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National Capital Region

Proceedings of the national peer review of NSERC's HydroNet: consolidating five years of research designed to develop knowledge and tools about the effects of hydroelectric facilities on aquatic ecosystems

September 15-17, 2015
Ottawa, Ontario

Chairpersons: Keith Clarke and Karen Smokorowski
Editor: Sophie Foster and Katrine Chalut

Fisheries and Oceans Canada
200 Kent Street
Ottawa, Ontario K1A 0E6

October 2016

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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Aussi disponible en français :

MPO. 2016. Compte rendu de l'examen national par les pairs du Réseau HydroNet du CRSNG : consolidation de cinq années de recherche destinées à développer les connaissances et les outils concernant les effets des installations hydroélectriques sur les écosystèmes aquatiques; du 15 au 17 septembre 2015. Secr. can. de consult. sci. du MPO, Compte rendu 2016/042.

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SUMMARY

These Proceedings summarize key discussions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) National Advisory meeting that took place September 15-17, 2015 in Ottawa. The meeting reviewed research and lessons learned from the Natural Sciences and Engineering Research Council of Canada (NSERC) HydroNet. NSERC's HydroNet was a national research network set up to provide government and industry with the knowledge and tools to contribute to the sustainable development of hydropower in Canada. In-person participation included employees of DFO Science Sector, DFO Fisheries Protection Program (FPP); and external participants from the Hydroelectric Industry, and academia. Participants reviewed four working papers and one additional presentation summarizing the knowledge gained and tools developed through HydroNet. The conclusions of this review will form the Science Advisory Report which will be made publicly available on the CSAS Science Advisory Schedule. Other supporting publications include four Research Documents, and these Proceedings.

SOMMAIRE

Le présent compte rendu résume les principales discussions ayant eu lieu à la réunion de consultation nationale du Secrétariat canadien de consultation scientifique (SCCS) de Pêches et Océans Canada (MPO), qui s'est tenue du 15 au 17 septembre 2015, à Ottawa. Les participants ont examiné les recherches et les leçons apprises grâce au réseau HydroNet du Conseil de recherches en sciences naturelles et en génie du Canada (CRSNG). Ce réseau de recherche d'envergure nationale a été créé pour que le gouvernement et l'industrie disposent des connaissances et des outils leur permettant de contribuer au développement durable de l'hydroélectricité au Canada. À cette réunion ont participé des employés du Secteur des sciences et du Programme de protection des pêches (PPP) du MPO, ainsi que des délégués du secteur de l'hydroélectricité et d'universités. Les participants ont passé en revue quatre documents de travail et une présentation résumant les connaissances acquises et les outils élaborés grâce à HydroNet. Les conclusions de cet examen constitueront un avis scientifique qui sera rendu public dans le cadre du calendrier des avis scientifiques du SCCS. Parmi les autres publications à l'appui figurent quatre documents de recherche et le présent compte rendu.

INTRODUCTION

OPENING REMARKS

The meeting Co-Chairs, K. Clarke and K. Smokorowski welcomed participants (Appendix I) to the national science advisory process concerning the national synthesis of HydroNet, and did a round of introductions. Katrine Chalut and Sophie Foster were introduced as rapporteurs for the meeting.

The Co-Chairs provided an overview of the CSAS process and described the documents associated with the process (e.g. Science Advisory Report, and Research Documents). They also described the context, background, and rationale for the meeting, referencing the workshop Terms of Reference (Appendix II). The meeting agenda was also provided (Appendix III).

The Co-Chairs outlined the structure of the two and a half day meeting which consisted of a series of presentations, each followed by a discussion and drafting of the main points of the Science Advisory Report.

An overview of the Fisheries Protection Program (FPP) was provided by Anne Phelps.

CONTEXT FOR MEETING

The Natural Sciences and Engineering Research Council of Canada (NSERC) HydroNet was a national research network whose overall mission was to provide government and industry with the knowledge about the effects of hydroelectric facilities on aquatic ecosystems and tools to contribute to the sustainable development of hydropower in Canada. HydroNet recently completed its final year of a 5-year mandate (2010-2014).

