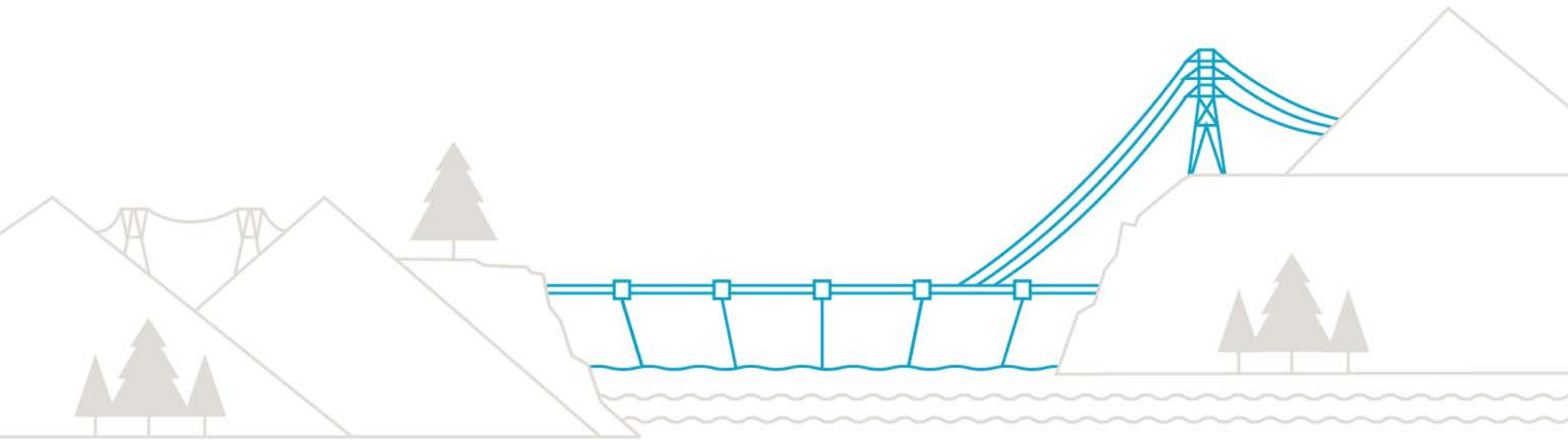


Evaluating the effectiveness of fish passage operations for resident Bull Trout at a flood storage dam in Southeastern British Columbia



Katy Jay

Authors and Acknowledgments

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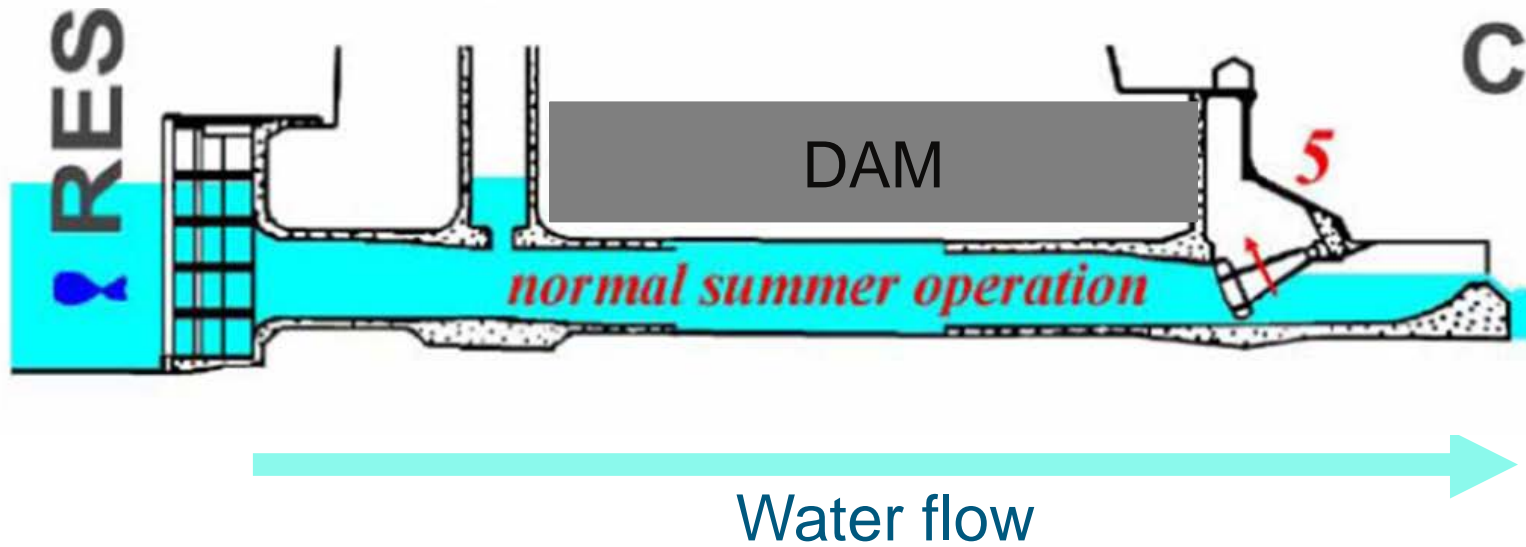
Trever Oussoren, Alf Leake, Len Wiens, Kris Wiens,
Brenda Thomas

