Ministry of Forests
Fish and Aquatic Habitat Section – Kootenay Region
401 – 333 Victoria Street
Nelson, BC V1L 4K3
Phone: 250-354-6333

Kootenay Region Angling Regulations
Proposed Changes for 2023-2025

INTRODUCTION

The following document summarizes changes to angling regulations currently under consideration for Kootenay Region waters. These changes, if approved, will be effective and appear in the Freshwater Fishing Regulations Synopsis beginning April 1, 2023. We welcome and will consider your comments as we finalize changes to the regulations.

Proposals for regulation changes result from requests by Rod and Gun Clubs, other non-government organizations, and the public at large. Others are developed from technical studies of trends in fish populations and angler use in the region. This document provides some of this background to assist you in understanding the rationale for each regulation change proposal.

WILL THERE BE A PUBLIC MEETING?

Due to poor past attendance, we are not holding public meetings for comment this year; instead, we are asking that you follow the approach this document outlines to contact us with your concerns and recommendations. This will allow you time to discuss with your colleagues and organize your ideas in writing. We hope to hear from a range of people, including those who may otherwise be unable to attend a meeting or are reluctant to speak in public.

WHO CAN COMMENT?

Anyone with an interest in freshwater sport fishing in British Columbia can comment.

HOW CAN I COMMENT?

We will accept comments in a number of forms. In order of preference, your options are:

(a) electronically via email to **fishandwildlife.kootenay@gov.bc.ca**
(b) conventional mail to the Nelson office of the Ministry of Forests, at the address noted at the top of this document;
(c) via FAX to Nelson office of the Ministry of Forests at 250-354-6332.

To assist us in getting the best possible information, **please use the forms we provide in this package**. An MS Word file is available from the web site should you wish to use a computer.

WHAT IS THE DEADLINE FOR SUBMISSIONS?

The deadline for submission of comments is September 8, 2022. Comments that you provide later than this date may not be timely enough to be considered in the development of final regulations proposals.

HOW WILL THE MINISTRY USE MY COMMENTS?

Angling regulations meet three main objectives:

(a) address fish conservation concerns;
(b) improve the quality of angling by restricting angler use and fish harvests; and,
(c) provide a range angling experiences to meet the diverse expectations of the angling community.

Simplification of regulations is also important, where simplification improves or at least does not affect these objectives. We will consider your comments wherever possible, in light of all three objectives. Ultimately, however, fish conservation receives highest priority in the final decision on any regulation change.

PRIVACY POLICY

The Government of British Columbia is committed to protecting the privacy of people whose personal information is held by government through responsible information management practices. Any personal information provided to the Government of B.C. is collected, used and disclosed in accordance with the Freedom of Information and Protection of Privacy Act or other applicable legislation.

Regulation Change Proposal 1: Whatshan Lake Bull Trout

Name and Affiliation of Submitter:

Ministry of Forests

Waterbody Name: Whatshan Lake

Brief Summary of Proposal:

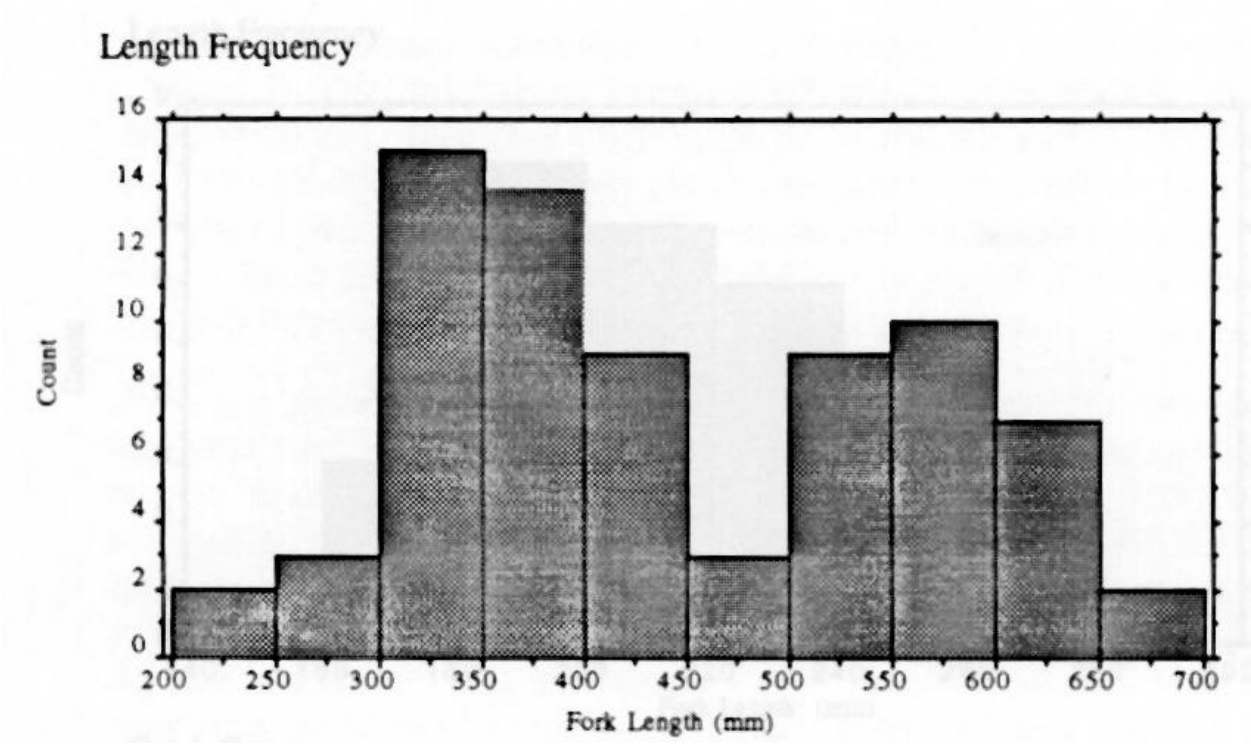
Whatshan Lake (historic natural lake with raised water level – a reservoir with BC Hydro dam) has an isolated core area of Bull Trout which is genetically unique and divergent from neighboring populations. This population is considered at risk by provincial status assessment methodology and has a small population the may be currently limited by angler harvest. This angling regulation change is to implement a 60cm minimum size limit (MSL), which would effectively protect 1-2 spawner ager classes and may increase spawner abundance. This is aligned with provincial fisheries program policy and in-draft bull trout provincial bull trout management plans for conservation of wild fish.

Rationale for Proposal (defend why should regulations change):

- The Whatshan Lake bull trout population is a "core area" identified by Hagen and Decker (2011) and assessed as "at risk" – there are 4 status ranks, and this is the second highest risk status. Hagen and Decker (2011) assessed the population assuming low exploitation.
- I re-ran the assessment raking. If exploitation were to be a high severity/scope threat, then the ranking would move to "High Risk" – the highest risk category.
- Most other at risk or high risk core areas are protected in Region 4 by catch and release or 60cm min size limits: Slocan, Salmo, Moyie, Flathead.
- Whatshan BT are genetically unique (Latham 2002) and isolated above a historic barrier. This means that if they were to go extinct, the unique population would be lost. It would also be permanent, as the population is isolated from neighboring populations, and thus could not be recolonized through straying from neighboring populations (e.g., Slocan could be recolonized from Kootenay lake).
- Current abundance of the spawning population is low. Redd surveys have been conducted for several years, and the habitat for spawning is well known and only spans a section of 4.25 km (Himmer 2018). Redd surveys found ~30 redds per year from 2016-2018 (Andrusak 2016b; Andrusak and Himmer 2018; Himmer 2018), which suggests a total spawning population <100 fish (average of 81 using a biostandard of 2.6 fish/redd). This is similar abundance to two of the most imperiled, isolated bull trout core areas in the Kootenay Region: the Salmo River (<200 spawners per year) and the Moyie River (<50 spawners per year), and by any conservation threshold commonly used in status assessments is considered a small