A national science advisory process was held September 15-17, 2015 in Ottawa, Ontario to consolidate five years of research by NSERC's HydroNet, highlight the findings, discuss the 'lessons learned', examine the current or potential application of these findings in support of FPP, and to provide recommendations for Ecosystem Science within Fisheries and Oceans Canada (DFO). Meeting participants reviewed four Research Documents, which were presented at the meeting. An additional presentation on 'Remote sensing of riverine geomorphology as a tool for the assessment of riverine physical habitat' was also given.

Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

PRESENTATIONS

UPSTREAM FISH PASSAGE AND DOWNSTREAM ENTRAINMENT RISK AT DAMS

S. Cooke and I. Gutowsky

Presentation:

A synthesis of results from HydroNet research on downstream entrainment risk and upstream passage was presented. The importance of critically evaluating biological fish passage efficiency estimates was demonstrated. Many potential factors can influence such estimates and need to be considered, such as fish motivation to migrate (not all individuals will be in breeding condition or may spawn below the barrier). In addition, many studies that consider fish passage are species-specific and community passage is often not addressed. Community-level assessments revealed that; turning basins can be problematic for some species, swimming ability may influence passage, predators' presence can alter survival or behaviour of species attempting to pass and the roughness of the bottom may be an important factor for some fish species. A number of recommendations were presented for studying and evaluating fish passage.

Entrainment work in HydroNet was also presented, focusing on adults of two resident species with different life history and behavior, burbot and bull trout. Entrainment was evaluated using a multidisciplinary team of engineers and biologists to consider fine-scale and broad-scale movement and factors that influence entrainment risk. A number of considerations were presented for future fish entrainment evaluations.

Discussion:

Points of clarification followed the presentation.

Upstream passage:

It was clarified that the fish studied in the upstream passage work were often sourced from the trap at the top of the fishway.

The author explained that some fish (e.g., redhorse) are more sensitive to being handled, and such predisposition could impact the results by altering the species migratory behavior.

The knowledge gained from the study was discussed: sturgeon were spawning downstream of the fishway indicating that fish passage may not always be an issue. A brief discussion of sturgeon spawning followed as well as a discussion of the impact of dams on different species. The presenter pointed out that dams may not always be an issue, depending on the species as dams can create new suitable spawning habitat downstream.

It was suggested that the authors discuss the need (or lack thereof) for fish passage in the Research Document. The author agreed, suggesting that this issue could be added to the future research directions section. A general discussion on when fish passage might be needed followed. The need for adaptive management and the importance of considering community need for passages were addressed.

The need for science-ecologically based passage targets was discussed, as well as the necessity to identify ways to develop targets.

Entrainment risk:

The presenter explained that no evidence of spawning migration in burbot was observed and that large-scale migration would likely have been detected suggesting that it was likely localized. The definition of entrainment was discussed in relation to clarifying the difference between downstream passage vs. entrainment, and participants agreed that a definition should be included in the Science Advisory Report. After discussion it was agreed to use the definition of entrainment as used by the Fisheries Protection Program and it will be included in the SAR.

A conceptual 2 dimension model for entrainment that was introduced in the presentation and further described in the Research Document was discussed. It was suggested that the model be expanded to a 3rd dimension. However the author pointed out that the horizontal movement could be considered 3D and will consider referring to the model as a 3D model instead.

The presenter explained that modelling can be used to make reasonable predictions of entrainment risk, but that a monitoring program is needed to validate the model predictions.

PHYSICAL AND CHEMICAL DRIVERS (FLOW, NUTRIENTS AND TEMPERATURE) OF FISHERIES PRODUCTIVITY ACROSS RIVERS OF VARYING HYDROLOGICAL REGIMES

M. Lapointe and Joseph Rasmussen

A series of three presentations were given to summarize the work on physical and chemical drivers.

