



Ministry of **Forests, Lands, Natural Resource Operations**  
and **Rural Development**



WASHINGTON-BRITISH COLUMBIA  
CHAPTER



**40 YEARS OF  
FISH AND FISHERIES  
IN THE PACIFIC NORTHWEST**

**The Future of Bull Trout populations and management  
in Washington and British Columbia**

Wednesday, March 21<sup>st</sup> 2018, 3:20-5:00pm

Vineyard 3



Ministry of **F**orests, **L**ands, **N**atural Resource **O**perations  
and **R**ural **D**evelopment

## **Welcome to the Symposium, to Kelowna, & to BC, all!**

We thank the Okanagan people for welcoming us on their traditional territory.

### Chairs of this session:

Dr. Nikolaus Gantner, BC Ministry of FLNRORD, Prince George, BC

Shawna Warehime, Eastern Washington University, Cheney, WA

Rachel Chudnow, UBC Fisheries Centre, Vancouver, BC

### Char of this session:

*Salvelinus confluentus*





## Why hold a Bull Trout symposium?

- Bull Trout (BT) are federally listed with some level of conservation concern throughout their range.
- Environmental and anthropogenic stressors pose threats to BT in British Columbia and Washington.
- Climate change is one major stressor, as water temperature is often the most important environmental parameter delineating BT distribution.
- Land use practises (hydro, forestry and fisheries management practises) can further affect BT populations directly and indirectly.







## The goals for today:

1. share lessons learned and success stories from the past
2. discuss future strategies to assess and manage BT.

## Format for our **S**ymposium:

- 5 x 20 min presentations, includes time for Q&A
- Contributions from BC Ministry, BC Hydro, Yakima Nation, & academia (UBC)
- Contributors asked to keep to the allotted time...
  - 5 min '*wink*', 1 min '*warning*', 0 min '**hook and tackle**'



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## Contributors this afternoon....

Title	Presenter	Affiliation
<b>Climate change influence on Upper Fraser Watershed and Bull Trout habitat</b>	Nikolaus Gantner	BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development
<b>Bull Trout in the Yakima basin: a proposal to prevent future declines</b>	Todd Newsome	Yakama Nation
<b>Predator-prey interactions between Bull Trout and juvenile Sockeye Salmon in Chilko Lake, British Columbia</b>	Nathan Furey	University of British Columbia and University of New Hampshire
<b>Evaluating the effectiveness of fish passage operations for resident Bull Trout at a flood storage dam in Southeastern British Columbia</b>	Katy Jay	BC Hydro
<b>Hierarchical bayesian meta-analysis to characterize cross-population variation in the stock-recruit relationship for Bull Trout (<i>Salvelinus confluentus</i>)</b>	*Rachel Chudnow	The University of British Columbia



# Climate Change Influence on Upper Fraser Watershed and Bull Trout Habitat



Nikolaus Gantner<sup>1</sup>, Vanessa Foord<sup>2</sup>, John Rex<sup>2</sup>, Sean Barry<sup>2</sup>,  
Susanne Williamson<sup>3</sup>, Ian Spendlow<sup>1</sup>, and Ray Pillipow<sup>1</sup>

<sup>1</sup>**Fisheries Team**, BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development (FLNRORD), Omineca Region, Prince George, BC

<sup>2</sup>**Research and Stewardship Team**, BC Ministry of FLNRORD, Omineca Region, Prince George, BC

<sup>2</sup>BC Ministry of the Environment and Climate Change Strategy, Omineca Region, Prince George, BC