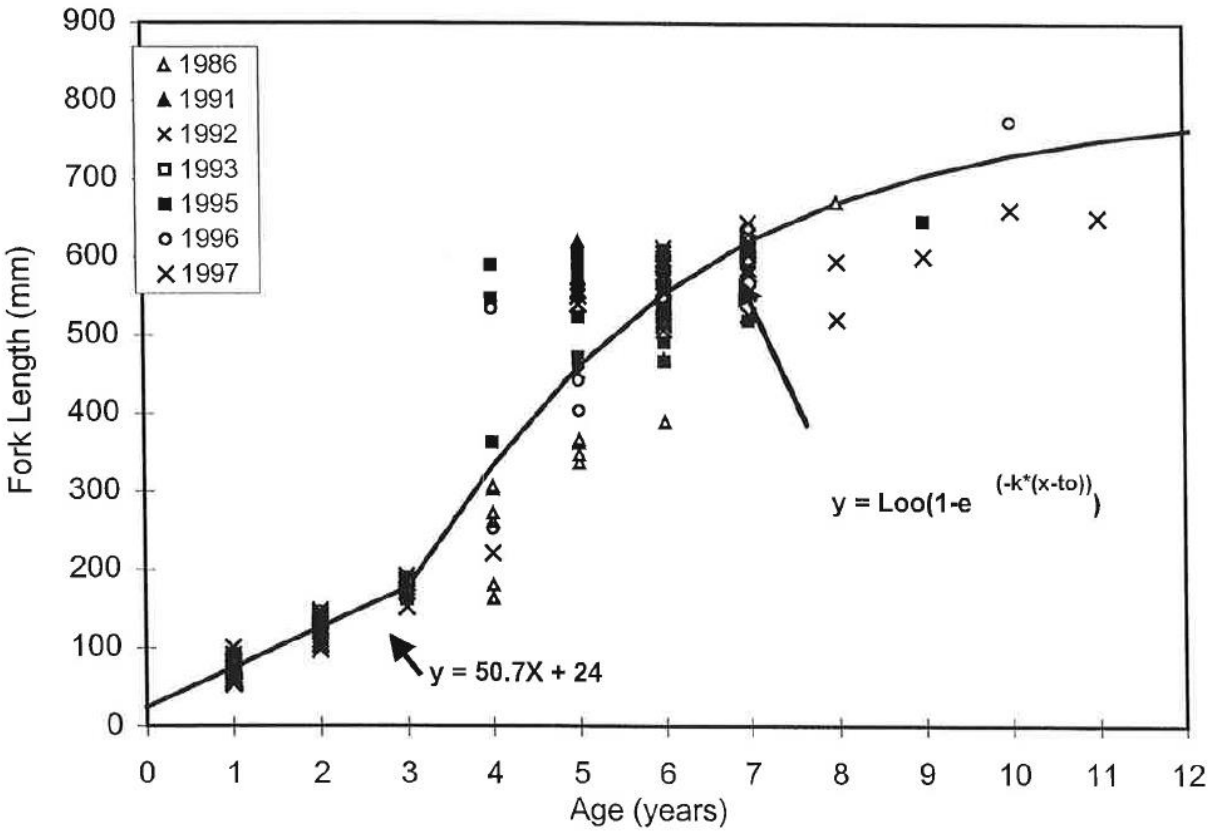
population which is at higher risk of extirpation (COSEWIC 2012; Hagen and Decker 2011; USFWS 2005). As an adfluvial population in a small-medium sized lake (500-10,000 ha), the spawner density per hectare of 0.048/ha is low, comparable to a spawner abundance of the imperiled Moyie Lake (2015-present) population of 0.021/ha (Warnock 2022) and the Slocan Lake tributary escapement (2013-2018 average) of 0.045/ha (Irvine and Baxter 2019). Spawner abundance per hectare in Lower Kananaskis Lake (~600 ha) was 0.1/ha with high exploitation (40 cm minimum size limit), but increased over twentyfold to >2/ha after 1 bull trout generation (7-8 years) after catch-and-release regulations were in place.

- Distribution is limited in the watershed <40km of linear stream habitat and Whatshan Lake (~1700ha). Barriers restrict movement in the upper Whatshan River, and spawning only occurs in 4.25km of Fife/North Fife Creek (Himmer 2018).
- Recent size structure information is limited. Only two fish were measured in the 2014-2015 creel (Andrusak 2016a); putative adfluvial spawners reported in a prior consultants' survey identified fork lengths of 460 and 534 mm (Ingersol Mountain Enterprises 2002). Creels conducted in 2014 and 2015 measured limited numbers of fish (450 and 570 mm) (Andrusak 2016a).
- The last time a significant in-lake assessment took place was from 1985-1991. Slaney et al. (1992) reported the following length-frequency histogram of gillnet catch:



- For fish caught >30cm, ones exceeding 60cm thus made up 13% of the catch in the late 1980s.

- The size distribution of catch in the 1980s and limited data since suggests that Bull Trout have high exploitation (i.e., few fish reach 60cm), or that growth is slow in Whatshan Reservoir (or both). If it is the latter, a comparable growth curve would be a lower productivity adfluvial Bull Trout population, such as lower Kananaskis Lake in Alberta, as Linf appears similar based on maximum sizes of fish observed in both lakes with exploitation. (Post et al. 2003) derived a von Bertalanffy Growth Function of Linf = 80 cm, k = 0.32 and T0 = 2.2 yrs, based on catch data in the figure below:



- If these growth parameters are used, a 60cm minimum size limit (MSL) would protect the average fish up to 7 years old. Since Bull Trout mature at age 5-7, the size regulation would effectively protect 1-2 year classes of spawners. The 60cm MSL is more conservative the slower that bull trout grow.
- There is no compelling reason to believe that Whatshan Lake would not be able to support a growth rate at least equivalent to Lower Kananaskis Lake. The population is at lower elevation (640m vs 1680m in Lower Kananaskis), similar latitude and in a milder climate regime than the east slopes of the Canadian Rockies, and Lower Kananaskis Lake is very unproductive. In addition, Whatshan Lake has a similar foodweb to other large, oligotrophic lakes in interior BC, with the immediate food resource for Bull Trout presumably being kokanee. Kokanee in Whatshan lake are of similar densities (~12-18 spawners/ha; (Andrusak 2016a)) and small terminal size (spawners <25cm) to neighboring large lake

populations (Arrow, Duncan, Kinbasket, uncollapsed Kootenay etc.; data from T. Weir), implying similar prey forage densities and age classes available within the gape limit of Bull Trout, though in-lake biomass density and forage base for kokanee may be somewhat lower in Whatshan than comparable reservoirs in recent limnological/kokanee assessments (Andrusak 2016a). Bull Trout growth in nearby populations with similar kokanee prey densities/spawner sizes is much higher than the Lower Kananaskis lake population. Thus, assuming slow growth is a conservative approach (would protect more age classes if growth is slow).