Presentation 1: Flow Regime: Detecting and Ranking Flow Regime Anomalies in Regulated Rivers

M. Lapointe and F. Maclaughlin

The main objectives of this work were to: describe and quantify the degree of flow regime modification associated with a particular hydro system, and; to determine the limits to flow regime modification tolerable for fish populations, based on empirical data. The authors presented an introduction to the characterization of flow regimes and important metrics to include such as magnitude, frequency, duration, timing, and rate-of-change of flow events. Features of flow regimes involve many indices (100s). A variety of methods to characterize flow regime were discussed, including before-after comparisons and the Ecological Limits of Hydrologic Alteration (ELOHA) approach. Limitations of these approaches were presented. An alternate approach, coined the flow regime anomaly approach, was also presented. Regulated rivers were compared to similar reference rivers (same size in the same areas). The flow regimes of unregulated rivers were classified using a K-means clustering and presented in a Principal Component Analysis (PCA) space. Five broad flow regime classes distributed over two distinct regions were identified; 2 in eastern Canada and 3 in western Canada. Regulated rivers were assigned to a regional flow class based on a Discriminant Function Analysis (DFA). This method allows for an analysis of whether the features of the flow regime in a regulated river differ from its regional reference class. Some regulated systems fell within the natural variation of the reference rivers while some did not. Extremely anomalous flow features may most strongly stress native biota.

Discussion 1:

The influence of inter basin diversion was discussed (i.e., other human activities that might affect the system). The author explained that in this study those types of systems were not included.

The quality of information was discussed, in particular the source of gauge information. The author explained that the rivers were selected based on quality of flow data available, and access to the river.

Participants discussed the various methods presented and the utility of the flow regime anomaly approach tool for the authorization process. It was cautioned that anomaly analysis cannot answer some questions but it can tell the type of flow regime the fish in the system are accustomed to, and the degree to which a regulated river differs (or is predicted to differ) relative to its reference class.

Participants discussed the application of the flow regime anomaly approach generally and observed that the approach would have limited application for really large river systems as it would be a challenge to find reference rivers for flow regime comparison.

The definition of run of river (ROR) for the study was discussed in the context of the Research Document and more generally. It was agreed to include a definition of how a river was defined as ROR for the work that was done.

Presentation 2: Thermal Regimes: Modelling Water Temperatures in Regulated Rivers

Authors: A. Maheu, J.A., Kwak, L. Beaupré, and A. St-Hilaire
Presented by: M. Lapointe

Tools to understand thermal regimes in rivers were presented. Both a regional analysis and a year-round analysis were presented. For the regional analysis, the summer thermal regime of 12 regulated and 17 natural rivers were compared using 15 metrics to describe the magnitude, frequency, duration, timing and rate of change of the thermal regime. Regulated rivers consisted of run-of-river, storage and peaking dams. A PCA was used to identify the components of the thermal regime that were most influenced by dams, according to their operational type. It appeared that the presence of a reservoir (i.e. storage and peaking dams) led to considerable differences in the thermal regimes of rivers. The rate of change and the September magnitude were the thermal attributes most influenced by storage and peaking dams. A year-round analysis was conducted for 2 regulated rivers with different operational types (ROR and storage dam with shallow reservoir) and 3 natural rivers. The year-round analysis of the thermal impacts of storage dams demonstrated the importance of assessing impacts throughout the entire year and considering morphometric characteristics of reservoirs when assessing the impacts of dams on the thermal regime of rivers. Performance and selection of models was also presented.

Discussion 2:

Participants discussed the models presented and their potential application. The discussion focused on the predictive power of the modelling techniques presented. It was noted that the temperature of reservoirs is difficult to predict because of mixing and that modelling is not good at capturing that interaction efficiently.

The influence of the size of reservoir was discussed and it was felt that it needed to be emphasized in the Science Advisory Report.

It was requested that a table of the thermal and flow indices be included in the Research Document and potentially in the SAR. In addition, the multiple regression models that were presented should be included in the Research Document as well as in the neural network model.

