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FRASER LANDSLIDES
RESEARCH PROJECT
COMMUNITY ENGAGEMENT SESSION

02/06/2024



YEAR 3 WORKSHOP

The Fraser Landslides Research Project held their 'Year 3 Workshop' on February 6, 2024, at the Hope Recreation Centre in Hope, BC and online. Participants discussed the latest findings in landslide impact on flow dynamics, fish migration, and genetics of Fraser River Salmon.

The workshop was facilitated by Kim Menounos and David Marshall (Fraser Basin Council) with support from Greg Witzky (First Salmon Management Council), Jeremy Venditti (Simon Fraser University), Tasha Peterson (FBC) and Bettina Johnson (FBC).

The event brought together First Nations, local government and experts in the field of landslide research including participants from the following:

Chawathil First Nation	Mt. Royal University
Coast-Salish First Nation	Nlaka'pamux Nation Tribal Council
Department of Fisheries and Oceans	P'egp'ig'lha Council
EcoFish	Sekw'el'was First Nation
Emergency Management BC	Simon Fraser University
First Nations Emergency Services Society	Shuswap Nation
Fraser Basin Council	Spuzzum First Nation
Fraser River Discovery Centre	Squamish-Lillooet Regional District
Fraser Raft Expeditions	St'at'imc First Nation
Fraser Salmon Management Council	Stswecem'c Xget'tem First Nation
Geological Survey of Canada	T'it'q'et First Nation
Government of British Columbia	Tsilhqot'in First Nation
Hakai Institute	University of Northern British Columbia
High Bar First Nation	Xat'sull First Nation
Legislative Assembly of BC	Xwisten First Nation
Leq'á:mel First Nation	

YEAR 3 WORKSHOP CONT.

The **Year 3 Workshop objectives** were to:

- Share project updates and research findings, and showcase the collaboration
- Hear stories about the research project opportunities and engagement process
- Open dialogue about next steps and opportunities to integrate findings
- Explore next steps



MEETING NOTES

Workshop participants were welcomed to the traditional territory of Chawathil First Nation by Chief Rhoda Peters.

RESEARCH OVERVIEW

Workshop participants gained valuable insight into the causes and impacts of landslides through interactive presentations and learned about newly identified sites of concern. A summary of research findings will be made available in the 'Landslide Impact on Flow Dynamics, Fish Migration and Genetics of Fraser River Salmon Year 3 Report' and once published can be accessed on the Fraser Basin Council website (spring of 2024).

During the morning session Jeremy Venditti, Simon Fraser University Research Lead gave an overview of the research project and process. Detailed presentations answered the following questions:

1. What is the size and frequency of past landslides in the Fraser Canyon?

Brian Menounos, University of Northern British Columbia

- Our work developed a landslide inventory, a first-step toward understanding how big and how often landslides occur adjacent to Fraser River.
- The age of historical landslides assessed through numerical dating shows some events occurred near or following retreat of the Cordilleran ice sheet (about 10,000 year ago), whereas the Texas Creek Landslide occurred about 2500 years ago.
- Not all landslides impact the Fraser River and the importance of any failure altering flow (salmon migration) depends on the size, type and where these events occur.

2. Where are migrating salmon currently delayed or blocked in the Fraser River?

Morgan Wright, Simon Fraser University

- There are three distinct morphologies associated with hydraulic barriers. At all barrier types, the fastest flow is observed through the center of the channel. However, the portion of the channel that experiences high velocity will vary between barrier types.

RESEARCH OVERVIEW CONT.

- Velocity varies a lot through the Fraser Canyon, both spatially and temporally. Swim speeds required for salmon to pass barriers are discharge dependent, with a greater portion of the channel requiring faster swim speeds at higher flows.
- Understanding channel geometry and how this impact water velocity allows us to predict the locations of potential barriers to migration over a range of discharges.

3. What river characteristics delay or block salmon in the Fraser River?

Jeremy Venditti, Simon Fraser University

- Salmon were delayed at Yale Rapids and Black Canyon at high flow, before they reached Hell's Gate or the Big Bar Landslide, leading to high rates of mortality in 2022.
- This occurred because high velocity zones in the river channel expand at the expense of low velocity zones until there are no passable areas of the channel for the fish to migrate upstream.
- Prediction of the hydraulics that lead to salmon migration delay is challenging because the hydraulics change with sediment cover on the bottom of these bedrock rivers.
- Monitoring of hydraulic barriers to salmon migration is necessary to understand when particular locations are likely to become problematic.

4. To what extent is salmon migration success determined by hydraulics and biological factors?

David Patterson, Department of Fisheries and Oceans

- Each migration barrier complex is made up of multiple flow features created unique surface velocity fields.
- Passage failure is related to surface velocities, that will change with discharge levels, and failure can occur at both high and low flow conditions.
- Passage success varies by species, sex, size, swim ability, as well fish behaviour (delay tolerance , attempts).
- Future hydrology is uncertain, but temperature is still the primary variable in migration success.

RESEARCH OVERVIEW CONT.

