

Fraser Salmon & Watersheds Program



2011/12 FINAL REPORT

FSWP File Number* FSWP 11 75 SIFM LR

* Please use the FSWP File Number provided in previous FSWP project correspondence.

1. Project Information

1.1. Project Title

Purchase of a Continuous Flow Centrifuge for Marine Derived Nutrient Sampling

1.2. Proponent's Legal Name

University of Northern British Columbia

1.3. Project Location

Quesnel River Watershed (Horsefly Basin)

1.4. Contact for this report

Name: Ellen Petticrew

Phone: 250 960-6645

Email: ellen@unbc.ca

1.5 Funding Amount

Original Approved Grant Amount:	Total FSWP Expenditures:	Final Invoice Amount:	Final Non-FSWP leveraging, including cash and in-kind:
\$27,993.31	\$13,996.65	\$13,996.65	\$27,475 cash; >\$100,000 in-kind

2. Project Summary

Please provide a single paragraph describing your project, its objectives, and the results. As this summary may be used in program communications, clearly state the issue(s) that were addressed and avoid overly technical descriptions. Maximum 300 words.

A flow through centrifuge is a large volume centrifuge that separates solids from liquids that are pumped into its separation chamber. This can be configured with pumps and hoses to pump water and sediment from rivers and lakes to separate and isolate suspended sediment. As many analytical methods require large amounts of sediment the use of a continuous flow centrifuge aids the environmental evaluation of sediment transported nutrients and contaminants. The purchase of a flow through centrifuge with our FSWP funds allowed us to collect suspended sediment from the outflow plume of the Horsefly River for the analysis of marine derived nutrients (MDN) during 2011.

We are interested in determining the amount of MDN that originates from the spawning and die-off of salmon that is subsequently flushed out of the river. The timing of this movement of nutrients is important to the functioning of the lake as it is a source of nutrients for primary production, the bottom of the food chain which supports the food web in Quesnel Lake. 2011 was our first attempt at this sampling approach and we

collaborated with DFO who installed instrumentation in the bay to track the movement of the plume and some aspects of its water quality. Our efforts in this preliminary year were rewarded in that we timing our sampling perfectly to capture the snowmelt freshet plume and had all our instrumentation working for the full open water period.

The most significant finding to date is that the signal of marine-derived nutrients is apparent at all of the times we sampled. While we expected to see the salmon nutrient signal being moved downriver during the fall spawning period, as this is the time that most researchers believe the transfers occur, we noted a significant amount of MDN was associated with the sediment that was flushed from river bed storage in the spring melt. This means the MDN is being stored in the river overwinter and potentially being incorporated into the food chain between the September spawn through to the May springmelt. Another point of interest is that we are identifying MDN in the water column during July sampling which occurred in a low flow period for the Horsefly River. This suggests that the nutrients are either recirculating in the lake water column or detectable amounts are moving downstream in low flows, likely associated with in-river primary production.

OPTIONAL: Please give a short statement (up to 100 words) of the most compelling activity or outcome from your project.

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3. Final Project Results and Effectiveness

3.1 Please copy THE EXPECTED DELIVERABLES from your detailed proposal and insert into this table. Add additional rows as needed. Then describe the FINAL DELIVERABLES (the tangible end products resulting from this work) associated with each expected Deliverable.

If FINAL DELIVERABLES differ from the original EXPECTED DELIVERABLES, please describe why, and the implications for the project.

EXPECTED DELIVERABLES	FINAL DELIVERABLES
<ul style="list-style-type: none"> 1. Use of centrifuge in the field to collect bulk samples of suspended sediment in spring and fall Horsefly River flows 	<p>The centrifuge was used to collect bulk samples of plume sediment from the Horsefly during the July and September sampling periods. The instrument was not available for the May sampling but as the concentration of sediment was so high we used a more manual method of collection to sample at that time</p>
<ul style="list-style-type: none"> Indicator of MND amounts being delivered via sediments 	<p>Stable isotope results were returned from the U California Davis lab in mid March. The preliminary data shown detectable amounts of MDN at each of the sample periods which is a major finding for us. This encourages us to continue this sampling program for one to three more years.</p>

3. monitoring physical and biological conditions of the plume and Bay water	UNBC researchers collected data on suspended sediment, chlorophyll a, sediment particle size and stable isotope concentrations. These results are shown as appendices along with Dept of Environment data for discharge in the Horsefly River (record not complete as yet for 2011). DFO has successfully downloaded the physical data from the mooring instruments and is currently in the process of analyzing that data. They are encouraged by the initial viewing of the results and are willing to collaborate with us again this year.
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3.2 Please evaluate the EFFECTIVENESS of your project in achieving Project Objectives, using the specific measures of success identified in your proposal. Please include any notable successes or challenges.