Presentation 3: Nutrients as Chemical Drivers of Fish Biomass: Empirical Models of the Relationship Between the Nutrient Regime and Fish Biomass

J.B. Rasmussen

Fish productivity is dependent on the underlying trophic regime, and ultimately the nutrient regime. Data from the literature was used to demonstrate regional variation in fish biomass, total phosphorous (TP) and species richness (European and North American data). The relationship between Log fish biomass and Log TP was strong but variable among regions and studies. Rivers with higher biomass had higher nutrients (TP). Rivers and streams had greater fish biomass than lakes and reservoirs but not higher species richness. High intercepts were associated with regions and studies on systems with high species richness. Undersaturated systems were left out of the analysis. Nutrients TP and total nitrogen (TN) were sampled in all HydroNet rivers across regions of Canada. The rivers sampled ranged from ultra-oligotrophic to oligotrophic (TP 2-12 $mg \cdot m^{-3}$). Neither TP nor TN differed among paired regulated and unregulated systems. In most cases, downstream values were within 20 % of their upstream values, except in the richest rivers.

Discussion 3:

It was noted that the Research Document would benefit from examples of applying the model.

The author clarified that a number of factors were used to determine limited recruitment.

It was noted that the linear models were fitted. The author clarified that TP values greater than 150 mg/m^3 no longer respected the relationship; however, as long as TP fell below 150 mg/m^3, a linear relationship was observed (log-log relationship).

The author acknowledged that some uncertainty remains; however noted that the relationship observed was more precise than expected.

The implications of turning a river into reservoir in the context of a new hydro development were discussed in terms of loss of fish biomass (in reference to Figure 2). The author explained that this relationship is dependent on what happens to the nutrient regime and that higher fish biomass in rivers was largely due to their overall greater nutrient richness. However, if a reservoir had a diverse trophic structure and the habitat was not recruitment limited, the reservoir can support a productive fishery.

General Discussion:

Participants agreed that a table of the HydroNet rivers that includes what data was available for use in the various studies would be useful. The authors agreed to produce a table that would be available in this document (Appendix IV).

BIOLOGICAL DRIVERS OF FISHERIES PRODUCTIVITY ACROSS RIVERS OF VARYING HYDROLOGICAL REGIMES

D. Boisclair et al.

Presentation:

An overview of HydroNet work related to understanding the relationship between fisheries productivity and environmental conditions in rivers was delivered. The goal of this work was largely to provide government and industry with tools to estimate and predict metrics of fisheries productivity in rivers. Data were collected (fish surveys, environmental variables, including landscape variables) from a total of 28 regulated (run-of-river, peaking and storage) and unregulated rivers. Differences in productivity fisheries metrics in rivers were observed. Fisheries productivity metrics (density, biomass, species richness) in rivers located downstream of run-of-the-river facilities tend to be similar to unregulated rivers. Rivers located downstream of storage dams had 33% higher biomass but 1.7% lower species richness than predicted for an unregulated river. Rivers located downstream of peaking facilities have 39%, -48%, and -13% lower fish densities, biomass, and species richness, respectively, than that predicted for unregulated rivers. Models were presented that could be used to predict change in fish productivity metrics for rivers that fall within the range of environmental conditions of rivers used to develop the models. Both flow and thermal indices contributed to explain a relatively large fraction of among river fish productivity metrics. Other indices that explained a large amount of among river variation in fish biomass were presented; expected changes to these indices post development could be used to predict changes in fish biomass.

Discussion:

A clarification was provided for the analysis of within-river variation (contribution 2.5); MANOVAs were used for all variables as opposed to pairwise comparisons.

The flow alteration score was described further as there was a question on why unregulated rivers had positive scores. It was explained that the score is a deviation from the mean of the comparative group, therefore all scores are positive.

Participants asked if the analysis captures intra and inter annual variation. Intra and inter annual variation were not looked at explicitly. In order to test intra and inter annual variation, multi-year (10 years) data would need to be used.