Duncan Dam – Bull Trout Transfer Program

- Storage dam constructed 1967
- Kootenay River watershed
- Bull Trout recreational fishery
- Dam operator observed migrating bull trout
- Transfers operating since 1968



Duncan Dam – Bull Trout Transfer Program



Duncan Dam – Bull Trout Transfer Program

- Constructed weir in 1994
- Weir installed as fish ladder for easy access
- Assumed increased use of smaller Bull Trout
- Timbers are installed/removed annually



Duncan Dam – Bull Trout Transfer Program

Related Implications

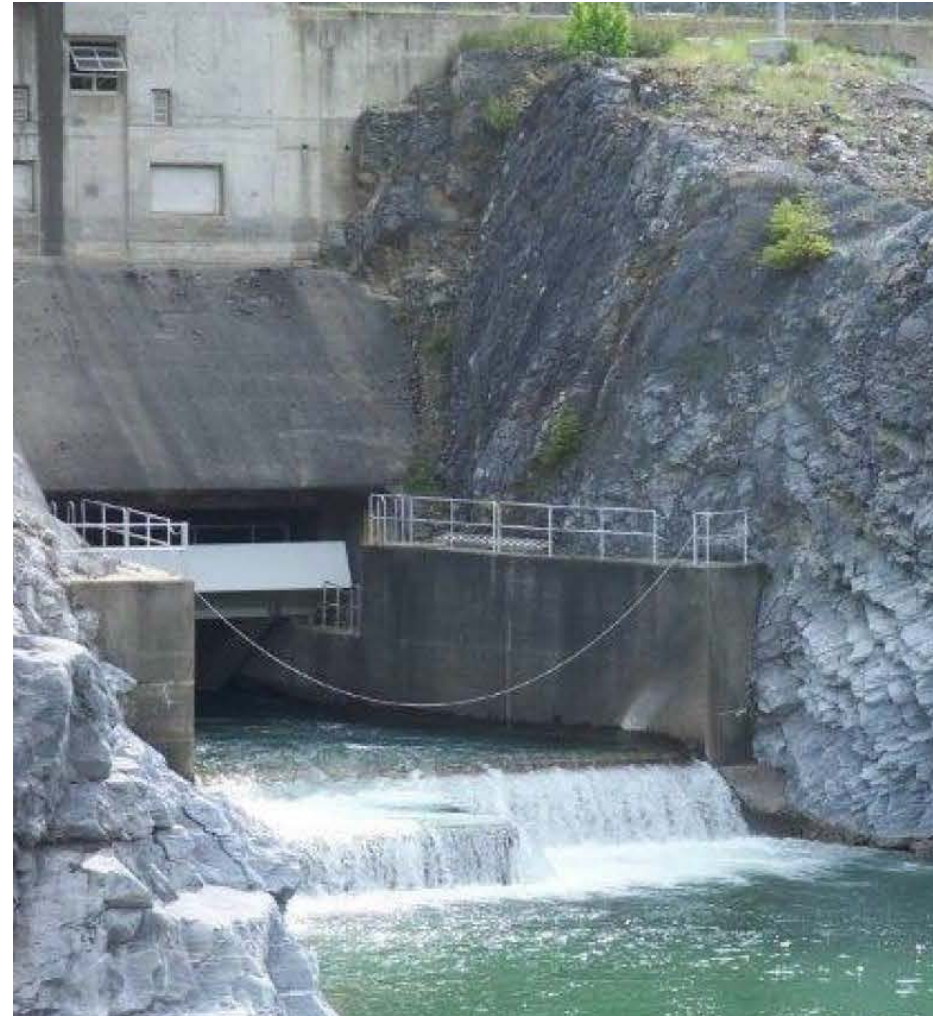
- Safety concerns during installation and removal
- Increased risk gas supersaturation during high flows
- Canal dewatering during transfer operations
- Erosion related to weir installation
- Weir maintenance and potential damage during increased flows



