Fraser Salmon & Watersheds Program

2009/10 FINAL REPORT

FSWP File Number*	FSWP 09 LR SIFM 83

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

1. Project Information

1.1. Project Title

Assessment of the in-river survival, migration rates and fishery impacts on spring-run Chinook salmon and summer-run sockeye stocks using radio-telemetry and near-shore species composition in the lower Fraser River using fishwheels.

1.2. Proponent's Legal Name

LGL Limited

1.3. Project Location

Tagging in the lower Fraser River, tracking throughout the Fraser watershed.

1.4. Contact for this report

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1.5 Funding Amount

Original Approved Grant Amount:	Total FSWP Expenditures:	Final Invoice Amount:	Final Non-FSWP leveraging, including cash and in-kind:
Part A – $584,954 Part B – $86,473	Part A - $584,954 Part B - $86,473		Part A - $128,830

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.

In recent years, the Mission hydroacoustic program has been met with criticism, and errors have been attributed to biased species composition estimates from nearby test-fisheries, which result in incorrect partitioning of the acoustics signals among species. The primary objective for the fishwheel component of the 2009 study was to provide species composition data that could be combined with similar data from the Whonnock test-fishery to determine how best to partition Mission acoustic signals among species. Two fishwheels were continuously operated from early July to mid-September in a relatively fast-flowing section of the Fraser River near Crescent Island. All captured fish were identified to species, and species composition was calculated daily. Including jacks, 15,611 pink, 3,824 sockeye, 1,287 Chinook, 635 steelhead, 43 coho, and 1 chum salmon were captured at the fishwheels, along with 14 other species. The PSC Mission hydroacoustic counts were split into near-shore (<50 m from shore) and off-shore strata. The species composition of the Crescent Island fishwheels and the Whonnock gillnets were applied to the near-shore and off-shore counts, respectively, to derive daily estimates of

the number of sockeye passing Mission which were consistent with the PSC's 'best judgement' in-season sockeye abundance estimates.
A second objective was to use mark-recapture techniques to provide an independent assessment of Mission escapement. Fish were marked (radio-tagged) near Crescent Island, and 239 radio-tagged sockeye were known to pass Mission, of which 186 passed Qualark. Mark rates were estimated using the sonar-derived sockeye abundances at Qualark.
A third objective was to radio-tag and track Spring-run Chinook in order to estimate travel speeds, and to identify problematic areas along their migration paths. Capture was attempted using drift and set tangle-nets near Yale and the Harrison-Fraser confluence. Catch rates were very poor, and only 6 Spring-run Chinook were tagged despite 179.5 hours of set netting and 25 hours of drift netting effort between 21 April and 10 June.
The primary objective for the radio-telemetry component of the 2009 study was to provide estimates of in-river survival, migration rates and the impact of fisheries on the survival of adult sockeye and Chinook salmon. In all, 307 sockeye and 86 Chinook were radio-tagged near Crescent Island in approximate proportion to the run size. Each radio-tagged fish was also measured and spaghetti-tagged, and a small adipose tissue sample was taken for microsatellite stock identification. Radio-tagged fish were tracked using 21 fixed-station receivers in 18 locations along the Fraser River and within major tributaries. Eighty-five percent of the radio-tagged Chinook were detected at least once after release, and 59% were known to pass the Mission site, of which 11.1% were returned from in-river fisheries. Ninety-two percent of the radio-tagged sockeye were detected at least once after release, and 88% were known to pass Mission, of which 7.0% were returned from in-river fisheries, and 37.8% were tracked to the vicinity of spawning areas. 'After-harvest' survival to spawning areas was significantly higher for Late-run sockeye (94.5%) than for all other run timing groups. Survival estimates for Early Stuart (55.9%), Early Summer (50.9%) and Summer-run sockeye (56.1%) did not differ statistically. Early Stuart, Early Summer and Summer-run sockeye exhibited median travel times that were faster than those for Late-run sockeye and Chinook in the Fraser mainstem. Median Summer-run sockeye travel speeds in 2009 were faster than those measured in 2005, 2006, 2007 or 2008.
The highest rate of en-route loss was observed in the reach between Seton and Quesnel. One probable cause of en-route loss was a period of higher water temperatures, which occurred during the migration of Early Stuart sockeye, and was concurrent with a period of poor survival. En-route losses may also have been fishery-related: 23% of radio-tagged sockeye that were last-detected between Thompson and Quesnel disappeared during periods of fishing activity. Also, most of the en-route loss in 2009 occurred in reaches that are affected by difficult passage points. The data compiled from the 2005-09 studies provide compelling evidence that cumulative effects of elevated water temperature, in-river fisheries and difficult passage points are consistent with the timing and location of en-route losses in 2009 and other years. While there is little that can be done to affect annual water temperatures and flow, it is possible to reduce the amount of stress associated with in-river fisheries. The degree to which en-route losses are associated with intensive fishing periods requires a substantial reduction in the potential for tagging-related effects and more detailed assessments of the timing in-river fisheries above Sawmill Creek. To address this question, we recommend that the tags be applied at times and locations where water temperatures are low (in-river tagging in early July and marine tagging from mid-July through early September) and future studies include a greater number of fixed-station receivers in the Thompson to Chilcotin area, coupled with increased mobile tracking efforts. By conducting additional focused monitoring of selected key fishing areas, it may be possible to better determine the fate of the radio-tagged sockeye entering these fisheries.