- Post et al. (2003) modeled different harvest regulations, a minimum 40cm size limit (effectively no limit as capture vulnerability below this size is low), a 65 cm size limit, and catch and release. They found that in the Lower Kananaskis Lake Bull Trout population, the difference between a 40 and 65 cm minimum size limit results in a ~2.5 fold higher angling pressure (4-10 angler hour/ha/yr, respectively) that the modeled population could sustain before falling to abundance levels considered non-viable (100 fish).
- (Andrusak 2016a) estimated that total angler effort in Whatshan Lake was 5397 hours in 2015, retention rate was high (effort is harvest driven), and total harvest of bull trout was 429. It is important to note, however, that effort and harvest was lower in 2014 (2269 hrs; 180 fish, respectively), and there are large errors to these annual estimates. If we use the higher effort value measured in 2015, and assume all anglers are targeting bull trout (a conservative assumption, as much of the effort is through the summer, likely for rainbow and kokanee), effort density at full pool (3.2 angler hrs/ha) numbers are similar to those estimated by Post et al. (2003) – that a fishery without a restrictive minimum size limit would lead to a minimum viable population of ~100 fish at 4 angler hours/ha/yr, which is very similar to the spawning population numbers of spawner observed in the Whatshan population. This may be a coincidence, but we don't have reason to suspect that parameters in the model (e.g., growth; stock productivity) differ strongly between the two populations, and angler effort density is roughly similar. Taken alone, the harvest values are also indicative of high exploitation, as total harvest estimates exceed spawner abundance. Exploitation has not been directly measured; exploitation in a neighboring population (Sugar Lake) is currently being measured and could serve as a reasonable proxy when results are available.
- How would the population change if a 60cm MSL was implemented? In many instances, regulation changes do not result in positive population responses where Bull Trout are limited by other threats (e.g., Salmo, Moyie); however, habitat is relatively intact in the Whatshan core area, and there is no strong reason to suspect that the population is being limited by other threats. Modeling by Post et al. (2003) as well as practical experience from Lower Kananaskis Lake, suggests that spawner abundance may increase substantially. This would theoretically increase the viability of the population, as the population size would increase. Stock productivity in bull trout is high where it has been measured in

adfluvial populations, so current spawner abundance could very well be saturating spawning habitat, thus adding spawners may not increase viability from a demographic standpoint. This is difficult to say without detailed stock-recruit information. From a genetic standpoint, being on the safe side of maintaining spawner abundances well above 50-100 individuals per year is a consideration as well, and has been discussed extensively in conservation and recovery planning literature for bull trout (recovery planning documents by COSEWIC, USFWS and references therein such as Rieman and Allendorf (2001)). The conservative management strategy, in line with provincial policy to protect wild fish populations would be to increase spawner abundance if possible and implementing a 60cm MSL is likely an effective lever in achieving this goal. The population response could easily be measured by conducting redd surveys.

- How would the fishery change if a 60cm MSL was implemented? Harvest would almost certainly be reduced initially until equilibrium is reached (i.e., the dynamics between angling and bull trout population response stabilizes). In the above presented gillnet catch, only ~15% of the catch would be harvestable by anglers above the MSL. At equilibrium, it is difficult to say what the net effect would be, especially without knowledge of how effort responds or what the growth rate of bull trout is. Some more certain results would be an increase in catch rate and mean size of catch. Overall catch may increase if angling effort increases; however, overall harvest yield may well decrease, especially at lower efforts. It would also depend on what the true growth rate of bull trout is in Whatshan lake at high and low densities, something we have limited information on. If we assume that bull trout grow slowly regardless of density, and effort remains low or becomes lower, there is likely a tradeoff in this regulation for the fishery – overall harvest yield will decrease, but quality of the fishery (catch rate and mean size of catch) will increase. This tradeoff of fishery quality with yield in harvest fisheries is described in detail in a bull trout example in lower Kananaskis Lake by Johnston et al. (2011). In that example, fishery effort declined overall because anglers were harvest oriented.

Alternatives Considered and Reasons for Not Selecting Them:

-Status quo was not selected due to persistent small population size in Whatshan Lake Bull Trout.

- Catch and release was considered too restrictive, as a 60cm MSL should provide a balance between conservation and angling/harvest objectives.

Current Regulations:

There is no waterbody-specific regulation; regional regulations apply: “1 bull trout (Dolly Varden) of any size”

What information/data/observations support this change:

See rationale; waterbody specific information includes:

1) Redd survey information (Himmer 2018), which indicates small population size

2) Creel survey data (Andrusak 2016a), which suggests potentially high (but also high uncertainty) exploitation rates, consistent with those expected to result in spawner abundance limitations

3) Gillnet catch (Slaney) and angler catch (Andrusak 2016a) suggesting low abundance of larger (60cm) size classes, indicating possible high exploitation of larger, more catchable fish, slow growth rates, or a combination of both.

4) Status assessment (Hagen and Decker 2011) which suggests an at-risk, isolated core area.

5) Extensive work on Bull Trout in a similar population (lower Kananaskis lake; Post et al. 2003) which showed strong population responses to management changes.

Monitoring would be helpful to determine the effect of fishing regulation changes on population and fishery responses. This is a perfect learning opportunity in a small, isolated population with information that will be useful provincially in Bull Trout fisheries management, especially combined with similar studies being conducted in neighboring Sugar Lake. Some basic monitoring programs include:

o At least several years pre- and post- regulation change of redd surveys, ideally post-surveys would continue up to a generation of bull trout (~7 years) after the regulation change is made.

o Size frequency distributions of in-lake and spawner populations and size-at-age data covering point in time surveys pre and post (ideally after equilibrium is reached ~ after a bull trout generation)

o Fish can be collected by gillnet, creel survey or kelt fence

o Estimates of basic fishery stats (effort, retention rate, catch etc.) by creel survey

Exploitation by high reward tagging may also be useful; however, if regulations changes are made for the next regulation cycle, there will be no pre-regulation data to compare against, in contrast to the above programs which have baseline data.

Consequences of Proposal (Both Positive and Negative):

Positive:

- If spawner abundance increases, population viability increases due to larger population size (increase in total egg deposition, reduction in genetic drift and inbreeding)
- Regulation is predicted to increase mean size of angler catch and catch rate, improving the fishery for trophy-oriented anglers.

Negative:

- Regulation is predicted to reduce overall harvest yield and negatively impact the fishery for consumptive anglers.

References:

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Andrusak, H. 2016b. Upper Whatshan River and Fife Creek Bull Trout Redd Surveys - 2016 Annual Report. Fish & Wildlife Compensation Program and Habitat Conservation Trust Foundation, Nelson, B.C.

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Latham, S.J. 2002. Historical and anthropogenic influences on genetic variation in bull trout (Salvelinus confluentus) in the Arrow Lakes, British Columbia. University of British Columbia.

Post, J.R., Mushens, C., Paul, A., and Sullivan, M. 2003. Assessment of alternative harvest regulations for sustaining recreational fisheries: model development and application to bull trout. North American Journal of Fisheries Management **23**(1): 22-34.

Rieman, B.E., and Allendorf, F. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management **21**(4): 756-764.

Slaney, T.L., Donnelly, W.A., and Fielden, R.J. 1992. Barnes Creek Diversion: compensation opportunities in Inonoaklin Creek and the upper Whatshan system. A.R. Ltd. B.C. Hydro, Vancouver, B.C.

USFWS. 2005. Draft Bull Trout Core Area Conservation Status Assessment. United States Fish and Wildlife Service, Portland, OR.

Warnock, W.G. 2022. Moyie River Bull Trout population status assessment. BC Ministry of Forests, Cranbrook, BC.

Regulation Change Proposal 2: Summit Lake (Crowsnest) Trophy Lake Removal

Name and Affiliation of Submitter:

Joe Tress, Fernie Rod and Gun Club

Waterbody Name: Summit Lake (Crowsnest)

Brief Summary of Proposal:

To change the fishing regulations of Summit Lake from a trophy rainbow to lake to a family oriented lake for the benefit of all age groups, especially seniors and young families.

Proposal: Remove from exemption table and go to regional lake regulations.

Rationale for Proposal (defend why should regulations change):

Winterkills periodically

Alternatives Considered and Reasons for Not Selecting Them:

Current Regulations:

SUMMIT LAKE 4-23

No Ice Fishing; Trout/char daily quota = 2; bait ban, single barbless hook

What information/data/observations support this change:

Consequences of Proposal (Both Positive and Negative):

Positive:

Negative:

Regulation Change Proposal 3: Slocan River Time of Day Closure

Name and Affiliation of Submitter:

Ministry of Forests

Waterbody Name: Slocan River (and tributaries)

Brief Summary of Proposal:

Revise the summer closure to a time of closure (12pm to midnight), pg. 40 in regulations book

SLOCAN RIVER* : No fishing 12pm-12am July 15-Aug 31 [all other text to remain the same]

* means including tributaries

Rationale for Proposal (defend why should regulations change):

For several weeks in the summer the Slocan River can reach 20°C, almost exclusively in the later afternoon. This temperature can present physiological challenges for the dominant sport fish, rainbow trout. However, almost every day in the current closed period (July 15-Aug 31), daylight hours until noon are below 20°C**. From noon until daylight the following day there are at least 15 to 17 hours of recovery time available to any trout an angler hypothetically lands.

