Developing

A Watershed-based Fish Values Monitoring Evaluation Framework

With application to BC's Fisheries Sensitive Watersheds (FSWs)

December 31st, 2011

Marc Porter[1], Darcy Pickard[1], Lars Reese-Hansen[2], Richard Thompson[3], Derek Tripp[4], Simon Casley[1], Emily Snead[1], Nick Ochoski[1], David Marmorek[1], and Kat Wieckowski[1]

Research Process:

As climate change and other forms of natural and anthropogenic disturbance influence the conditions, including goods and services (e.g. water, fish, forest products, etc.) derived from a watershed, watershed-based monitoring will become an important tool in understanding both the beneficial and adverse consequences of both past and future (cumulative) management actions. Monitoring can provide information on watershed stressors and the results of management activities, allowing management actions to be better tailored to alleviate undesirable outcomes and mitigate impacts linked to both management and climate change. Values associated with fish and their habitat can be recognized in B.C. through the designation of "fisheries sensitive watersheds" (FSW) under the *Forest and Range Practices Act's* Government Actions Regulation (and the *Oil and Gas Activities Act's* Environmental Protection and Management Regulation). A FSW designation requires the respective sectors to operate such that they do not adversely impact aquatic habitat values necessary to fish.

Assessing watershed condition, and understanding the effectiveness of watershed designations under these regulations, including recognition of the influence of climate change, is critical to the future management and maintenance of key values hosted in these watersheds. Accordingly, the overriding goal of this FFESC project was to advance the development of a monitoring protocol that will help land managers assess the effectiveness of their watershed management activities today, over-time, and under a changing climate scenario. Pilot work was undertaken within candidate FSW's in the Skeena Region's Lakelse drainage in 2010-2011 to develop a consistent cost-effective approach that can be used for watershed-based fish values and FSW monitoring (hereafter referred to as "FSW monitoring"). Monitoring protocols and analytical methods evaluated as part of this project are intended to lead towards completion of a standardized methodology of both remote-sensed (GIS) and field-based monitoring of watershed condition for application to FSWs (and other similar high value watersheds) across the province.

[1] ESSA Technologies Ltd.
[2] B.C. Ministry of Forest, Lands, and Natural Resource Operations
[3] B.C. Ministry of Environment
[4] Tripp and Associates Consulting Ltd.

Collaboration:

The FSW monitoring project has involved extensive collaboration with key developers of the province's Forest and Range Evaluation Program's riparian, water quality and fish passage indicators. All our pilot work to date has gone through, and is continuing to go through, a process of vetting and review by leading provincial experts. Data collected during our pilot work conformed to FREP's data quality standards and is intended to be made available through the FREP Information Management System. Additionally, as part of the larger FFESC project, we provided multi-day training in the use of all three of the province's FREP/BC MOE field-based monitoring protocols. Training was delivered in Terrace BC to: FLNRO, MOE and DFO agency staff; representatives from the University of Northern BC, Northwest Community College, Kitimat-Stikine Regional District, and the Lakelse Watershed Society; and staff from local consulting companies in the Skeena Region. In addition to field sampling protocol training, participants in our monitoring pilot were provided with an introduction to applying a state-of-the-art statistical sampling design (known as Generalized Random Tessellated Stratified – GRTS) developed for resource monitoring by the US Environmental Protection Agency.

Communication:

Progress and outcomes of our FSW monitoring project were communicated through presentations at regular meetings with our partners in the broader Climate Change Adaptation Planning for Northwest Skeena Communities FFESC consortium. PDFs of our presentations on the status of FSW monitoring framework status from April 14, 2010, Sept 18, 2011 and Feb. 18, 2011 consortium meetings are available for download from the "FSW Outreach" folder maintained on ESSA Technologies' website at: http://essa.com/services/fast/fisheriessensitive/. Information on our project was also communicated to the public and various agency stakeholders in the Skeena Region as part of the May 24-27, 2011 training session on FSW monitoring protocols that was held in Terrace. Our core FSW presentation for this training is available at the above mentioned ESSA website FSW Outreach folder. The FSW monitoring framework, methods development and early results of our monitoring efforts in the Lakelse drainage were presented to variety of stakeholders in the Skeena region as part of day-long community wrap-up workshop the FFESC consortium hosted in Prince Rupert, Lax Kw'alaams and Terrace, BC in December 2011. A PDF of our FSW presentation for those meetings is available at the ESSA website FSW Outreach folder.

Deviations from project plan:

We completed the majority of the objectives related to FSW monitoring development within our FFESC-funded workplan as intended. Pilot work was considered to have been successful with the caveat that unexpectedly severe weather conditions during both our spring and fall field sampling sessions created high flow conditions and access constraints, limiting the number of sites we were able to sample across our study area, particularly within larger order streams. Consequently, we were unable to collect data in a timely manner from a sufficient number of sites across our defined sampling strata in the Lakelse drainage to undertake a defensible power analyses required for informing broader sample size recommendations in other

watersheds. This analytical component of the Tier II FSW monitoring protocol development has instead been deferred to the following year when we will seek to supplement our collected data by tapping into other existing agency datasets. Within the period of the FFESC-funded project we had expected to establish finalized/vetted quantitative benchmarks of concern for each of our Tier I habitat indicators. Similarly, we had also forecasted that we would determine a method to rollup both the Tier 1 and Tier 2 indicators into an overall indication of watershed condition (e.g. red, yellow, green status categories). These elements are however still incomplete and will require consultation with the FSW Monitoring Technical Advisory Group early in the upcoming year. Once these two steps are complete a first working iteration of the watershed-based fish values (FSW) monitoring protocol documents will be ready for application and fine-tuning outside the pilot area. It is expected that these steps and the working protocol will be ready by the end of the first quarter of next year.