Participants discussed the variability of peaking (from gentle to extreme), and its different impacts. It was explained that different degrees of peaking (i.e. ratio of change of flow within a day) would be reflected in the model; a system with lower levels of peaking would likely fall within the biomass range of other rivers. In the models presented, 3 peaking systems contributed to the relationships, 2 of which were intense peaking rivers.

The application of different tools presented was discussed, as well as how uncertainty could be carried through in some of the calculations.

A participant asked if dissolved gas super-saturation was considered. The author explained that it was not part of systems worked on, and therefore results would not apply for systems with dissolved gas super-saturation.

Clear language of important factors is needed in the Research Document; terms need to be clarified and defined. The author agreed to include a table indicating key thermal or flow indices and a description of terms.

MESOSCALE MODELLING OF FISHERIES PRODUCTIVITY IN A RESERVOIR

D. Boisclair, G. Rose and G. Bourque

Presentation:

An overview of HydroNet research related to estimating and predicting metrics of fisheries productivity in reservoirs was provided. The work examined both the pelagic zone (deeper than 3 meters) and littoral zone (shallower than 3 meters) of one reservoir in Manitoba. Hydroacoustics methods were used in the pelagic zone to describe the fish community size spectra. Application and challenges of this method were discussed. In the littoral zone, a variety of sampling techniques (gear type, sampling frequency, day-night) and habitat variables (local variables, e.g. substrate type, % macrophyte cover, lateral variables, e.g. trees, roads, golf course proximity, and contextual variables, e.g. proximity of other influences such as big tributaries, marshes etc.) were compared to determine relationships with metrics of fisheries productivity. Results and application were presented.

Discussion:

Clarification was provided for sampling methods. Sampling of the littoral zone is often an issue that proponents ask DFO for advice.

Participants discussed the acceptance of electrofishing from a boat as a valid sampling tool, since some agencies avoid boat electrofishing, participants felt the validity of boat electrofishing as a sampling tool should be communicated. Participants felt that fish boat avoidance as a potential bias for boat electrofishing should also be mentioned in the SAR.

Participants requested that the delineation between the pelagic and the littoral zone be included in Figure 8 of the Research Document. It was also requested that a sonar image that was in the presentation be included in the Research Document for the reader.

A participant asked why gill net was dropped as a sampling method after one year. The author replied that the method did not provide a model and kills fish. Participants discussed that gill netting is often used to determine Catch per unit effort (CPUE).

Participants discussed how the day-night comparison for electrofishing was problematic because sampling was done in different years. Participants felt that the information could be included but conclusions need to be tempered to reflect that the sampling was done in different years and inter-annual differences were detected using other methods.

Participants requested that information about survey dates be included in a table (table 1) or on Figures 4 and 5 so that the reader can see the temporal spread for the survey and better interpret the graphs.

REMOTE SENSING OF RIVERINE GEOMORPHOLOGY AS A TOOL FOR THE ASSESSMENT OF RIVERINE PHYSICAL HABITAT

M. Lapointe

Presentation:

High resolution multi-spectral satellite coverage was presented as a tool to assess and predict change of river geomorphology (see Hugue et al 2015 for more detail on the approach). In parallel, an overview of various methods (Lidar and drone low level flying) to assess riverine physical habitat was provided as well as the costs. A high resolution multi-spectral satellite can provide a large footprint, at half meter resolution (with current technology). Mean depth, velocity and width of river can be obtained with field calibration. Depth bands require calibration in several point locations as returns will depend on turbidity (the method cannot be used under certain circumstances such as high turbidity). Periphyton and macrophytes can also be identified by bands from the satellite (after ground-truthing). Information about heterogeneity of river geomorphology can be obtained allowing one to quantitatively identify representative reaches to sample fish. In comparison to other available methods, satellite is a powerful and low cost method ($ 2-3 K for 10s of km of river).

An example of how this method can be used to predict impacts was provided using information from the Oldman Dam in southern Alberta (pre-dam and post-dam). Coarser substrate was observed after dam addition. Other scenarios were presented on how the tool could be applied.