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## Omineca 7A

~130,000km<sup>2</sup>

Fraser River headwaters

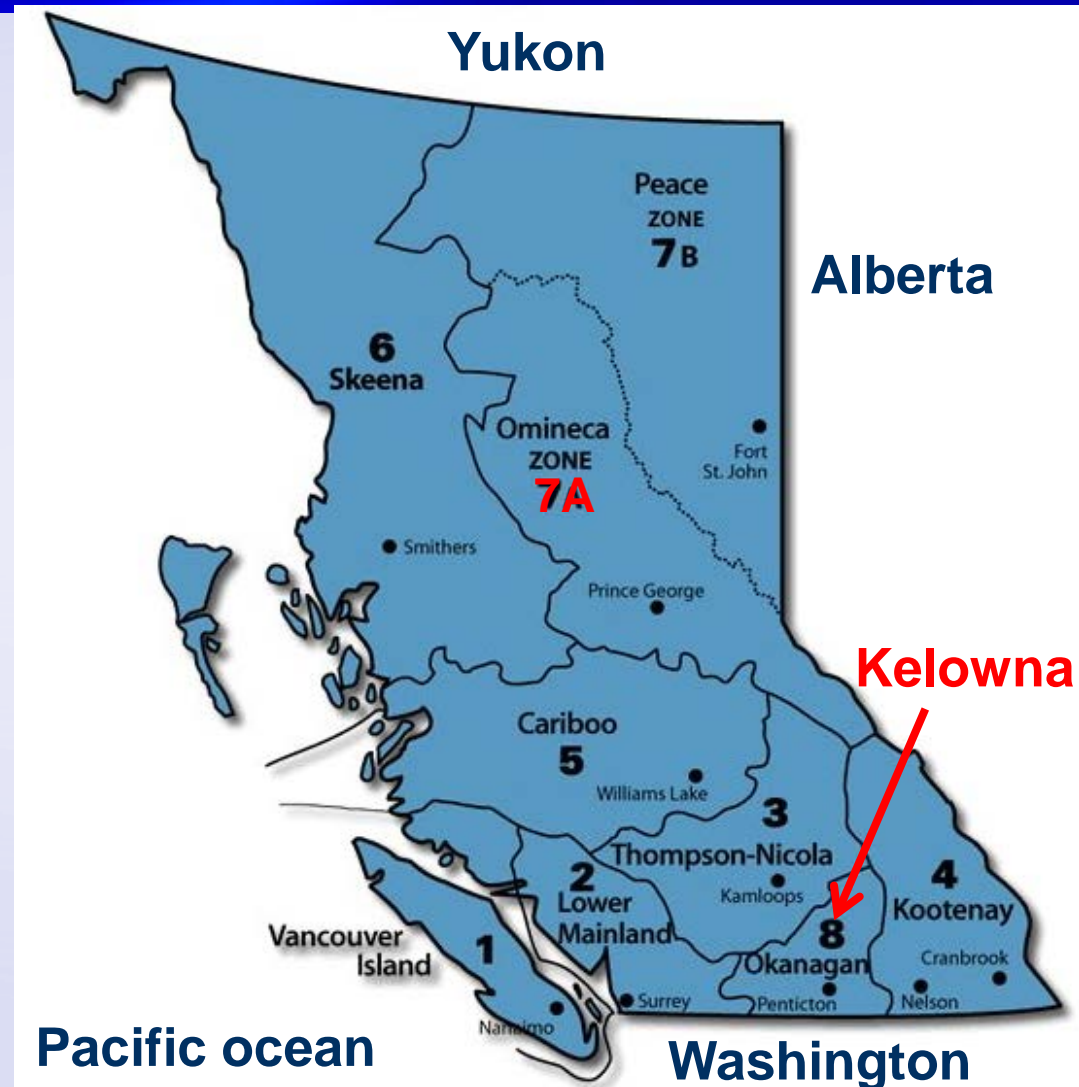
~700-1300 rkm from Pacific

Three BT life histories

- Resident
- Fluvial
- Adfluvial

Chinook salmon (1200 rkm)

Sockeye salmon (900 rkm)





## Omineca 7A: Middle and Upper Fraser Bull Trout studies

- Pacific and Arctic populations
- Moderate/slow growth
- Max age ~15 yrs
- Age at maturity ~7 yrs
- Adfluvial, fluvial, resident life history forms
- Highly mobile
- Spawn at high elevation (1000m), ground water streams.
- Highly vulnerable to exploitation
- Catch & release, retain 1 >50cm from lakes
- **Vulnerable to habitat and temperature changes**



Ian Spendlow, fisheries biologist  
Omineca Region 7A





## BC's Bull Trout conservation.....

**1994** Bull Trout are **Blue Listed** by the BC Conservation Data Centre, considered a  
*“Species of Special Concern”*

- Identified wildlife management strategy includes Bull Trout

**2011** Provincial management planning & COSEWIC develops national BT conservation status update.

- Information synthesis and risk assessment for BC Bull Trout (Hagen and Decker 2011)
- National BT assessment produced (COSEWIC 2012)

*DU5 “Pacific populations - NOT AT RISK”*

**2013** expert workshops held provincially.

- BT management plan for BC (Pollard et al. 2015)
- BT management model introduced (van Poorten et al. 2015)