Duncan Dam – Bull Trout Transfer Program

- Water Use Plan (2007)
- Facilitate bull trout passage between May 1 and September 30 of each year
- Monitors: DDMMON-5 and DDMMON-6

Objective: Determine recruitment benefits, evaluate effectiveness of weir, and propose a solution of weir re-design to restore flexibility to operations



DDMMON-5

Upper Duncan River Bull Trout Migration Monitoring

Management Question

Does the Bull Trout transfer program contribute to the Kootenay Lake recruitment?

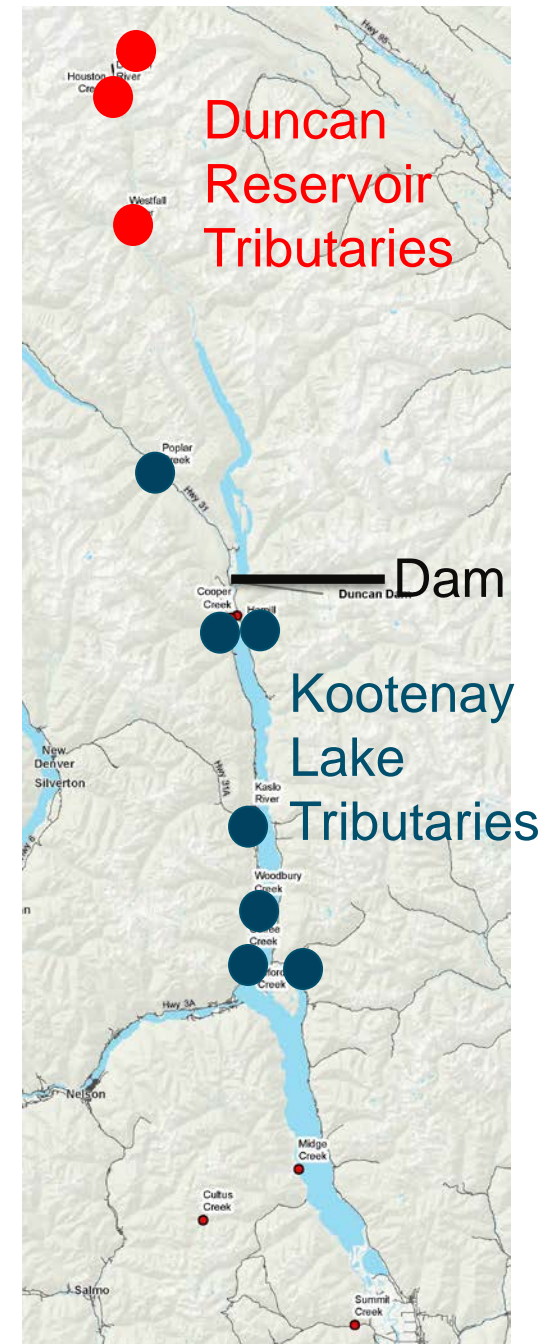
Method - Otolith chemistry signature to determine adult natal origin