There are only two middle sized streams in the West Kootenays offering excellent trout fishing – the Salmo and Slocan Rivers, and re-opening the Slocan River to angling opportunities on summer days before noon would create meaningful social and economic benefits.

**Average temperatures between 5am-12pm exceed the threshold by up to 1°C between July 29-Aug 6, 2021 see Figure 1)

Alternatives Considered and Reasons for Not Selecting Them:

Status quo – unnecessary restrictive

Current Regulations:

No fishing July 15-August 31 (EXCEPT Kock Creek* upstream of falls located approximately 700 m downstream of the Little Slocan Forest Service Road Koch Creek Bridge crossing and Little Slocan Lake's tributaries; see Lemon Creek).

Bait ban (where open) June 15 – Oct 31

Trout/Char release (EXCEPT Koch Creek* upstream of falls and Little Slocan Lake's tributaries)

Proposed change to this part only

What information/data/observations support this change:

Water temperature data on file with the Ministry, and Slocan River Streamkeepers from 1998, 2000-2003 and 2021. For example:

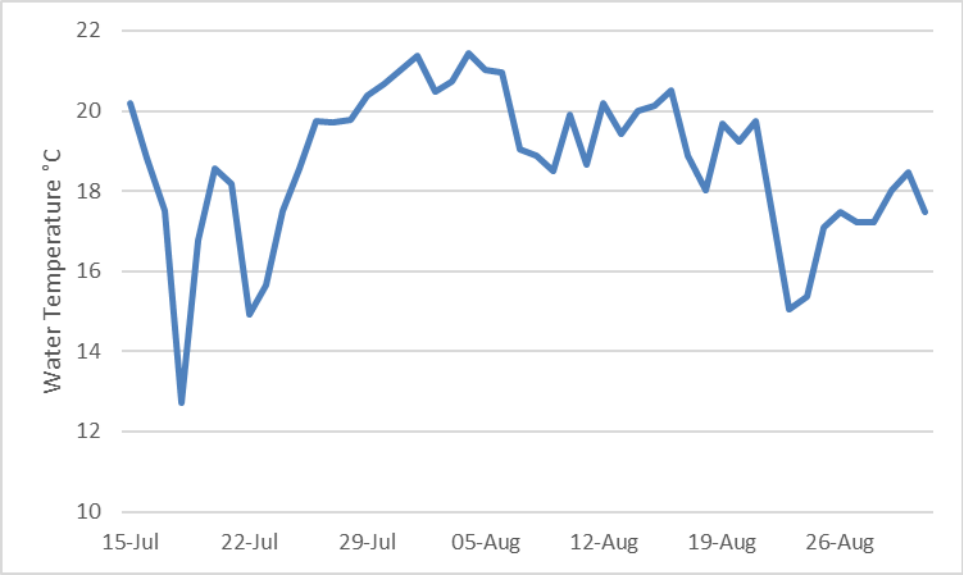


Figure 1. Average daily water temperatures in the Slocan River in a typical rainbow trout reach between July 15, 2021-August 31, 2021 in the hours of 5:00am-12:00pm (minimal angling prior to 5:00am is unlikely). Note there are few days when water temperatures exceed 20°C during the proposed time-of-day opening.

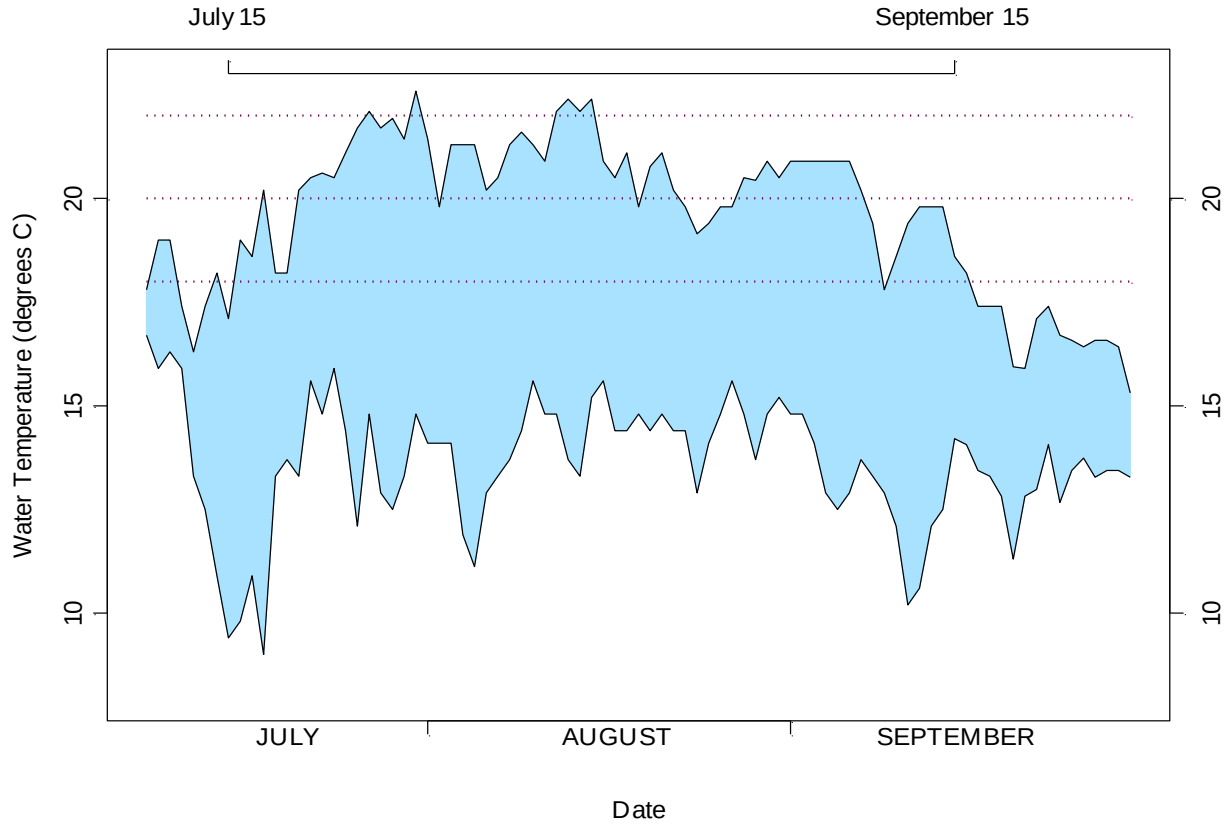


Figure: Slocan River daily summer (1998 and 2000-2003) water temperature ranges observed (8000 measurements) in a typical rainbow trout reach. Dotted lines illustrate temperature levels of concern and the top axis notes the date range for the time-of-day closure alternative.