## Regional management “metapopulation concept”

**2011-2016 Bull Trout distribution evaluations mid-upper Fraser**

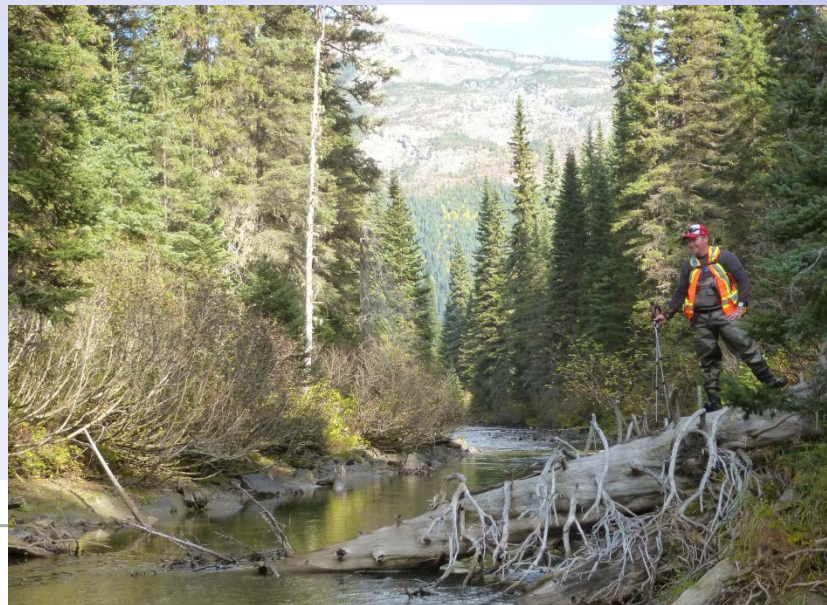
- Spawner abundance: Redd counts
- Movements of fluvial BT from upper Fraser streams
  - 150 radio tags in natal systems
  - 350 PIT tagged in key-overwintering locations
- Otolith microchemistry (ongoing)