DDMMON-5

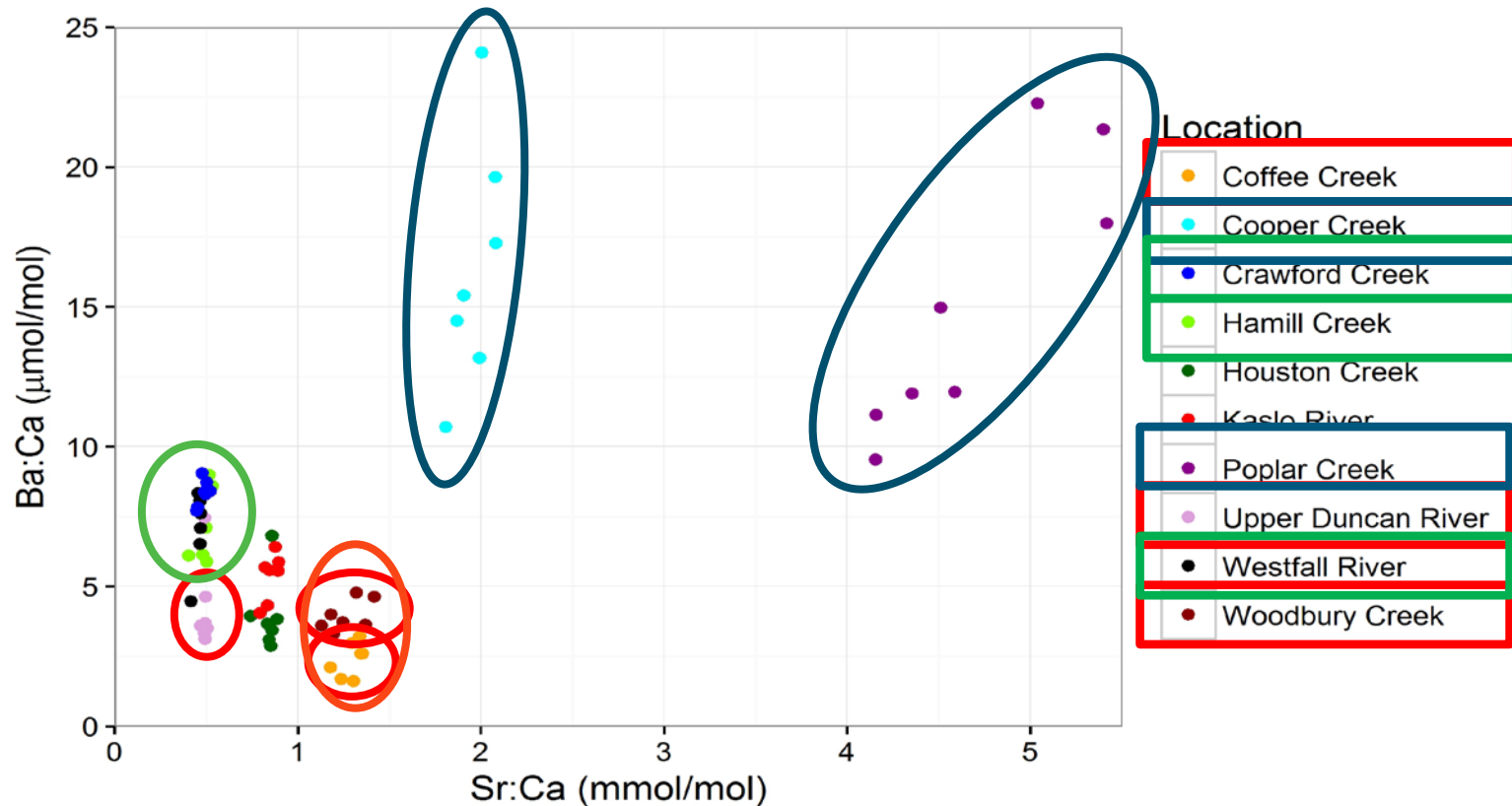
Upper Duncan River Bull Trout Migration Monitoring

- 5 years of sampling
- 10 tributaries
- Water sampling (n=26) – tributaries
 - Determine chemistry differences between streams
- Juvenile Otoliths (n=354) – natal tributaries
 - Develop and validate predictive model
- Adult Otoliths (n=125) – flipbucket / recreational fishing
 - Determine natal stream using predictive model



DDMMON-5

Upper Duncan River Bull Trout Migration Monitoring



Otolith chemistry of juvenile Bull Trout by natal tributary

Isotope Analyses: Strontium (⁸⁶Sr) and Barium (¹³⁸Ba)

