travel routes to the Babine River;
- Informing anglers in the area of the closure;
- Informing local media of the closure;
- Posting notifications on the LBN website and social media; and
- Posting other closure notices as appropriate.

3.5 Criteria for Re-opening

When ambient temperatures in the Babine River drop below the thresholds in Table (1), the LBN Fisheries Director will consider whether temperatures are likely to remain below the threshold and determine whether to re-open the recreational fishery.

4 Summary

High water temperatures and intensive recreational fishing on the Babine River are having ongoing adverse effects on migrating Babine salmon as they attempt to return to their natal streams to spawn. The presence of these adverse effects are supported by both the scientific literature and LBN Indigenous knowledge.

Pursuant to our inherent jurisdiction to manage and protect our *yintah*, Lake Babine Nation has developed the management measures outlined in this Recreational Sockeye Management Plan to mitigate the adverse effects of the recreational fishery during periods of significantly elevated water temperatures.

In the event that a mean weekly maximum temperature of 15.5°C, or a maximum daily temperature of 17.5°C is recorded at the *Tse Tesli* fence by LBN Fisheries staff, the LBN Fisheries Director will be empowered to close the recreational fishery on the Babine River between the *Tse Tesli* fence and the Nilkitkwa confluence.

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