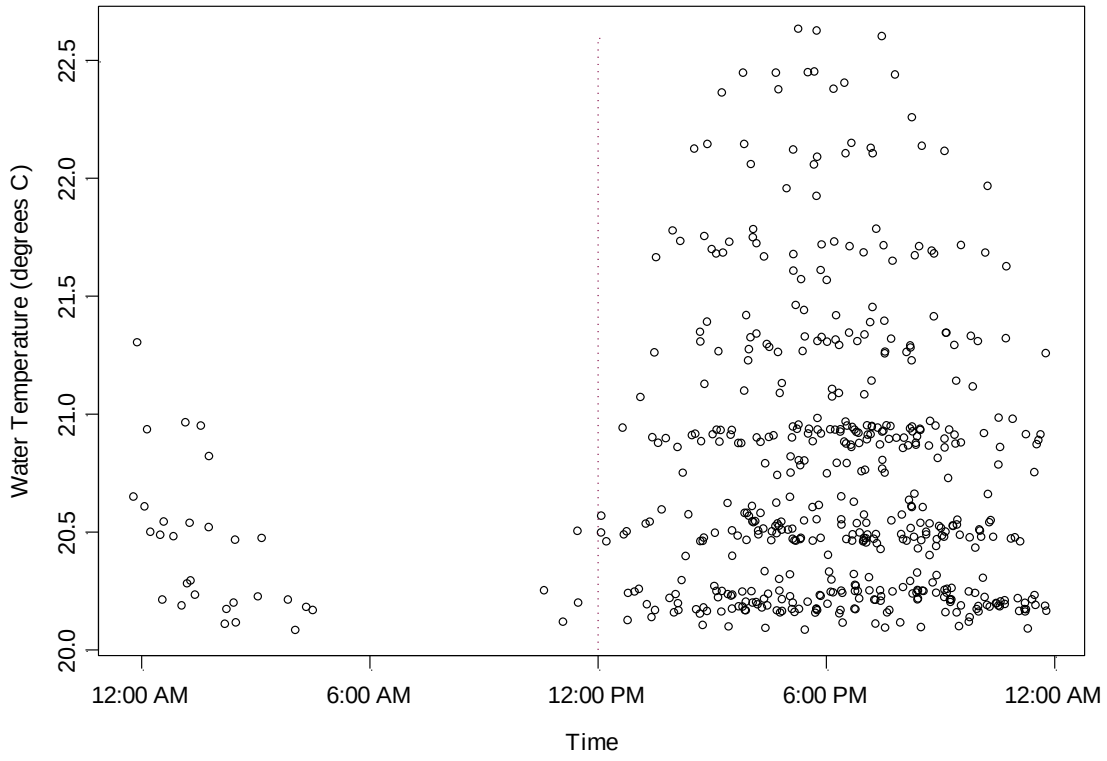


Figure: Slocan River temperatures above 20 °C vs Time of Day. There are few (<1%) days when water temperatures exceed 20 °C in the hours 5:00 AM – 12:00 PM (minimal angling is likely earlier than dawn).

Temperature thresholds:

Table 4. Relative temperature thresholds for fish handling in recreational fisheries by species affected by drought conditions in BC

Species	Stress Induced Threshold (°C)	Optimal and Range	Upper Limit (°C)	CTM (°C)
Rainbow Trout	20.0	13.1 (8-20)	25.6	28.0
Cutthroat Trout	18.0	13.6 (8-20)	25.0	28.0
Sturgeon*	20.0	13.1 (8-20)	24.0	28.0
Bull Trout	16.0	<13 (6-13)	20.0	24.0

*Note-due to the overlap, salmonid optimum temperatures were used as surrogates for sturgeon based on expert opinion.

Table 4 From

Andrusak, G.F., Ward H. and R. Ptolemy. 2019. Provincial Fisheries Management: Drought Response Plan-2018. Prepared for the Ministry of Forests, Lands, Natural Resource Operations, and Rural Development, Victoria, BC. January 2019. 22 pp+

Consequences of Proposal (Both Positive and Negative):

Positive: improved angling opportunities in the West Kootenays; additional angler “eyes” on the water to report non-compliance

Negative: Rare temperature related post-release stress and mortality

Regulation Change Proposal 4: Fussee Lake Opening

Name and Affiliation of Submitter:

Ministry of Forests

Waterbody Name: Fussee Lake

Brief Summary of Proposal:

Re-open to angling April 1, 2023 IF 2022 confirms bass absence

Rationale for Proposal (defend why should regulations change):

Fussee Lake was closed to angling on April 1, 2017, after largemouth bass were illegally introduced there. Confirmation of the eradication of bass from Fussee Lake in 2021 prompted stocking of the local native trout for sportfishing in spring of 2022. If no bass are found during 2022, the angling closure could be lifted.

Alternatives Considered and Reasons for Not Selecting Them:

1. Fussee Lake could remain closed for 2 more years or indefinitely to trial native trout stocking. This is not as favourable option as the lake has been closed for 5 years and if bass are not present should be open for angling.
2. Fussee Lake remain closed and not stocked for angling. This is not favourable as Fussee Lake has been a managed sport fishery since the 1950s.

Current Regulations:

Closed to angling

What information/data/observations support this change:

The closure of Fussee Lake after largemouth bass were introduced prompted a Fussee Lake Largemouth Bass Management Plan (2019) that incorporated stakeholder input from a workshop. The recommended action was for eradication of bass (through rotenone treatment) and to re open the fishery after bass removal. A treatment plan was developed and monitoring included fish, invertebrate, zooplankton, amphibian, and water sampling. The plan to treat with rotenone in 2021 was unnecessary as a heavy winterkill eradicated the bass and intensive sampling in 2021 determined that bass were no longer present in the lake.

Direction from a working group prompted the stocking of yearling 3N WCT in 2022 to trial the native species in a shallow, eutrophic system. First Nations was consulted. The plan to open the fishery to angling was recommended.

Consequences of Proposal (Both Positive and Negative):

Positive:

Re-establish Fussee Lake as a fishery

Negative:

Climate change and warming trends may increase complexities in the Fussee Lake fishery. Bass could be re-introduced.

Regulation Change Proposal 5: Restrict Fly Use on Trophy Lakes

Name and Affiliation of Submitter:

Dave White East Kootenay Wildlife Association

Waterbody Name: All lakes designated as trophy lakes

Brief Summary of Proposal:

Make the use of booby flies, mop flies etc illegal on all lakes designated as trophy lakes in the Kootenays

Rationale for Proposal (defend why should regulations change):

For some reason fish inhale these flies resulting in high mortality.

Alternatives Considered and Reasons for Not Selecting Them:

None, even barbless hooks injure the tongue and gills resulting in bleeding and suffocation.

Current Regulations:

No restriction

What information/data/observations support this change:

Personal observation of many fish floating dead around and after fishermen using booby flies release fish. Most trophy lakes allow retention of only one fish over 50cm resulting in lots of catch and release.

Consequences of Proposal (Both Positive and Negative):

Positive:

Less impact on the resource.

Negative:

Regulation Change Proposal 6: Restrict Jet Boat Use

Name and Affiliation of Submitter:

Dave White East Kootenay Wildlife Association

Waterbody Name: All small tributaries to Kootenay and Columbia Rivers

Brief Summary of Proposal:

Restrict use of jet skis and jet boats on these smaller rivers and creeks.

Rationale for Proposal (defend why should regulations change):

Spawning habitat is being disturbed and destroyed by the jet propulsion of the jets.

Alternatives Considered and Reasons for Not Selecting Them:

None.

Current Regulations:

No restrictions.

What information/data/observations support this change:

Mud being thrown up by the jet.

Consequences of Proposal (Both Positive and Negative):

Positive:

Reduce impact on spawning bed. Survival of fertilized eggs.

Negative:

Some impact on weekend warrior behaviour. Loss of tourists wanting to wherever they feel like.