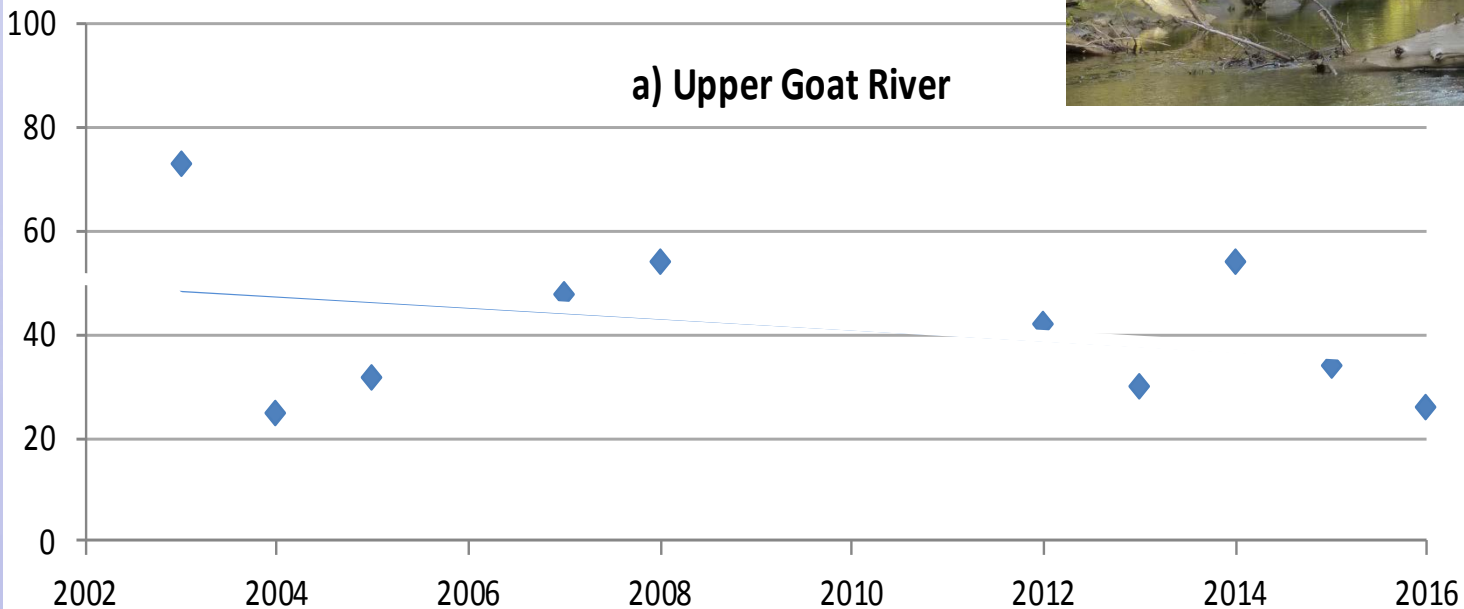


## FLNRORD redd count data

Example: Goat River 2001-2016  
Trend through ~1 BT generation



a) Upper Goat River



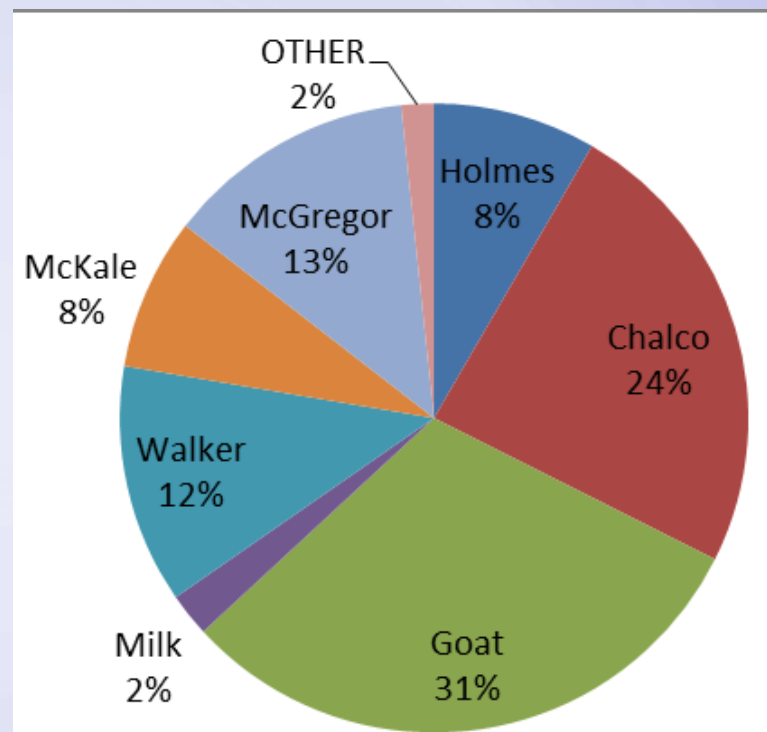




## Regional management “metapopulation concept” (con’t)

### 2011-2016 Bull Trout distribution evaluations mid-upper Fraser

- DNA of Nechako overwintering BT suggests mixed stock
- Concurrent BT modelling by UBC -> Risks and trade-offs of sustainable fishing options