Research outcomes:

FFESC-funded pilot field-work in the Lakelse drainage has allowed initial development and subsequent refinement of Tier I (remote sensed, GIS based data) and Tier II (field-based data) protocols for monitoring of FSW habitat condition. The current draft PDF versions of associated Tier I and Tier II FSW monitoring protocol documents (protocol rationale documents and protocol methodology reports) are available for download from the "FSW Monitoring – Products" folder on ESSA's FSW webpage: http://essa.com/services/fast/fisheriessensitive/. Completion of these monitoring protocol documents for broader use across the province is an intended focus for the upcoming year. Tier I indicator data was collected for four FSWs in the Lakelse drainage (Williams Creek, Lakesle Mainstem, Furlong and Schulbuckhand) and results were assessed vs. a subset of a historic (i.e. 2008) Coastal Watershed Assessment Procedure's defined indicator risk thresholds. Better identification, refining and vetting of relevant risk benchmarks that can be used at appropriate watershed scales will be a primary focus for the FSW project as it continues into the following year. A summary of the Tier 1 indicator results for the four Lakelse FSWs is available on the ESSA website's FSW Products folder. Tier II field-based indicator data was collected for the Williams Creek and Lakelse Mainstem FSWs, but only in the Williams Creek watershed was sufficient field data collected during our pilot to allow preliminary interpretations of habitat condition within the watershed. Remote sensed data (Tier I) and field data (Tier II) collected (in May 2011 and Sept 2011) for the Williams Creek FSW (primary focus of our intensive 2011 pilot work) has been analyzed and an initial workup into the aforementioned draft integrated Williams Creek habitat status "report card" produced. This represents an initial and still evolving mock-up of a concise reporting structure ultimately aimed at capturing information on a portfolio of FSWs across the province. The FSW report card is undergoing further refinements to the analysis and data reporting structure of the report and will likely be modified through further discussion with the FSW Monitoring Technical Advisory Group. The example habitat "report card" for the Williams Creek FSW is also available on the ESSA website's FSW Products folder. Finally, after a review of potential climate change monitoring indicators, four indicators were selected as having the most utility for FSW monitoring. These indicators included monitoring: long term extent of snow/ice fields within the watershed basin, stream temperature(s), and additional localized hydrometric data. All of these influence water quality and availability, critical factors for maintaining aquatic habitat conditions.

A further risk indicator was also identified that uses a model (developed at UBC) to rate watershed susceptibility to adverse impacts resulting from climate change.

Recommendations:

As climate change and other forms of natural and anthropogenic disturbance influence the conditions derived from a watershed, watershed-based monitoring will become an increasingly important tool in understanding both the beneficial and adverse consequences of past and future land management activities. Monitoring can provide information on watershed stressors and the consequences of management activities, allowing land managers to plan and implement activities that avert undesirable outcomes and mitigate impacts associated with both management and climate change. Not only does this FSW monitoring project have relevance to the BC provincial government, it also will have value to other organizations interested in assessing watershed condition and in understanding the influences of management activities, climate change, and other drivers on condition. These organizations (i.e., multiple levels of government, industry, academia, and non-government environmental organizations) will be able to take advantage of the products derived from this work. The project may have national relevance too, as it can serve as a template for the development of other watershed monitoring initiatives elsewhere in Canada. To this end it is recommended that the products of this project continue to be refined in a way that will provide the greatest level of utility for the variety of organizations that have a mandate or interest in FSW monitoring.

Extension of research outcomes:

Site level habitat information collected in 2011 as part of our pilot Tier II monitoring field-sampling in the Williams Creek watershed was shared with the local environmental regulatory agencies (FLNRO and DFO) and forest licensees to help inform their near-term response to identified impacts to stream habitat resulting from the operational activities of forestry and other land management sectors. The ultimate extension products from this continuing work will be FREP-based monitoring protocols (both for (i) collection of data-extensive, remote sensed GIS-based information; and for (ii) localized, data-intensive field-based information) that can be undertaken by land management agencies, forest licensees, or by other stakeholders. These protocols will serve an important role in informing managers of the current status of key watershed condition indicators at different spatial and temporal scales, and allow for regular, consistent, and relatively easy/cost effective tracking of these conditions over time. The intent is to build from our initial pilot work in the Lakelse drainage towards general application of these monitoring protocols for assessing condition of FSWs, or other watersheds with significant aquatic values, in the region and across the province.

Utility of the FFESC research program:

The FFESC research program provided an excellent opportunity for developing and improving major elements of our FSW monitoring protocol. Furthermore, it benefited from a multidisciplinary research approach which served to identify other attributes requiring improvement that may not have been discovered otherwise. For example, engagement with

social scientists in the larger FFESC-Skeena project consortium allowed us to identify elements of our proposed monitoring that were (or were not) of perceived value to stakeholders and community leaders in the FFESC-Skeena study area communities. Accordingly, social science project partners ranked the “things” people value as important. Consistently, and in all communities, one of the highest values identified was associated with fish for cultural, social, recreational, and economic reasons. This finding reinforces the relevance of maintaining fish values and understanding fish habitat condition, something FSW monitoring can play a considerable role as part of an integrated resource management and adaptive management scheme. This engagement, as well as our interaction with the climate change quantitative modellers in the consortium, helped us identify important additional components of the monitoring framework. These components have been, or we will be, incorporated into our final FSW monitoring protocol at the Tier I and Tier II levels to measure changes in stream habitat condition that may be reflective of climate change impacts in combination with localized watershed management decisions.