Management Approach Proposal 1: Multiple Watersheds Time of Day Angling Closure

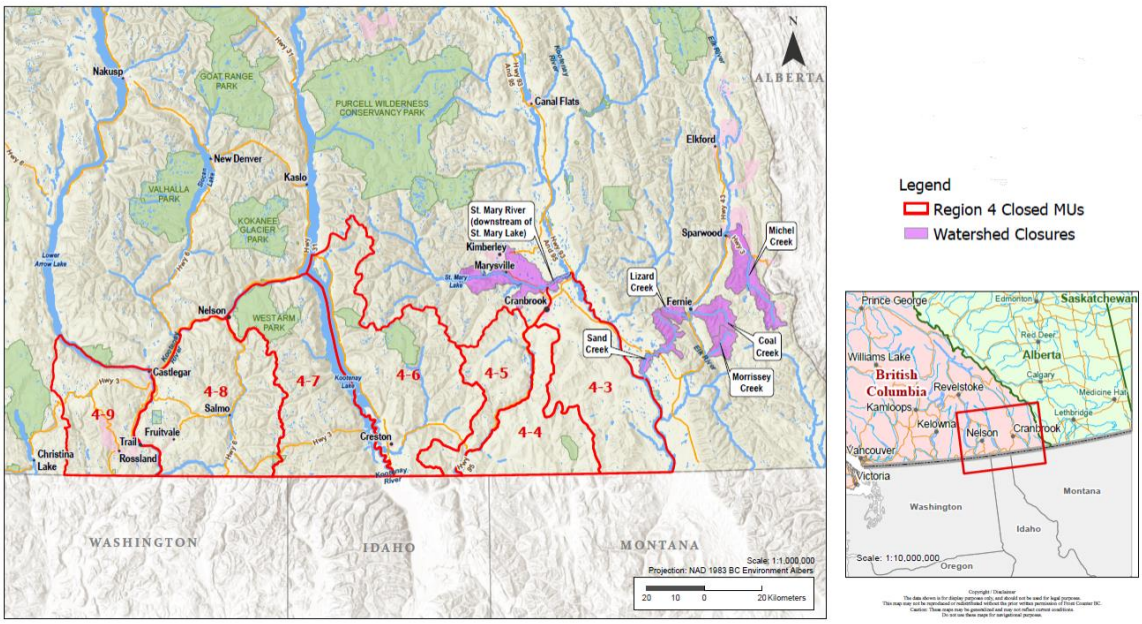
Name and Affiliation of Submitter:

Ministry of Forests, Kootenay Region

Waterbody Name:

Michel Creek watershed, Morrissey Creek watershed, Lizard Creek watershed, Coal Creek watershed, Sand Creek watershed, St. Mary River (lower) watershed, all streams in MUs 4-3 to 4-9.

Stream Closures - Kootenay Region - Proposed Approach



Brief Summary of Proposal:

Implement a temporary in-season time of day angling closure (2:00 pm – Midnight) to mitigate angling related stress on vulnerable game fish species. Implementation triggers when average daily maximum stream temperatures reach or exceed species-specific stress induced thresholds for a period ≥ 7 days on any one of the following westslope cutthroat trout and rainbow trout indicator streams:

- Westslope cutthroat trout 18 °C threshold in Michel Creek, lower St. Mary River, Sand or Gold Creek
- Rainbow trout 20 °C threshold in the Salmo River

If temperatures trigger this management approach, the regulation will prohibit angling between 2 pm and midnight on the following streams and all their tributaries: Michel Creek (excluding Alexander Creek and its tributaries), Morrissey Creek, Lizard Creek, Coal Creek, Sand Creek and the St. Mary River (from the outlet of St. Mary Lake to its confluence with the Kootenay River), and all streams in MU's 4-3 to 4-9

in Region 4 until September 10 or earlier if temperatures decline. All other regulations for these waterbodies remain in place. The main stem Columbia and Kootenay Rivers, will be exempt from this angling prohibition (all other regulations remain in place).

Rationale for in-season approach:

In some years, a combination of early snowpack loss, lower than average spring and early summer precipitation and record-breaking high air temperatures can result in the rapid warming of some Kootenay regional streams.

The cumulative impacts of above normal water temperatures and reduced stream flows generate stress in fish and reduce insect drift, increase competition in reduced habitat areas, disrupt patterns of movement into and out of sanctuary habitats and increase metabolic stress particularly where fish are angled to exhaustion. Optimal water temperatures selected by westslope cutthroat trout are 13-15 °C, and as water temperature increases from optimal, the lethal effects of temperature alone, and combined with stress from catch and release, increase (Bear et al. 2007, Gale et al. 2013). For example, catch and release mortality rates observed for Atlantic salmon increased from 0% at 12 °C to 40% at 23 °C (Wilkie et al. 1997). Temperatures exceeding 19 °C have a stress response even in rainbow trout that are not subject to angling (Feldhaus et al. 2010) and the typical lethal temperatures for rainbow trout, westslope cutthroat trout, and bull trout that are not exhausted through catch and release, are 25 °C, 20 °C, and 21 °C, respectively (Selong et al., 2001 and Bear et al. 2007).

Past and ongoing regional stream temperature monitoring (using in-situ temperature data loggers) supports our proposed geographic scope, and the proposed time-of-day closure to angling. During warm weather periods stream temperatures cycle diurnally, with morning water temperatures typically 2–5 °C cooler than those recorded in the afternoon and evening (Ministry data on file). This reduction in temperature generally drops temperatures below the level at which significant catch and release mortality occurs (> 20°C, Boyd et al. 2010) and below stress thresholds. A rest period for trout from 2 pm to the following morning also allows in excess of 14 hours to recover from catch-and-release stress. Trout require less time, namely 2 -12 h, to return to resting states of common trout stress indicators (muscle: phosphocreatine 4 h, adenosine triphosphate 2 h, glycogen 8 h, lactate 8 h and pH 10 h; and blood: pH 4 h, lactate 12 h, adrenaline 2 h, noradrenaline 2 h, and cortisol 6 h) after exhaustive exercise (figures in Milligan 1996). For westslope cutthroat trout and rainbow trout, the stress induced threshold is 18 °C and 20 °C respectively, and angling closures will trigger when average maximum daily stream temperatures reach or exceed the threshold for a period ≥ 7 days (FLNRORD Drought Response Plan, Andrusak et al. 2019).

Regional biologists note that, while seasonally sympatric with westslope cutthroat trout or rainbow trout in many Kootenay region streams, bull trout will have ascended to cooler water locations when they stage for spawning later in the summer and early fall, and key systems for bull trout reproduction are already protected from angling but where not, cooler water temperatures prevail. Therefore, stress induced threshold temperatures for bull trout (16 °C; FLNRORD Drought Response Plan, Andrusak et al. 2019) are not a trigger for angling restrictions in this approach.

We propose a Columbia and Kootenay River exemption because while warm, the proportion of fish vulnerable to angling is much less on these largest rivers than all other Kootenay Region streams.

Post-release angling mortality during low flow/high temperature periods is a management concern, both for wild fish conservation and future angling opportunities. Implementation of a time of day closure to angling will mitigate mortality and metabolic stress effects related to angling and handling of fish, while still providing opportunity for anglers as well as the associated economic benefits. This proposal allows for decreased harm to wild stream salmonid stocks while still maintaining angling opportunities.

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Alternatives Considered and Reasons for Not Selecting Them:

- Status quo – Would not mitigate for the likely angling related fish mortality associated with current and predicted high temperature and low flows, would ignore best science, regional data, and provincial guidance/policy.
- Full day (24 h) closures during the same timeframe for the proposed stream systems. This unreasonably removes all angling related social and economic benefits and creates unnecessary

confusion and impacts to anglers who purchased classified waters licences on Michel Creek (tributaries included) through the angling licence booking system (capped system with limited angler days) and impacts to angling guide operations.

- Time of day angling closures on all Kootenay classified waters. Stream temperature data demonstrates that other classified water temperatures during peak summer periods remain well below the thresholds used to justify angling closures in regional streams.
- Full day (24 h) closure on all classified waters during the same timeframe for the proposed stream systems. This approach is unnecessary given regional stream temperature data results which are well below stress induced thresholds, and species-specific temperate mortality thresholds even during peak ambient temperature periods.

Current Regulations:

Streams are open for angling in the summer.

What information/data/observations support this change:

Regional staff and NGOs have collected stream temperature data for several years in Kootenay Regional Classified waters and other priority stream systems. This data provides baseline and in-season temperature data to proactively gauge impacts to fish stocks during periods of high stream temperatures and angling related stress. Long term data provides effective analysis of peak temperature periods and evening/nighttime temperature recovery (see Figures 1-3 for Salmo River, Lower St. Mary River and Michel Creek thermal recovery examples) for multiple high and low elevation stream systems. These data allow for a more comprehensive defensible regulatory approach (time of day) which maintains both species protection and angler opportunity.

Additionally, Kootenay regional fisheries staff have reviewed data and policy approaches in neighbouring jurisdictions to evaluate a range of regulatory approaches to high stream temperatures and angler related impacts to fish stocks (Montana, Alberta, etc.). Ultimately, the Kootenay regional approach is a combination of real time stream temperature data, provincial guidance on species specific temperature thresholds and literature review.