Discussion:

The author explained that the method presented assumes that the discharge is constant; therefore, if a tributary is detected, there is a need to stop at that section for calibration. Alternatively, a threshold could be defined depending on the influence of the tributary.

Participants discussed the possibility of quantifying habitat availability if the fish biology is known.

A participant asked if studies comparing methods exist; the author stated that some validation of the methods does exist.

It was asked if it was possible to get thermal data; the author explained that it was not possible as thermal data does not reach the satellite (the signal gets absorbed by the atmosphere).

CONCLUSIONS

The main points for the Science Advisory document were discussed and drafted at meeting. The chairs informed participants that a draft version of the SAR would be circulated for comment.

REFERENCES

Hugue, F., Lapointe, M., Eaton, B., Lepoutre, A. 2015. Satellite based remote sensing of running water habitats at large riverscape scales: Tools to analyze habitat heterogeneity for river ecosystem management, Geomorphology. doi: 10.1016/j.geomorph.2015.10.025

APPENDIX I- LIST OF PARTICIPANTS

Name	Affiliation
Keith Clarke (co-chair)	Fisheries and Oceans Canada, Newfoundland and Labrador Region
Karen Smokorowski (co-chair)	Fisheries and Oceans Canada, Central and Arctic Region
Gary Anderson	University of Manitoba
Daniel Boisclair	University of Montreal
Mike Bradford	Fisheries and Oceans Canada, Pacific Region
Daniel Cassie	Fisheries and Oceans Canada, Gulf Region
Katrine Chalut	Fisheries and Oceans Canada, Ottawa
Steve Cooke	Carleton University
Eva Enders	Fisheries and Oceans Canada, Central and Arctic Region
Neil Fisher	Fisheries and Oceans Canada, Ottawa
Sophie Foster	Fisheries and Oceans Canada, Ottawa
Joel Hunt	Manitoba Hydro
Carol Jacobi	Fisheries and Oceans Canada, Maritimes Region
Richard Janusz	Fisheries and Oceans Canada, Central and Arctic Region
Bronwyn Keatley	Fisheries and Oceans Canada, Ottawa
Jason Kelly	Fisheries and Oceans Canada, Newfoundland and Labrador Region
Jim Kristmanson	Fisheries and Oceans Canada, Ottawa
Michel Lapointe	McGill University
Tommi Linnansaari	New Brunswick River Institute
Michael McArthur	BC Hydro
Anne Phelps	Fisheries and Oceans Canada, Ottawa
Francois Plante	Fisheries and Oceans Canada, Gulf Region
Joseph Rasmussen	Lethbridge University
Dan Sneep	Fisheries and Oceans Canada, Pacific Region
Mike Stoneman	Fisheries and Oceans Canada, Ottawa
Simon Trépanier	Fisheries and Oceans Canada, Québec Region
Jay Walmsley	Nova Scotia Power
Dean Watts	Fisheries and Oceans Canada, Pacific Region
Jay Wilson	Canadian Electricity Association

APPENDIX II- TERMS OF REFERENCE

National Peer Review - National Capital Region

September 15-17, 2015
Ottawa, Ontario

Co-Chairpersons: Dr. Karen Smokorowski and Keith Clarke

Context

The Natural Sciences and engineering Research Council of Canada (NSERC) HydroNet is a national research network whose overall mission is to provide government and industry with the knowledge and tools that will contribute to the sustainable development of hydropower in Canada (please see the NSERC HydroNet Network's web site for additional information). HydroNet recently completed its final year of a 5-year mandate (2009-2014). The research activities of HydroNet were developed based on consultations with numerous hydropower companies and government agencies to identify what research activities would provide the most value to these organisations. At the time of HydroNet's development, it became clear that the implementation of the principle of "no net loss of the productive capacity of fish habitats", which was central to the previous *Habitat Management Policy* of Fisheries and Oceans Canada (DFO), was hampered by the difficulty of estimating and predicting the productive capacity of fish habitats (PCFH). As such, the development of new knowledge and tools to support the implementation of the principle of "no net loss" formed the central axis of the research mission, and the production of metrics of PCFH was highlighted as the main focus. With the amendments to the *Fisheries Act* (FA) being introduced in June 2012, the focus of the regulatory process moved from PCFH to fisheries productivity, but the principle of 'balancing losses and gains' has been maintained. The metrics of PCFH being developed within HydroNet were always biologically focussed, and therefore remain highly applicable to implementing the Fisheries Protection Provisions (FPP) of the new FA.