5. Where are future landslides likely to impact the Fraser Canyon?

Julia Carr, Simon Fraser University

- Landslide impact on the channel depends on how steep and rocky hillslopes are, if those hillslopes can deposit material directly into the channel, and the frequency and magnitude of landslides.
- Hillslope relief, cliff height, and the connectivity between hillslopes and the channel increases from North to South in the Fraser Canyon, with two zones of highest hazard (Yale to Boston Bar and Bridge River to White Canyon).
- All bedrock canyons in the Fraser have steep cliffs that are hazardous for future landslides, and these canyons are distributed across the entire Fraser Canyon.

6. Did the Big Bar landslide change Fraser salmon genetics?

Greg Owens, University of Victoria

- Genetics played little role in whether Pacific salmon were able to pass the Big Bar blockage.
- There is a large amount of genetic variation for migration timing.
- Pacific Salmon populations are genetically stable across years.

7. Where are the primary sites of concern for future landslides?

Julia Carr and Jeremy Venditti, Simon Fraser University

- We have identified 13 sites of concern in the Fraser Canyon (Chimney Creek, Iron Canyon, Grinder North, Grinder South, Big Bar, High Bar, Leon Creek, White Canyon, Fountain Canyon, Texas Creek, Hells Gate, Black Canyon, and Dry Rack Canyon [Yale]).
- Each site of concern is selected based on the criteria that: 1) the channel is laterally constricted by exposed bedrock, 2) the channel has high rock banks, and 3) the rock is broken and fractured in a manner that would produce massive blocks that the river is unlikely to move.
- These sites should be monitored.

RESEARCH OVERVIEW CONT.

8. What salmon populations are vulnerable to blockage at the sites of concern?

Derek Heathfield, Hakai Institute

- Hakai developed a project webmap that focused on the "sites of concern". Geospatial data, including 3D sphere images, are displayed on a public facing webmap for exploration and interpretation.
- Hakai is currently developing a webGIS tool to look at what Salmon populations are vulnerable to blockage at the sites of concern. This tool incorporates spatial data with Salmon population data to look at impacted areas following a blockage at a given site of concern.

In the discussion following the research findings, participants voiced ongoing concern for the changes in weather patterns (e.g. lack of snow, impacts of freezing, drought) and environmental events (e.g. debris in canyon, seismic activity).

Participants were interested in continued and expanded monitoring and research in the Fraser Canyon and other rivers in British Columbia, and eager to determine how the research results and data would be used, or what the next steps are. There was also discussion around the responsibility of emergency management and warning systems, given the length of time the Big Bar Slide went undetected.



ENGAGEMENT OVERVIEW

To celebrate the collaborations, reciprocal sharing and Indigenous engagement we heard from Greg Witzky, Fraser Salmon Management Council and project First Nations engagement liaison. Greg highlighted that "in the past government and NGOs would come in and do the work in our communities; That has changed with this project with learnings around cultural awareness, a collaborative success we want to keep going".

A group discussion formed around the successes of tripartite relationships/governance structure that was seen in the Big Bar Slide response, and the possibility to replicate this relationship in the continuation of this (Fraser Landslides) project.

Kim Menounos, Fraser Basin Council gave an overview of the project engagement strategy, website development and where participants can find more information, data and results, and contact information moving forward. Participants were also offered printed maps identifying sites of concerns and USB's that contain reports, maps, data sets and metadata files, and include:

- Year 1 & Year 2 Project Reports (May 2022 & May 2023)
- Atlas of the Fraser Canyons (August 21, 2020)
- Sites of Concern Report (2024)
- Ground-based Camera Videos
- River Kilometers KMZ fileS
- Suite of maps highlighting sites of concern with: Environmental monitoring sites, Indigenous Territories, salmon spawning runs, undercut banks, past landslides, etc.

The engagement team is working with the Fraser River Discovery Centre to bring the research results and data findings to the public, both adults and youth. Participants can find updates about this legacy project at www.fraserbasin.bc.ca/fraserslides/html.

AFTERNOON SESSION - GROUP DISCUSSION

During the afternoon session, facilitated by Kim Menounos and David Marshall, Fraser Basin Council participants explored the following questions:

1. What have we learned/key messages?
2. What should we do with this information?
3. What should be the focus?

In discussion of all three questions, conversation was focused around three themes: Collaboration, education and continuation of work.

Collaboration:

- *Learned:* Project saw unique collaboration of different levels of government throughout the project.
- *Do:* Need for continued collaboration and communications with those who have invested time to-date, as well as others who should/need to be involved in discussion, in particular around emergency response (e.g. railway, telecommunications, etc.)
- *Focus:* Ensure collaborative approach moving forward. Create a committee across input groups to continue discussions. Develop agreements (MOU's).

Education:

- *Learned:* Education of (the project and results) individuals and communities is an important driver of collaboration and progress. Important for two-way education (Western and Indigenous Science).
- *Do:* Need for this information to be more broadly shared (e.g. smaller communities, schools).
- *Focus:* Collaboration with communities/Nations to host tailored information sessions.

Continuation:

- *Learned:* Research/work to-date is of interest and important to communities/Nations and should continue.
- *Do:* Need to continue:
 - River monitoring
 - Collection of data and ensuring that data accessible
 - Integration of Indigenous Knowledge into research
 - Emergency planning conversations: system for response, response leadership, alert system, etc.
- *Focus:* Creation of a committee to continue this conversation, determine next steps and source funding.