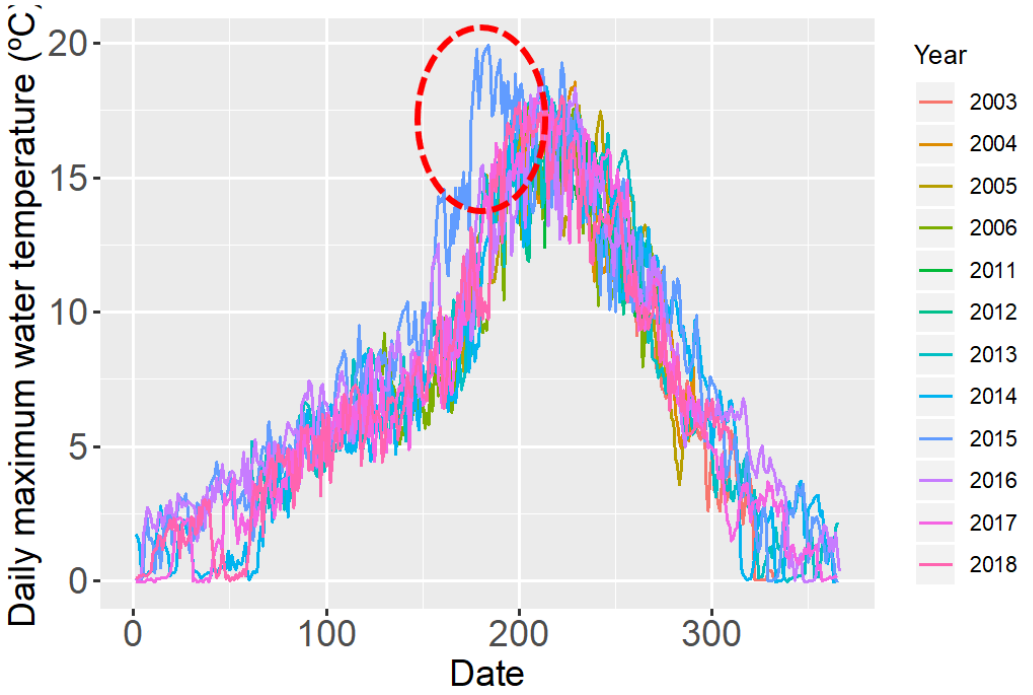

Figure 1. Salmo River maximum daily water temperatures versus day of the year ("Date") for many years. 2015 peaks in red dashed circle. From Appendix 4 in Nellestijn, G. and N. Tran. 2021. 2020 Update for the Salmo River Rainbow Trout Abundance Monitoring Program (2002-2020). Salmo Watershed Streamkeepers Society. Unpublished manuscript, 21 p. + app.

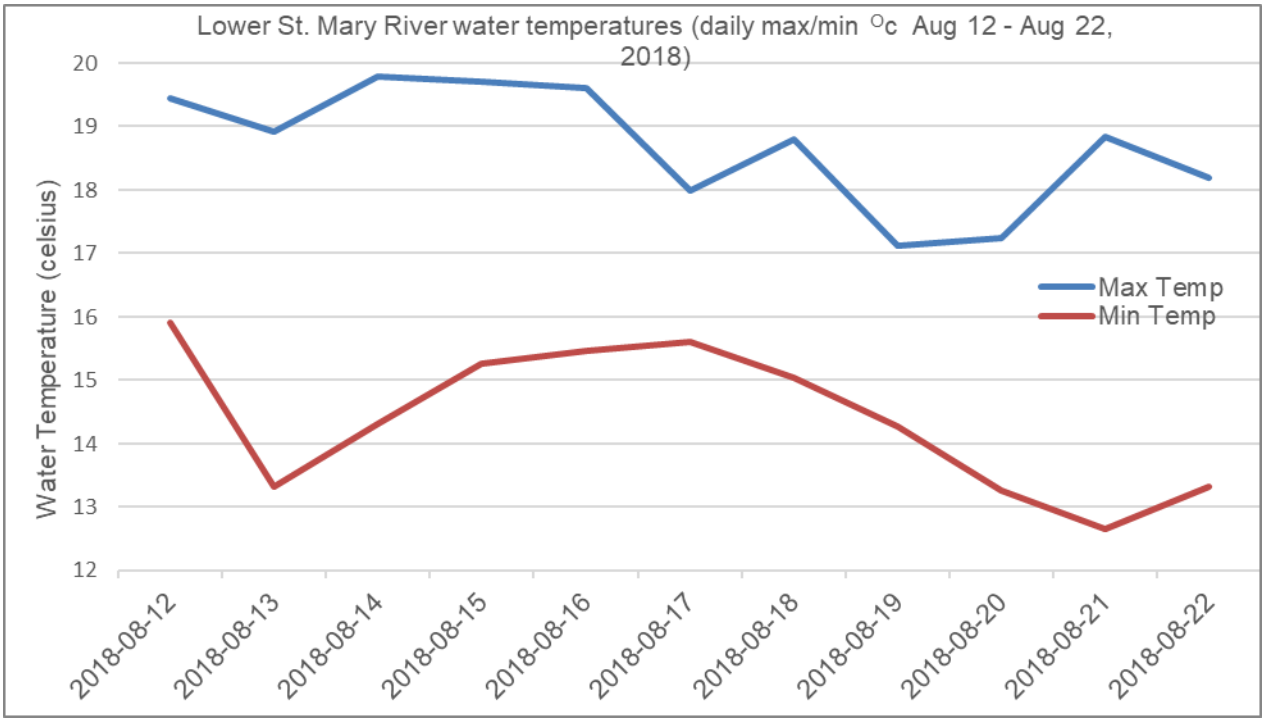

Figure 2. Overnight thermal recovery during a 11-day peak water temperature period, lower St. Mary River 2018.

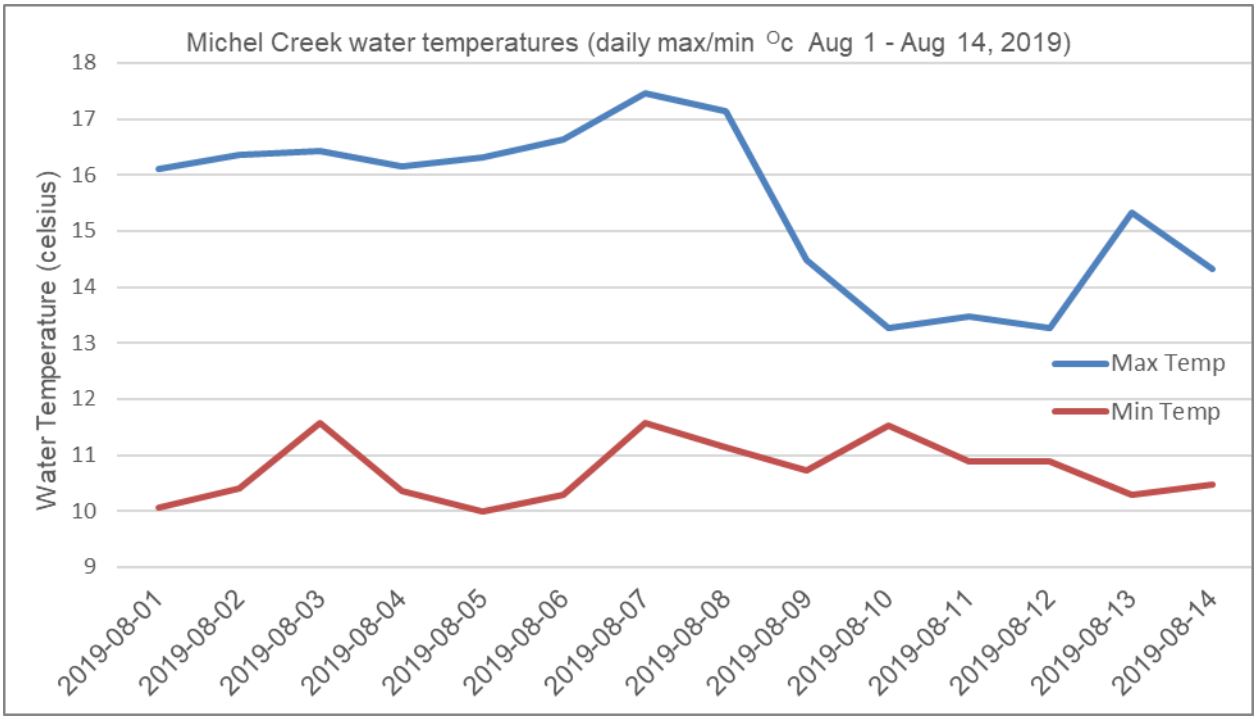

Figure 3. Overnight thermal recovery during a 14-day peak water temperature period on Michel Creek (2019).

