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Proceedings of the national peer review of Science Advice on Regional Productivity Benchmarks

September 29 to October 1, 2015
Toronto, Ontario

Chairpersons: Keith Clarke and Karen Smokorowski
Editor: Sophie Foster

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

October 2016

Canada

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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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 from September 29 to October 1, 2015 in Toronto. The meeting examined the feasibility of using regional benchmarks of fisheries productivity for the Fisheries Protection Program. Regional benchmarks of fisheries productivity have the potential to be used in a number of ways including; to estimate targets of potential gains in productivity expected from offsetting; to understand baselines for the purposes of impact assessment in the absence of site-specific data for small-medium impact projects; and to refine estimates of equivalent adults and area per individual for informing decisions about whether or not an authorization is required. The advice builds on past advice that has been provided to support changes to the *Fisheries Act*. Feasibility was addressed using data and models mainly from freshwater ecosystems, however, some quantitative data from coastal marine areas and an appropriate model framework to determine production derived from coastal ecosystems was presented to initiate discussion of possible application in marine coastal ecosystems. A specific meeting to address marine regional benchmarks is an anticipated next step. Participants included members of DFO Science Sector, DFO Fisheries Protection Program (FPP); provinces (Ontario) and academia. Two working papers and several additional presentations were reviewed. The conclusions resulting from this review will form the Science Advisory Report which will be made publicly available on the CSAS Science Advisory Schedule. Other publications resulting from this process include two 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 29 septembre au 1er octobre 2015, à Toronto. Lors de cette réunion, on a examiné la faisabilité d'utiliser des points de référence régionaux de la productivité des pêches pour le Programme de protection des pêches. Les points de référence régionaux de la productivité des pêches peuvent être utilisés de différentes façons, y compris pour établir des objectifs raisonnables de gains potentiels de productivité attendue des projets de compensation, comprendre les bases de référence aux fins d'évaluation de l'impact en l'absence de données propres au site dans le cadre des projets à petite et moyenne incidence et pour améliorer les estimations des équivalents adultes et de la zone requise par individu en vue d'éclairer la prise de décisions quant à savoir si une autorisation est requise. Les avis sont fondés sur des avis antérieurs qui ont été fournis pour appuyer les modifications à la Loi sur les pêches. La faisabilité a été examinée à l'aide de données et de modèles provenant principalement d'écosystèmes d'eau douce; toutefois, certaines données quantitatives provenant de zones marines côtières et d'un cadre modèle approprié pour déterminer la production à partir des écosystèmes côtiers ont été présentées afin d'entamer des discussions sur l'application possible aux écosystèmes marins et côtiers. Une réunion spécifique pour discuter des points de référence régionaux marins est une prochaine étape prévue. Les participants comprennent des membres du secteur des sciences du MPO, du Programme de protection des pêches (PPP) du MPO et du milieu universitaire, ainsi que des représentants provinciaux (Ontario). Deux documents de travail et plusieurs présentations supplémentaires ont été examinés. Les conclusions découlant de cet examen constitueront un avis scientifique qui sera rendu public dans le cadre du calendrier des avis scientifiques du SCCS. D'autres documents résultants de ce processus comprennent deux documents de recherche ainsi que 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 freshwater benchmarks of fisheries productivity, and did a round of introductions. Sophie Foster was introduced as rapporteur for the meeting.

The Co-Chairs provided an overview of the CSAS process describing the documents generated from CSAS meetings and their respective contents. They also described the context, background, and rationale for the meeting.

Participants were asked to familiarize themselves with the workshop Terms of Reference (Appendix II) as these would provide the basis for the discussions and also the Science Advisory Report. The meeting agenda was also provided (Appendix III). One of the research documents was not available prior to the meeting. The participants had a brief discussion of whether advice could be given related to this work. It was agreed to revisit this issue at the time of the presentation related to the work that was not available (de Kerckhove and Freeman).

An overview of the Fisheries Protection Program (FPP) was also provided by Chantal Ménard. A brief discussion of how the program would use the advice followed. It was pointed out that using tools often identifies other needs or additional questions and that additional follow up work may be identified.

The meeting proceeded with a series of presentations and discussions of the presentations.