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

Build confidence in the fisheries management decisions by building a reliable multi-species stock assessment system. Build more sustainable fisheries through efforts to understand and reduce en-route losses.

3.Final Project Results and Effectiveness

3.1 Copy EXPECTED OUTCOMES from your detailed proposal and insert into this section. Add additional rows as needed. Then please list the FINAL OUTCOMES (the tangible end products resulting from this work) associated with expected outcome.

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

EXPECTED OUTCOMES	FINAL OUTCOMES
1. Estimates of the in-river survival, migration rates and impact of fisheries on in-river survival for adult sockeye and Chinook salmon.	The data compiled from the 2005-09 studies provide compelling evidence that the timing and location of en-route losses are related to the cumulative effects of elevated water temperature, in-river fisheries and difficult passage points. While there is little that can be done about annual water temperatures or difficult passage points, it is possible to minimize cumulative effects by dissociating the timing and location of in-river fisheries from these other stressors.
2. Species composition data from the operation of two fishwheels at the Crescent Island site.	The species composition of the Crescent Island fishwheels and the Whonnock gillnets were applied to the near-shore and off-shore counts, respectively, to derive daily estimates of the number of sockeye passing Mission which were consistent with the PSC's 'best judgement' in-season sockeye abundance estimates.
3. Reliable in-season estimates of abundance for sockeye, Chinook, and pink salmon at Mission in 2009, derived from Mission and Qualark hydroacoustic estimates combined with species composition data from the Whonnock gillnet test fishery and Crescent Island fishwheels.	The above species composition data were combined with DIDSON hydroacoustic estimates for near-shore areas in September 2009, provided daily estimates of the number of Chinook and pink salmon passing Mission that were consistent with the pre-season expectations and post-season escapement estimates for these species. In-season abundance estimates for pink salmon were not reliable due to the underestimation bias associated with split-beam estimates during the peak of the pink salmon migration.
4. Prepare a run reconstruction model for Fraser sockeye.	All available data for Fraser cockeye CUs and in-river fisheries were integrated into run reconstruction analyses for 2002-07.

3.2 Please evaluate the EFFECTIVENESS of your project in achieving Project Objectives. Please identify the indicators you have used to measure the effectiveness of your project. Please include any notable successes or challenges.

The 2009 project clearly demonstrated that the Crescent Island fishwheel site was an effective location for operating fishwheels from late June through late-September. The combination of a floating shoreline abutment, one regular-size fishwheel and the new large fishwheel deployed at the Crescent Island site provided more consistent and substantially higher catch rates than the fishwheels operated at the Mission Railway Bridge site. The data collected in 2009 provided clear evidence of substantial numbers of pink salmon migrating upstream in near-shore locations that were not sampled in the Whonnock gillnet test fisheries and would be enumerated as upstream migrating salmon at the Mission hydroacoustic site. Modification to the fishwheels to reduce fish avoidance behaviour (e.g. better plugs for the aluminium tubing) probably contributed to the substantially increased catch rates.

3.3 REQUIRED: attach all DOCUMENTATION of Final Outcomes, and LIST attachments here. These may include technical reports, maps, photos, evidence of communications, lists of meeting participants, etc.

A comprehensive report entitled: “Application of Fishwheels and Radio-telemetry for In-season Assessment of Salmon Returns to the Fraser River, 2009” was prepared and submitted to the client in March 2010 and finalized in April 2010. (see attached).

3.4 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?

Objectives/Plans for 2010

- Obtain daily estimates of the near-shore species composition using the Crescent Island fishwheels.
- Obtain weekly DNA and biological samples from fishwheel caught sockeye to augment the stock composition data obtained from other test fisheries.
- Assess in-river survival rates for Early Stuart sockeye using fish capture by fishwheels in early July when water temperatures are low.
- Assess river entry timing and survival rates for other sockeye run-timing groups captured and tagged using marine purse seines and possibly US reef nets.
- Identify the times and locations where any en-route losses of radio-tagged sockeye occur in 2010 and conduct more fine scale tracking in areas where the majority of en-route losses have occurred in previous years.
- Track radio-tagged sockeye, Chinook and coho released from other studies condicted by DFO, UBC and Carleton University researchers.
- Collect age, length and DNA samples for Chinook, coho and steelhead captured in the fishwheels.
- Continue the develop of the in-river sockeye run reconstruction models that integrate inputs from First Nations, DFO, PSC and tagging programs.

3.5 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. Large fishwheels are much more effective than smaller fishwheels when waters are less turbit.

2. Species composition can vary substantially between near-shore and off-shore areas in the Lower Fraser River.

3. Tagging related loss rates were closely related to increasing water temperatures in the Lower Fraser River.