HydroNet undertook and completed 21 projects under a Strategic Network Grant focussing on PCFH of riverine environments below hydropower dams (supported by Fisheries and Oceans Canada), and 2 projects under complementary Collaborative Research and Development Grants that included:

1. Predicting the Entrainment Risk of Fish in Hydropower Reservoirs with BC Hydro; and,
2. Mesoscale Modeling of the Productive Capacity of Fish Habitats in Reservoirs with Manitoba Hydro.

With the substantial financial, intellectual and managerial contributions by DFO and industry towards achieving the objectives of NSERC's HydroNet, it is important that the new knowledge and tools gained about the effects of hydroelectric facilities on aquatic ecosystem be disseminated in a concise and transparent manner. The Canadian Science Advisory Secretariat process provides an ideal environment to consolidate and peer review the knowledge gained from HydroNet's substantial research efforts. The intention is to use this science advice to help achieve HydroNet's general objective: to develop science-based practical solutions that will provide government and industry resource managers with new tools to assess, mitigate, and minimise potential impacts on aquatic ecosystems.

Objectives

To consolidate and integrate knowledge and tools gained from 5 years of HydroNet Research activities under 5 themes:

1. Physical and chemical drivers (flow, nutrients and temperature) of fisheries productivity across rivers of varying hydrological regimes: lessons learned from NSERC's HydroNet 2010-2015.
2. Biological drivers of fisheries productivity across rivers of varying hydrological regimes: lessons learned from NSERC's HydroNet 2010-2015.
3. Mesoscale modeling of fisheries productivity in a reservoir: lessons learned from NSERC's HydroNet 2010-2015.
4. Downstream entrainment risk and upstream fish passage at dams: lessons learned from NSERC's HydroNet 2010-15.
5. Remote sensing of riverine geomorphology as a tool for the assessment of riverine physical habitat.

Expected Publications

- Science Advisory Report (SAR)
- Proceedings
- Research Documents (4)

Participation

- Fisheries and Oceans Canada (e.g., Ecosystems and Oceans Science and Ecosystems and Fisheries Management)
- Academia or Academics
- Industry

APPENDIX III- MEETING AGENDA

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat (CSAS)
National Science Advisory Workshop

AGENDA – HydroNet 1 Review and Advice

Ottawa, ON
Lord Elgin Hotel

September 15-17, 2015

Tuesday, September 15th

Time	Topic	Presenter
8:30 – 10:00	• Introduction to CSAS advisory process • Introduction of participants • Review Terms of Reference • Overview of goals and objectives of meeting • Overview of the FPP program • Downstream entrainment risk and upstream fish passage at dams(Presentation)	Chair FPP Cooke/Gutowsky
10:00	Break	
10:15–12:00	• Discussion – entrainment and fish passage. Draft SAR points.	
12:00 – 1:00	Lunch Break	
1:00 – 2:30	• Physical and chemical drivers (flow, nutrients and temperature) of fisheries productivity across rivers of varying hydrological regimes (presentation) • Discussion – physical and chemical drivers. Draft SAR points.	Lapointe
2:30	Break	
2:45 – 4:30	• Discussion – physical and chemical drivers cont'd. Draft SAR points.	