DDMMON-5

Upper Duncan River Bull Trout Migration Monitoring

Percent of correct classification of juvenile capture location

Capture Location	Un-validated Model	Cross-Validated Model
Duncan Watershed		
Houston Creek	71%	71%
Upper Duncan River	86%	86%
Westfall River	86%	57%
Kootenay Watershed		
Coffee Creek	100%	100%
Cooper Creek	100%	100%
Crawford Creek	57%	57%
Hamill Creek	67%	50%
Kaslo River	71%	71%
Poplar Creek	100%	100%
Woodbury Creek	100%	86%
Total	84%	79%

DDMMON-5

Upper Duncan River Bull Trout Migration Monitoring

Classification of Adult Natal Origin

Predicted Natal Tributary	Adult Capture Location		
	Duncan Reservoir	Flip Bucket	Kootenay Lake
Houston Creek	17%	30%	31%
Upper Duncan River	8%	26%	23%
Westfall River	25%	22%	15%
Total Duncan Watershed	50%	78%	69%
Coffee Creek	0%	0%	0%
Cooper Creek	0%	0%	8%
Crawford Creek	17%	4%	0%
Hamill Creek	8%	0%	8%
Kaslo River	25%	17%	15%
Poplar Creek	0%	0%	0%
Woodbury Creek	0%	0%	0%
Total Kootenay Watershed	50%	22%	31%

DDMMON-5

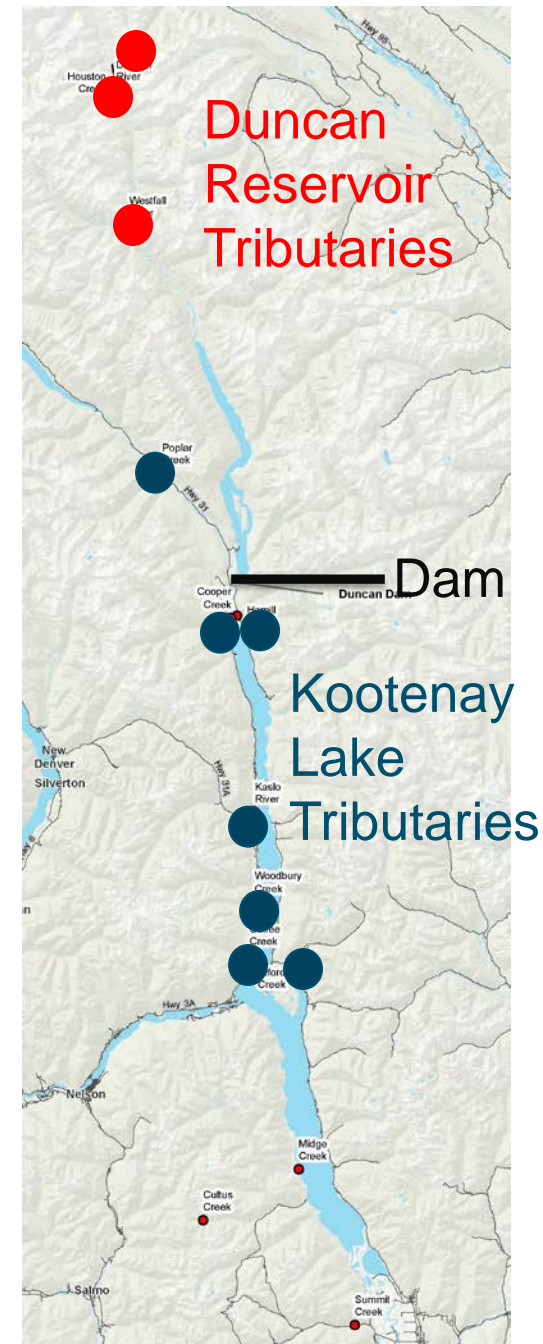
Upper Duncan River Bull Trout Migration Monitoring

Management Question

Does the Bull Trout transfer program contribute to the Kootenay Lake recruitment?

Conclusion

Yes - ~25% of Kootenay Lake adults originated from Upper Duncan River



DDMMON-6

Duncan Dam Bull Trout Passage

Management Questions

Does the weir improve access for Bull Trout migrating to the Upper Duncan River system?

Is there an alternative design that would improve operating conditions?