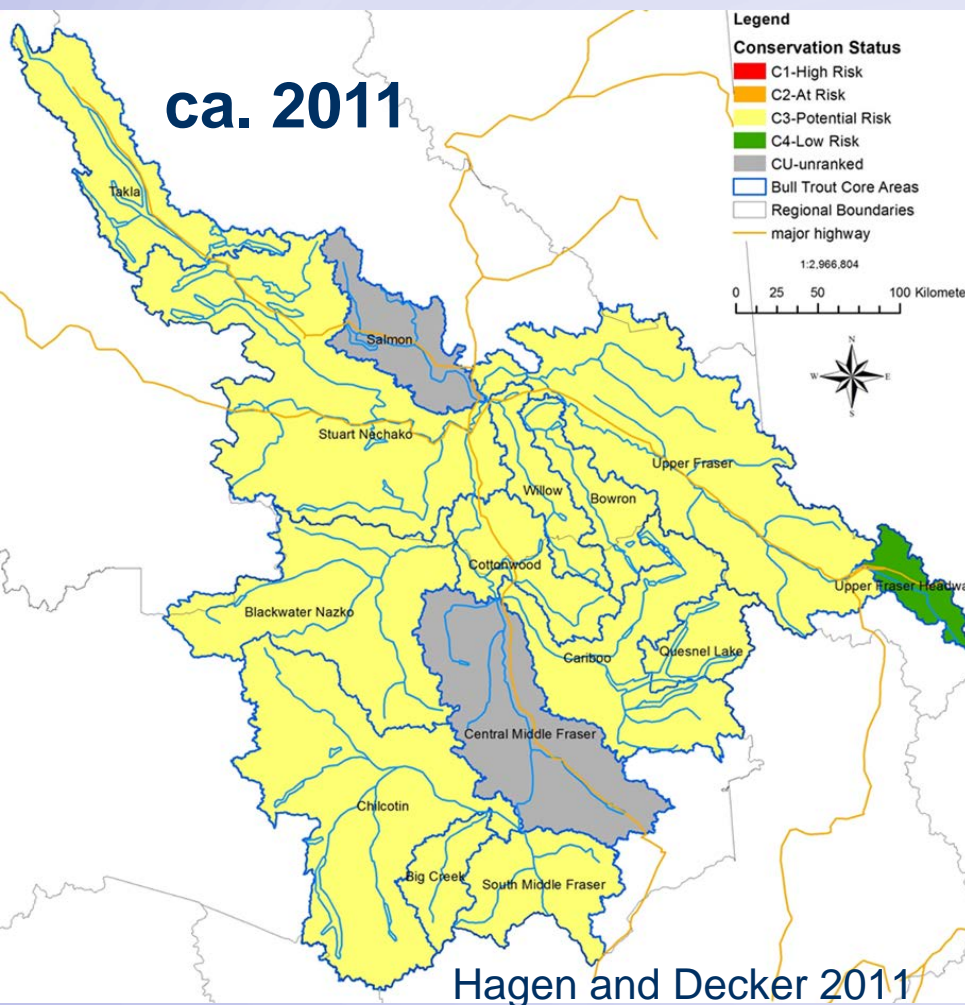
Taylor et al, in prep

*Rachel Chudnow – this Symposium*



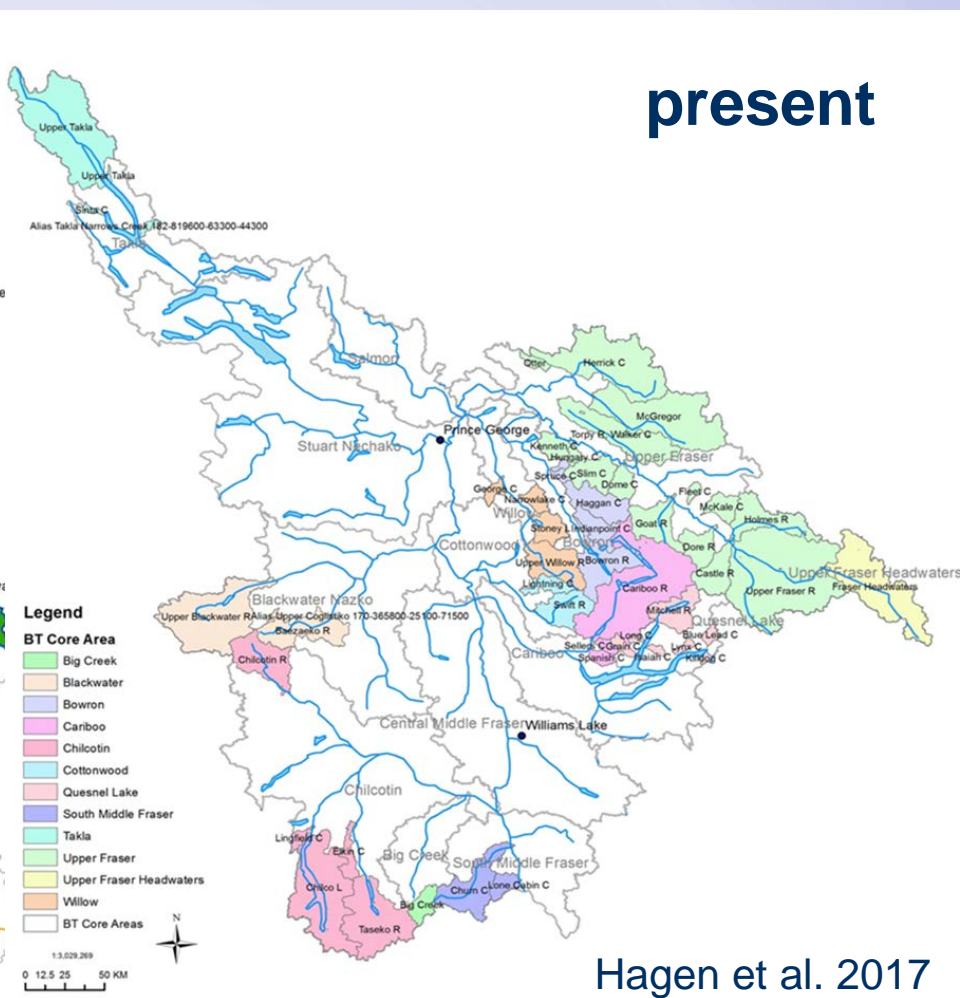
## Bull Trout Core Areas

- 15 putative metapopulations



## Bull Trout Designated-Watersheds

- 51 unique stream networks delineated





## Regional management “metapopulation concept”

### Key recommendations:

- Priority regional areas to address information adequacy
- Further need to map/inventory critical habitat
- eDNA for rapid & widespread distribution mapping
- Thermal habitat suitability (i.e. cold water climate shield)
- New Case Study...

### Bull Trout Management Plan for the Middle and Upper Fraser River Watershed

John Hagen,<sup>1</sup> Lee Williston,<sup>2</sup> Rob Dolighan,<sup>3</sup> Sean Barry,<sup>4</sup> Susanne Williamson,<sup>2</sup> Ray Pillipow,<sup>5</sup> Ian Spendlow,<sup>6</sup> and Greg Andrusak<sup>7</sup>

November 2017, Draft v.2



Prepared for:

Ministry of Forests, Lands, Natural Resource Operations, & Rural Development,  
Fish and Wildlife Branch, Williams Lake and Prince George, BC.