We were able to meet all of our initial objectives as stated in our proposal. Our deliverables as indicated in the table above were also met. Comparing our current status to the suggested measures of success from our proposal shows that we have all the data for our planned approach but we still need to complete the analytical evaluations and correlations of the physical and biological parameters to meet two of the four measures of success. This will be done in the next six months.

- 1) An estimate of the mass of sediment being delivered from the watershed to allow a mass balance for nutrient delivery to the lake.

We have the centrifuge and suspended sediment data we collected in the three field periods but the DoE data from the Horsefly River on daily discharge is still outstanding. These data must be checked and verified internally at DoE before they are released and as such we only have data to July. With the rest of the year's flows being reported in the near future we will be able to complete this aspect of the project.
- 2) Data to determine if MDN is stored overwinter in the river channels and flushed out for use in nursery lake in spring

This measure of success was met and is our most useful finding as it is clear the MDN is overwintering. As 2010 saw returns of ~124,000 sockeye to Horsefly River we are interested to follow this over the next four years to evaluate the variation in storage and delivery of overwintering MDN with variable returns.
- 3) The same evaluation to be done to compare the mass of MDN delivered post spawn in late September

With the very recent arrival of our stable isotope results (March 12) we are able to determine that the fall post-spawning period in Sept 2011 showed the delivery of MDN. As this was a low flow period and sockeye returns in the Horsefly in 2011 were much lower (~ 36,000) it will be of interest to see the quantity that overwinters by sampling the springmelt of 2012.
- 4) Data to determine the flow direction of the plume, biota (via chl a) and sediments in the plume and the bay

DFO instrumentation successfully collected the physical and fluorometric (Chl a) data from the moorings in Horsefly Bay. The chl a data was calibrated with the hand collected samples from UNBC and shows strong correlation, therefore successful full season recording. The collation of comparison of all the data together has yet to be done but will be completed in the next few months.

3.4 If applicable, please describe project outcomes that relate to one or more of the following strategic approaches (Section 2.1 of RFP; section 8 of detailed proposal template), and include specific examples.	
Engagement of First Nations. Please specify who, and in what capacity.	
Active partnerships with one or more organizations.	Drs Eddy Carmack and Svein Vagel (DFO-IO) and associate John Morrison came to QRR in April 2011 to install lake moorings for recording the physical parameters of the lake over the summer season. A second trip in mid September was set up for the retrieval and downloading of the data. There was successful data collection by all the recording instruments. The September retrieval was arranged to coincide with a Quesnel Lake Fisheries workshop which had fourteen researchers interested in the Lake in attendance (see attachment)
Engagement and participation of diverse and under-represented groups.	
Relationship building, as a foundation for sustainable, enduring activities.	Collaborations from this project, between DFO and UNBC, cemented a research relationship and both groups are now actively involved in extending the research to other collaborators and to a larger focus on Quesnel Lake (as discussed at the Quesnel Lake Workshop: Interactions between sockeye salmon, kokanee and rainbow trout in Quesnel Lake, September 2011)
Capacity building, including mentorship models, leadership training and skills development.	Training and skills development for Sam Albers the research assistant on this project was the main capacity building. His field, instrumentation and analytical skills were improved. Both his and Petticrew's association with DFO collaborators also increased skills and knowledge bases.
Recognition and support of champions and their initiatives.	
Opportunities to influence policy and decision making,	This has not occurred at this point in the context of results from this project but the expectation is that with a couple of more years of data the role of marine-derived nutrients on lake productivity will be elucidated.

3.5 Please describe how the benefits of this project will be sustained and/or be built upon into the future. What are the planned next steps, or recommendations for further work, if applicable?