DDMMON-6

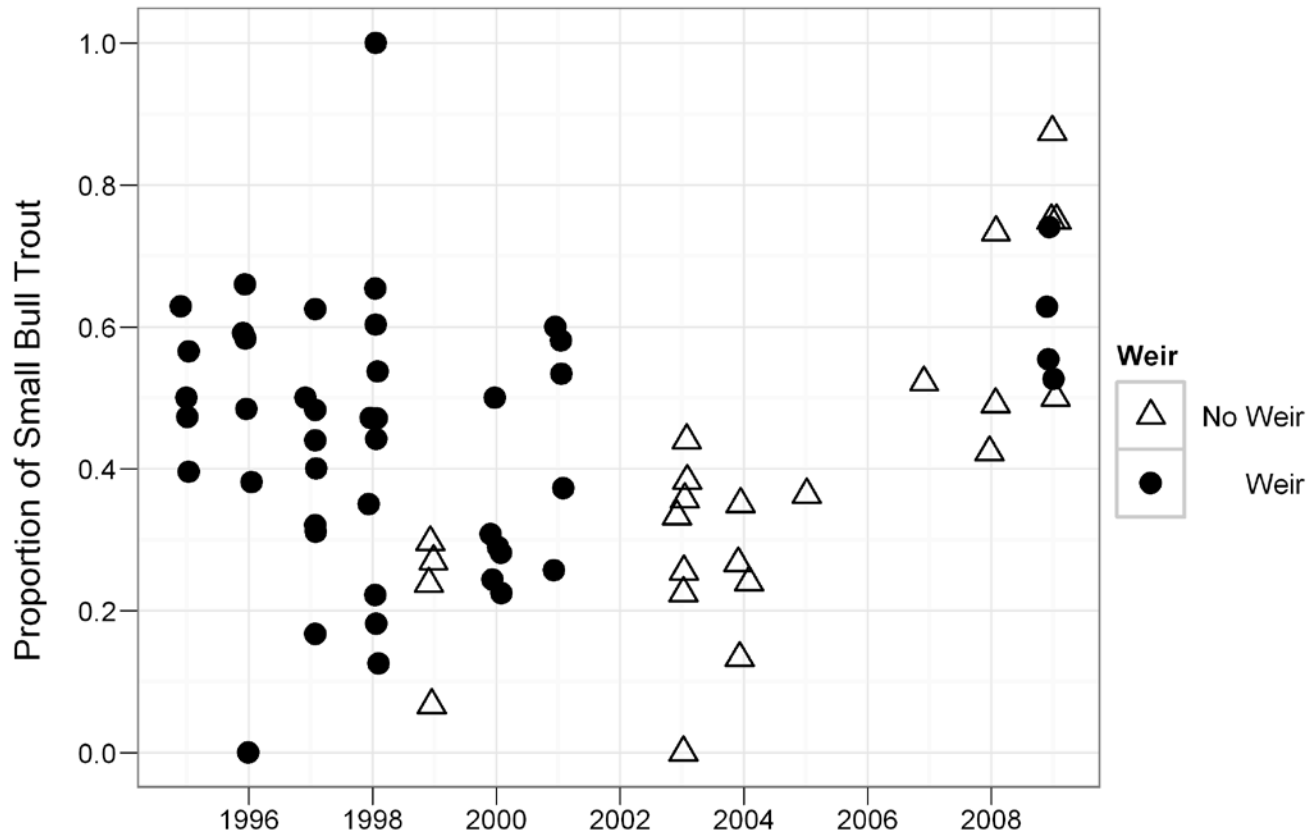
Duncan Dam Bull Trout Passage

Year 1 – analysis of historical data (1995-2008) to determine effectiveness of weir increasing passage of smaller (<65cm) Bull Trout



DDMMON-6

Duncan Dam Bull Trout Passage



Proportion of small (<65cm) Bull Trout in flip bucket during transfer events by year and weir presence