Habitat Conservation Trust Foundation, Victoria, BC.

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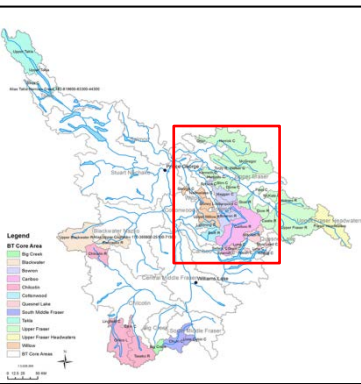
<sup>7</sup> BC MFLNRORD, Victoria; greg.andrusak@gov.bc.ca





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## Bowron River Watershed





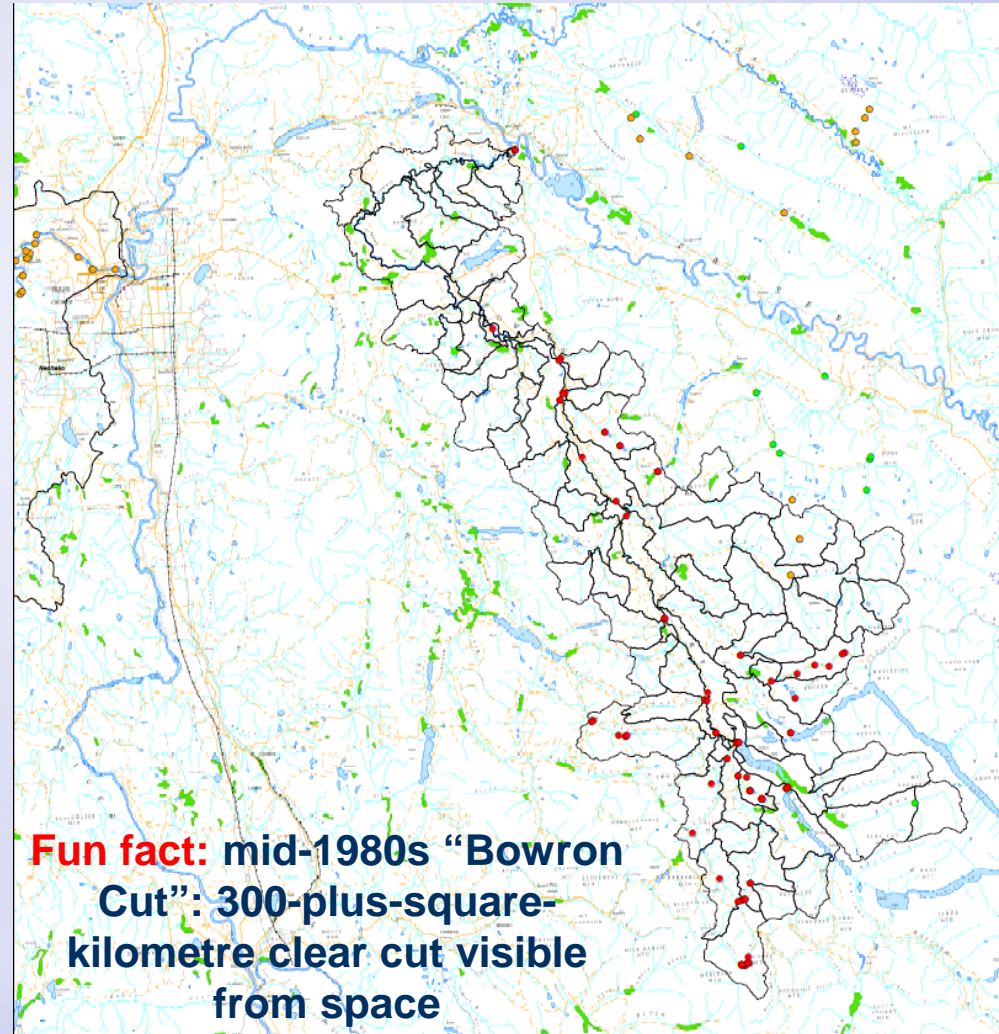
## Case study: Bull Trout Climate Action project

### Study site:

Bowron River Watershed

### Objectives

1. Identify areas of potential risk to BT from climate change
2. Identify areas of potential climate refugia for BT
3. Provide science-based advice to decision makers regarding management actions