Consequences of Proposal (Both Positive and Negative):

Positive:

- Approach effectively mitigates conservation risks, while maintaining angler opportunity and social and economic benefits.
- Proactive and responsive plan to protect fisheries resources during obviously stressful conditions for highly valued and sensitive fisheries.
- Supports ongoing regional efforts to broaden temperature monitoring.
- Simple and easily understood; legal; enforceable.
- Fits science and regional data better than alternatives.
- Reduces administrative decision and communication burden compared to other closure alternatives, especially Classified Waters (refund requests on licences and rod days, business harm and losses to booked guiding)
- Reduces impact on tourism sector business and maintains angler opportunities.
- Allows for broader geographic protection than more restrictive alternatives which, due to their social and economic impact carry a decision pressure to reduce waterbody scope.
- Excellent monitored approach for BC fisheries management alternatives in the Kootenays, in other parts of the province, and for future climate change adaptation of fisheries management.

Negative:

- Affects high demand, popular classified and non-classified fisheries and some stakeholders may perceive closure, even time of day and not full, as an overly aggressive fisheries management action despite the compelling case.
- Does not close streams completely, and some stakeholders may perceive time of day closures as inadequately precautionary despite the data and science.
- This closure will have some impact on guided angling opportunities (guided angling activities frequently extend to ≥ 6 pm).
- These closures may shift some angling effort to other nearby stream fisheries, which may compromise Angling Management Plan (AMP) angler day quotas and objectives, or conservation objectives in other areas.

Management Approach Proposal 2: Upper West Arm Kokanee Fishery

Name and Affiliation of Submitter:

Ministry of Forests

Waterbody Name: Upper West Arm of Kootenay Lake

Brief Summary of Management Approach:

We propose that the default minimum harvest opening for Upper West Arm kokanee be April 1 – 3 and July 1 -2 (5 days total), with supplementary openings of a number of days in the months of April, May, June, and/or July only when forecasting suggests additional harvest will be sustainable, by means of in-season change.

Past and current consultation reveals that anglers prefer a daily quota = 5. We are proposing no change to the daily quota of 5 kokanee when open.

Rationale for management approach:

In most years Upper West Arm kokanee population forecasting has suggested that angling harvest should occur for less than 30 days, to ensure kokanee conservation.

The published opening in the fishing regulations synopsis, with the exception of 2021-23 has therefore been misleading to anglers and has required in-season variations almost every year to avoid recruitment overfishing in many years.

Stock-recruit analysis of all of the annual Upper West Arm spawner numbers and fisheries harvest estimates, from the early 1990s until present, suggest that it is possible to sustainably harvest with a daily quota = 5 (when open) for a limited number of days (at least 5 days annually) in all years, with minimal risk of uncompensated recruitment overfishing based on escapement (spawner numbers), and almost no risk based on egg deposition (at lower numbers females are more fecund).

Maximum sustainable yield occurs at escapements of 8000 to 10000 kokanee, or roughly 3.5 – 4 million eggs, under both Ricker and Beverton-Holt models of recruitment fitted to West Arm kokanee dynamics.

Forecasting based on April catches from FLNR creel surveys, cohort strength from fry production estimates, environmental conditions, and from other analyses and surveys, could allow for in-season supplementary harvest days without risking kokanee conservation in some years.

A consistent and published minimum opening of 5 days every year is reliable for angler planning and avoids administratively unsustainable annual revision.

Alternatives Considered and Reasons for Not Selecting Them:

- More than 5 days open with a lower daily quota:
  inconsistent with past stakeholder consultation which indicated a daily quota of 5 was optimal for anglers.
- Closed to fishing unless open under annual review of forecasted surplus:
  annual revision is not administratively feasible for Director's staff
- Open for more days with annual revision as forecasted surplus varies:
  annual revision is not administratively feasible for Director's staff

Current Regulations:

Kokanee release, EXCEPT Apr 1-Apr 3 and July 1-July 2 only, when daily quota = 5

What information/data/observations support this change:

- Annual spawner number estimates for 2 spawning channels, all significant spawning creeks, and shore spawners (Ministry data on file)
- Annual creel surveys of Upper West Arm kokanee fisheries when open (Ministry data on file)
- Beverton-Holt (e.g. fig. 1) and Ricker (on file) stock-recruit analyses for the West Arm kokanee population suggests maximum sustainable yield at a target of 8,000 to 12,000 spawners.
- April 1 – 3 and July 1 – 2 fisheries in the recent past harvested 2000 to 3000 kokanee

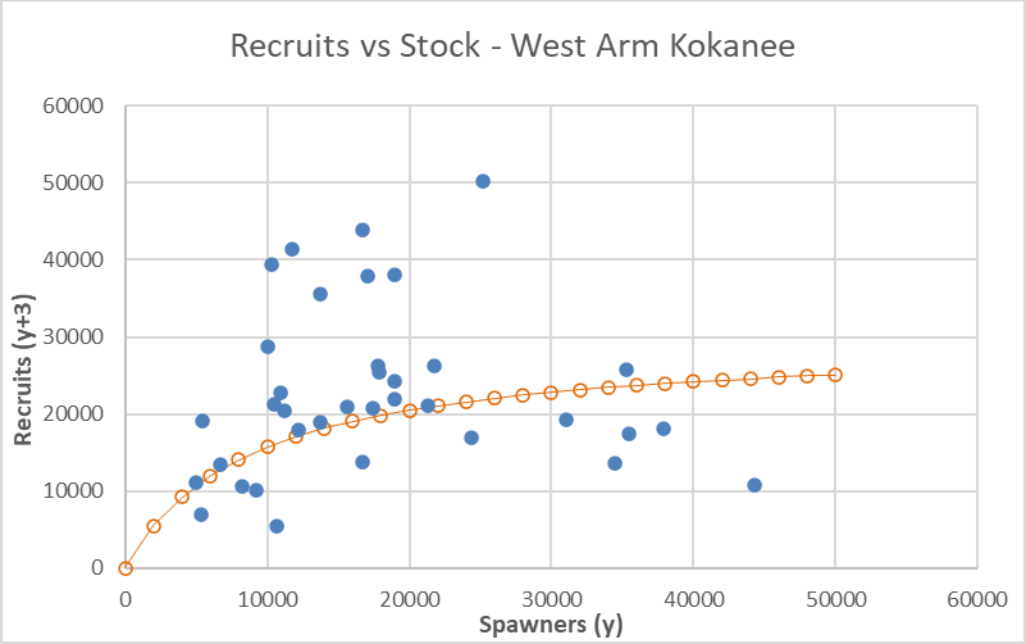

Figure 1. Beverton Holt analysis of West Arm kokanee spawner to spawner recruitment. Maximum sustainable yield is in the range of 6000 to 9000 spawners. Note, maximum sustainable yield under Ricker assumptions is 10000 spawners.

Consequences of Proposal (Both Positive and Negative):

Positive:
A reliable minimum opening:
- Allows anglers to plan for angling
- allows Ministry biologists to plan and budget for creel and other surveys;
- avoids an annual administrative burden of in-season change requests

Negative:

- May reduce angler opportunity in abundant years.
- Rare environmental and population circumstances may still require unanticipated regulation changes.