Wednesday, September 16th

Time	Topic	Presenter
8:30 – 10:00	• Re-cap of day 1 (progress). • Biological drivers of fisheries productivity across rivers of varying hydrological regimes (presentation) • Discussion – Biological drivers. Draft SAR points.	Chair Boisclair
10:00	Break	
10:15 – 12:00	• Discussion – Biological drivers cont'd. Draft SAR points.	
12:00 – 1:00	Lunch Break	
1:00 – 2:30	• Mesoscale modelling of fisheries productivity in a reservoir (presentation) • Discussion – Mesoscale modelling. Draft SAR points.	Boisclair
2:30	Break	
2:45 – 4:30	• Discussion – Mesoscale modelling cont'd. Draft SAR points.	

Thursday, September 17th

Time	Topic	Presenter
8:30 – 10:00	• Re-cap of day 2 • Remote sensing of riverine geomorphology as a tool for the assessment of riverine physical habitat.(Presentation – no accompanying Res Doc). • Discussion of remote sensing tools. Draft SAR points.	Chair Lapointe
10:00	Break	
10:15 – 12:00	• Complete drafting Science Advisory Report • Wrap Up / Next Steps • Workshop Ends	Chair

APPENDIX IV- TABLE OF RIVERS SAMPLED

Table 1: HydroNet rivers and data availability.

River Name	River Regulation	Province	Latitude	Longitude	Fish community	Habitat structure	Flow regime	Thermal regime	Nutrient	Fish stress indicator	Channel geomorphology
Kananaskis	Peaking	AB	50.7901	-115.1571	X	X	X	X	X		X
Magpie	Peaking	ON	48.0069	-84.8029	X	X	X	X	X		X
Mississagi	Peaking	ON	46.8722	-83.3314	X	X	X	X	X	X	X
Waterton	Storage	AB	49.3939	-113.5902	X	X	X	X	X		X
Dee	Storage	NB	47.0716	-66.9962	X	X	X	X	X		X
Serpentine	Storage	NB	47.2067	-66.8552	X	X	X	X	X		X
Kiamika	Storage	QC	46.6052	-75.1868	X	X	X	X	X		X
Saint-François	Storage	QC	45.6135	-71.5295	X	X	X	X	X		X
Coaticook	RunofRiver	QC	45.1784	-71.8106	X	X	X	X	X		X
Du Sud	RunofRiver	QC	46.8816	-70.6976	X	X	X	X	X		X
Etchemin	RunofRiver	QC	46.6608	-71.0768	X	X	X	X	X		X
Sainte-Anne	RunofRiver	QC	46.6663	-72.1156	X	X		X	X		X
Saint-Jean	RunofRiver	QC	48.2199	-70.2275	X	X		X	X		X
Castle	Unregulated	AB	49.5071	-114.1191	X	X	X		X		X
Elbow	Unregulated	AB	50.9140	-114.6448	X	X	X	X	X		X
Gulquac	Unregulated	NB	46.9657	-67.1906	X	X		X	X		X
Aubinadong	Unregulated	ON	46.9184	-83.4249	X	X	X	X	X	X	X
Batchawana	Unregulated	ON	47.0142	-84.5024	X	X	X	X	X		X
Goulais	Unregulated	ON	46.7483	-84.0996	X	X	X	X	X		X
Au Saumon	Unregulated	QC	45.6087	-71.3889	X	X	X	X	X		X

River Name	River Regulation	Province	Latitude	Longitude	Fish community	Habitat structure	Flow regime	Thermal regime	Nutrient	Fish stress indicator	Channel geomorphology
Becancour	Unregulated	QC	46.2758	-71.4724	X	X	X	X	X		X
Du Loup	Unregulated	QC	47.5770	-69.6674	X	X	X	X	X		X
Eaton	Unregulated	QC	45.4290	-71.6279	X	X	X	X	X		X
Nicolet	Unregulated	QC	46.1045	-72.3996	X	X	X	X	X		X
Noire	Unregulated	QC	45.6103	-72.5927	X	X	X	X	X		X
Ouelle	Unregulated	QC	47.4122	-69.9578	X	X	X	X	X		X
Petit-Saguenay	Unregulated	QC	48.2098	-70.0699	X	X	X	X	X		X
Picanoc	Unregulated	QC	46.0418	-76.1182	X	X	X	X	X		X