DDMMON-6

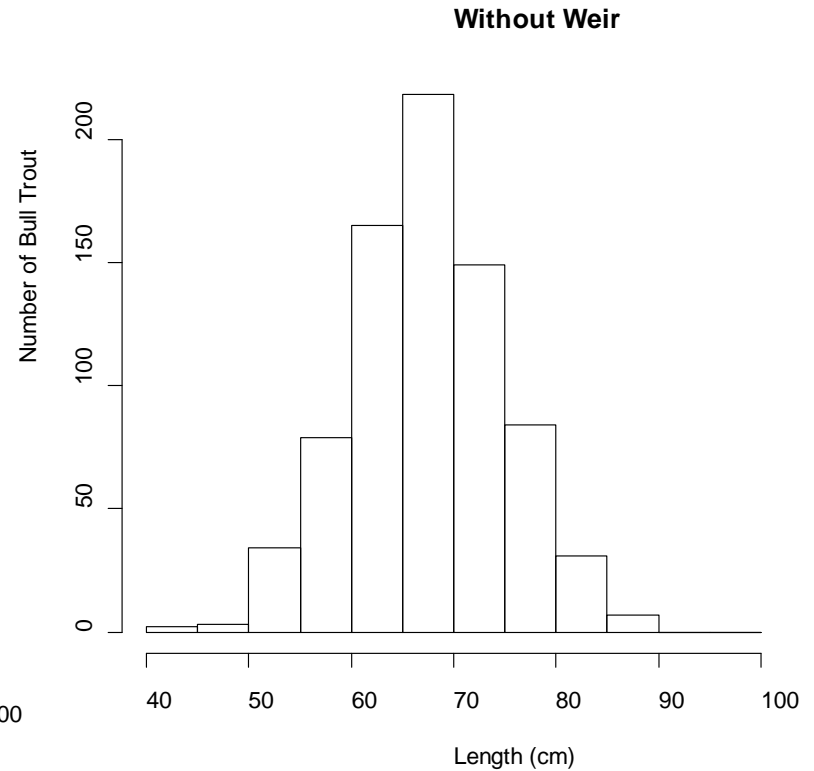
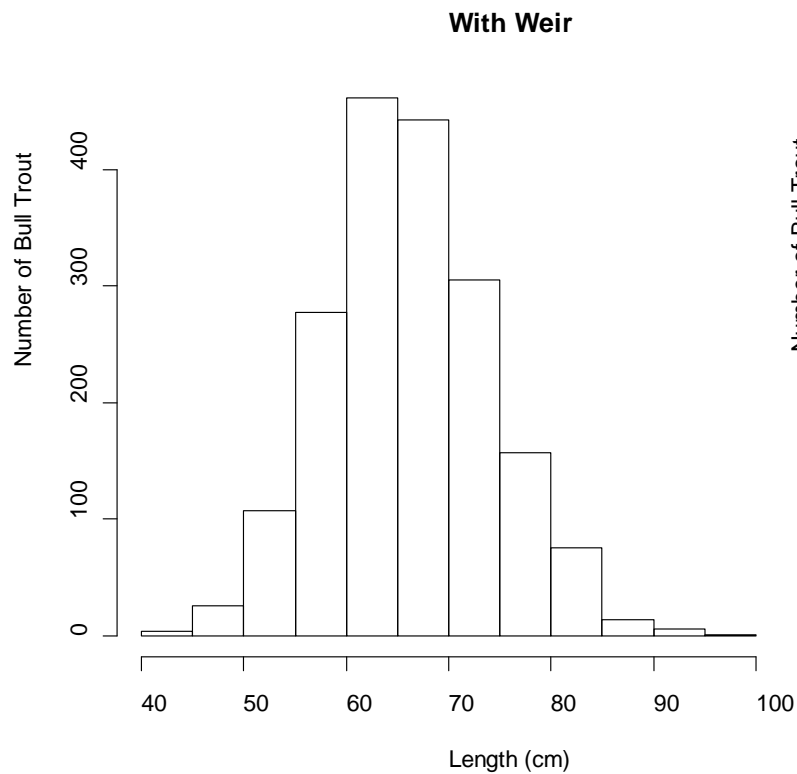
Duncan Dam Bull Trout Passage

Year 2 – enumerated of all fish transferred in sampling year; measured fork length (cm)



DDMMON-6

Duncan Dam Bull Trout Passage



DDMMON-6

Duncan Dam Bull Trout Passage

Management Questions

Does the weir improve access for Bull Trout migrating to the Upper Duncan River system?

Conclusion

Weir facilitates movement of smaller Bull trout



Duncan Dam Fish Weir Re-Design

Management Question

Is there an alternative design that would improve operating conditions?

Conclusion

Currently implementing weir re-design to improve operations and maintain Bull Trout passage