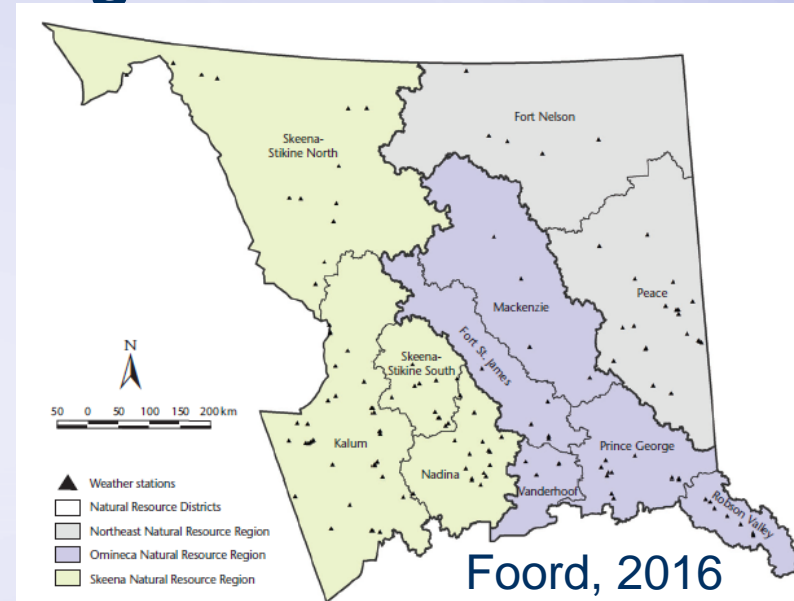






## Climate change in the Omineca Region

- ✓ Mean annual air temperature increased by  $1.3^{\circ}\text{C}$  through past 100 years and is projected to further increase by  $3.5^{\circ}\text{C}$  by 2055.
- ✓ Recently experienced below average snowpacks coupled with warm, dry summers  $\rightarrow$  increasing stream temperatures.
- ✓ Aligns with our *Omineca Climate Action Plan* and the ministry's *Climate Change Strategy*
- ✓ 4 met stations throughout watershed
- ✓ Historical data available (1885-present)





## The Bowron Watershed Hydrology

- ✓ one of 51 *BT - Designated Watersheds*
- ✓ Relative proximity to Prince George.
- ✓ Relevant model input data available.
- ✓ 50 air and water temperature loggers to be deployed this Aug
- ✓ Historical data explored

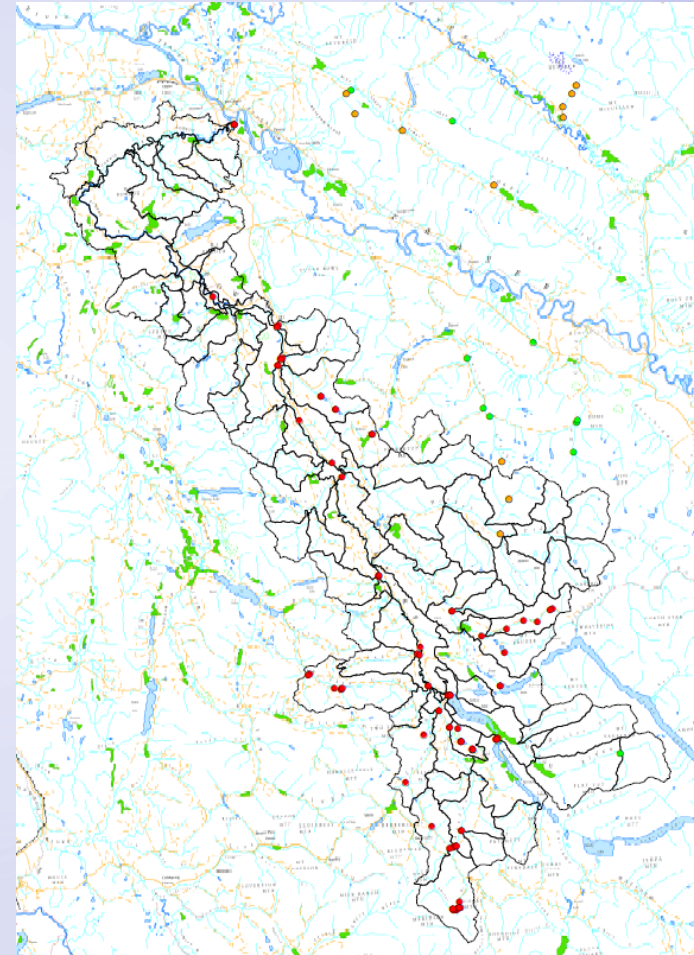






## Bowron River Bull Trout

- ✓ BT presence / absence well documented
- ✓ Not major contributor to Nechako BT
- ✓ Identify most sensitive areas to stream and riparian air temperature increase.
- ✓ Inform fisheries habitat, water management, as well as conservation planning and management activities influenced by future climatic conditions.
- ✓ Implement watershed-specific forestry and riparian management practices to mitigate projected temperature increases to lower risk of future BT habitat loss.