The project the centrifuge was used for in the open water season of 2011 will be repeated in 2012 and hopefully for the two years following this so that we can measure effects over a full four year sockeye cycle. The centrifuge will be used in the Horsefly River over these four years but we are currently looking for funding opportunities to expand this work to other tributaries of the Quesnel system and possibly to other interior sockeye lake watersheds.

3.6. What are the top three lessons learned from this project that could be useful to communicate to others doing similar work in the Basin?

1. the centrifuge is an effective tool for in-stream and in-lake sampling and allows bulk samples to be collected for a suite of analytical tests
2. we are able to detect marine-derived nutrients in the plume sediments of the Horsefly river at three specific times of the year which represent different flow regimes and salmon influence (spring melt delivering past falls stored MDN, mid- summer in low flows and in fall after spawning but again during low flows)
3. marine-derived nutrients are apparent in the water column in July during low flows indicating the signal is either still being transmitted downstream in association with sediment or has been incorporated in primary production. While we still need to determine which compartment MDN is in at this time it is important that it is detected in the water column when fry need resources for growth.

3.7 REQUIRED: Attach all DOCUMENTATION of Final Deliverables, and LIST attachments in Section 8. These may include technical reports, maps, photos, evidence of communications, lists of meeting participants, etc.

4. Outreach and Communications

Please describe how you have communicated project activities and results within local and basin-wide communities, across organizations and/or to decision makers.

Please list and attach copies of (or links to) any communications materials from these efforts that you have not previously submitted.

Preliminary results of our work were presented at:

1. the Quesnel River Research Centre Open House (Oct 1, 2011) as an oral talk by research assistant Sam Albers and a linked talk was presented by Dr Svein Vagel (DFO collaborator). The Open House talks are to the local public and interested citizens of the Quesnel watershed.
2. Quesnel Lake Workshop: Interactions between sockeye salmon, kokanee and rainbow trout in Quesnel Lake, September 2011 at Elysia Resort on Quesnel Lake (Petticrew and Albers, to a group of 14 researchers working to obtain funding for future research on Quesnel Lake.
3. The Prince George Citizen wrote a story for the local newspaper on this funding and research opportunity (July 29, 2011).
4. I was also invited to give a presentation of work at QRRRC to the Quesnel meeting (Jan 11, 2011) of FSWP. This project was included as part of the presentation.

5.1 If you have had any significant differences in spending in comparison to your original budget, please provide an explanation. Significant differences could include costs that exceed 20% of a line item or budget category (labour, materials, administration), and new items or services that were not originally budgeted, exceeding 10% of total FSWP contribution.

Petticrew received a \$6,000 Seed Grant from UNBC for this project so was able to cover the costs of accomdation, food, travel and boat gas for the DFO collaborators and the UNBC researchers. This line item was not included in the original document, so increases the cash contribution by UNBC to the project. We used a different lab for Isotope analysis which was significantly cheaper than we expected so saved money there (\$1,205), but used slightly more funds for the research assistant costs (\$1,694).

5.2 Please describe all non-FSWP project contributions, cash and in-kind. ATTACH letters of confirmation for non-FSWP contribution sources (cash and/or in-kind).

Non-FSWP Contribution Sources	Letter of Confirmation Attached (Y/N)	Cash (\$)	In-Kind (\$)	Total (\$)
UNBC Seed Grant (used for DFO collaborators and UNBC travel and accommodation and boat costs)	N (funds spent recorded at UNBC finance)	\$6,000		\$6,000
DFO researchers, equipment loan and field efforts	Y		>\$100,000	
Petticrew Research Funding	N (funds spent recorded at UNBC finance)			
Research Associate (90 days salary and benefits)		\$16,093.80		\$16,093.80
Shipping, Taxes and peripheral costs for centrifuge		\$4,662.04		\$4,662.04
Isotope Analysis		\$720		\$720

6. Additional Comments

OPTIONAL: Provide any additional comments or recommendations for future efforts and suggestions for helping partners to meet the goals of the Fraser Salmon and Watersheds Program.

It is very disappointing to have heard that the program is being disbanded. This comes at a time when salmon activity in the northern part of BC would benefit greatly from FSWP. We appreciate the efforts and support over the past number of years and will aid your agency in providing data or letters of support if this is helpful for your future program development. The folks at FSWP and PSF have been very supportive and helpful over the years.