## Planned eDNA sampling 2018

COOP Student  
&  
PICS Intern  
~50 sites  
+ electro-fishing



Carim et al., 2016





## Summary

- Bull Trout in the Upper Fraser are well studied and a Management Plan was recently established.
- BT are susceptible to climate change, yet the extent is yet to be determined.
- Modelling stream temperatures to characterize BT resilience and susceptibility to Climate Change allows us to identify optimal management strategies to mitigate potential risk.
- Results are applicable to conservation of other salmonids, including Arctic Grayling across our region.







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## The Future of Bull Trout populations and management?







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## References:

- Carim, K. J., T. Wilcox, M. K. Young, K. S. McKelvey & M. K. Schwartz, 2015. Protocol for Collecting eDNA Samples from Streams. U.S.D.A. Forest Service, Rocky Mountain Research Station V2.1 (April 2015). Available at <http://www.fs.fed.us/research/genomics-center/docs/edna/edna-protocol.pdf>
- Chezik, K. A., S. C. Anderson, and J. W. Moore, 2017. River networks dampen long-term hydrological signals of climate change, *Geophys. Res. Lett.*, 44, 7256–7264, doi:10.1002/2017GL074376.
- Foord, V.N. 2016. Climate patterns, trends, and projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia. Prov. B.C., Victoria, B.C. Tech. Rep. 097. [www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr097.htm](http://www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr097.htm)
- Hagen, J., L. Williston, R. Dolighan, S. Barry, S. Williamson, R. Pillipow, I. Spendlow, and G. Andrusak. 2017. Bull Trout Management Plan for the Middle and Upper Fraser River Watershed: Draft v.2. BC Ministry of FLNRORD, Williams Lake and Prince George, BC, and Habitat Conservation Trust Foundation, Victoria, BC. *Unpublished*.
- Isaak, D. J., Young, M. K., Nagel, D., and Horan, D., 2014. Coldwater as a Climate Shield to Preserve Native Trout through the 21<sup>st</sup> Century; Wild Trout Symposium XI—Looking Back and Moving Forward (2014)
- Isaak, D. J., Young, M. K., Nagel, D. E., Horan, D. L., & Groce, M. C., 2015. The cold-water climate shield: Delineating refugia for preserving salmonid fishes through the 21st century. *Global Change Biology*, 21, 2540–2553.
- Isaak, D. J., Young, M., Luce, C., Hostetler, S., Wenger, S., Peterson, E., . . . Nagel, D., 2016. Slow climate velocities of mountain streams portend their role as refugia for cold-water biodiversity. *Proceedings of the National Academy of Sciences of the United States of America*, 113, 4374–4379.
- Isaak, D. J., Wenger, S. J., Young, M., 2017b. Big biology meets microclimatology: defining thermal niches of ectotherms at landscape scales for conservation planning. *Ecological Applications* 27: doi:10.1002/eap.1501
- Isaak, D. J., Wenger, S. J., Peterson, E. E., Ver Hoef, J. M., Nagel, D. E., Luce, C. H., . . . Parkes-Payne, S., 2017a. The NorWeST summer stream temperature model and scenarios for the western U.S.: A crowd-sourced database and new geospatial tools foster a user community and predict broad climate warming of rivers and streams. *Water Resources Research*, 53. <https://doi.org/10.1002/2017WR020969>
- McKelvey, K. S., M. K. Young, W. L. Knotek, K. J. Carim, T. M. Wilcox, T. M. Padgett-Stewart and M. K. Schwartz. 2016. Sampling large geographic areas for rare species using environmental DNA: a study of bull trout *Salvelinus confluentus* occupancy in western Montana. *Journal of Fish Biology* (2016) 88, 1215 – 1222; doi:10.1111/jfb.12863
- United States Fish and Wildlife Service (USFWS). 2008. Bull Trout Recovery: Monitoring and Evaluation Guidelines. USFWS, Vancouver, WA.

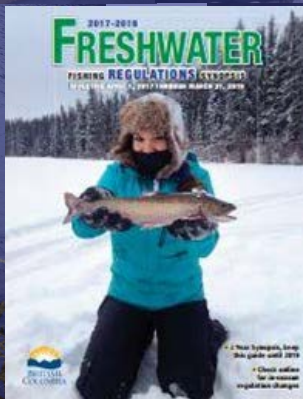




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