PRESENTATIONS

REGIONAL BENCHMARKS OF FISH PRODUCTIVITY

Robert Randall, D. de Kerckhove, A. Van Der Lee et al., presented by Robert Randall

Presentation:

The author presented work on the feasibility of using existing electro-fishing data to determine regional benchmarks through a ‘proof of concept’ approach. Specific objectives were: to determine if it is feasible to quantify regional differences in average community biomass of fishes with existing electrofishing data; to determine if fish density-body size relationships differ among regions; to assess if the current biomass of populations and communities reflect the habitat carrying capacity; to investigate the key drivers of habitat capacity for possible use in predictive models, and to discuss the possible application of benchmarks. In the draft research document, electrofishing data were examined from 11 different regions (NL, Maritimes, and ON). For the presentation, detailed information was presented for three representative datasets: a series of small rivers and tributaries located in Terra Nova National Park, Newfoundland, the Margaree River, Nova Scotia, and Magpie and-Batchewana Rivers, Northern Ontario. An overview of data from the other eastern Canadian rivers was also presented. It was feasible to determine regional benchmarks of productivity with existing electrofishing data, with qualifications. Long term data sets such as the Margaree and Miramichi data could be used to determine carrying capacity; other data were shorter term (snapshots). Results demonstrated that productivity varied significantly and predictably among regions Results were supported by literature values, for example rivers in the Toronto area had high biomass-density values while Newfoundland rivers had relatively low biomass-density values.

Individual species of salmonids were also observed to have significant regional differences in biomass. Average biomass density among regions was significantly related to air temperature, indicating regional differences in temperature were a primary driver. Different approaches were used to examine density-body size relationships but the results were similar. However, the regressions, although significant, often had low precision (low R^2). Results confirmed that density-body size relationships from the literature can be used to adjust density for fish body size if needed.

Recommendations for application for offsetting programs and future work were presented. Regional Fisheries Management Zones were found to be a viable boundary however further work to examine other boundaries (either smaller or larger than fisheries zones) was recommended. Use of catch per unit effort (CPUE) electrofishing data could increase the available data therefore this option should be explored further (specifically, by investigating ranges in catch efficiency). Regional productivity benchmarks can be used in conjunction with project specific data to compare estimates of productivity. The approach could also be useful to establish Ecologically Significant Areas and to evaluate accumulated effects.

Discussion:

Participants were invited to ask questions of clarification. Many of these questions were related to details related to the original data. For example clarification was provided on the difference between species surveys versus community survey design. The author explained that most of the datasets were collected for a specific species and objective, and this objective needs to be acknowledged along with any bias that it might introduce when establishing benchmarks. Although many of the data sets were collected for target salmonid species, fish community level data were usually collected as well. A participant suggested post stratification however the author felt there was not enough data sets to divide them based on salmonid versus community, most were salmonid focused. Participants went on to discuss that the habitat that would be targeted for salmonid surveys would potentially present a habitat bias for other species. It was acknowledged that the context for which the original data was collected will be important in establishing where the benchmark would be relevant. Species, life stage and productivity that occurs outside the river area surveyed were all discussed as potential areas of concern when considering regional benchmarks. It was decided to include caveats in the advice about feasibility related to this discussion.

Another theme of the discussion was how regional benchmarks will be used. Although the author and some participants focused on the utility of regional benchmarks for offsetting it was explained that regional benchmarks can be useful at a variety of stages of project review and evaluation, including for self-assessment. Utility of the benchmark approach was also discussed in the context of monitoring effectiveness. Past advice has outlined potential application (DFO 2014/015, DFO 2012/060). Participants felt that all potential applications should be considered when developing the science advice. Another line of discussion was related to how to set the benchmark given the natural variation in the data. It was suggested that a productivity scalar could be used rather than using an average condition (e.g., percentiles). The application of regional benchmarks related to this suggestion was discussed.

Participants also discussed the temporal nature of data and how benchmarks would potentially change over time. Participants briefly discussed the frequency that benchmarks might need to be re-assessed. Participants felt that benchmarks should represent some degree of quality and reflect carrying capacity of the system. If recent data are used, a benchmark gives a measure of current conditions. Thus these benchmarks are a measure of what is there currently and includes human disturbances, including the presence of barriers to passage in some systems.

ANALYSIS OF STREAM ELECTROFISHING DATA FROM BC

M. Bradford and M. Shimomura, presented by Mike Bradford

Presentation:

Some of the available stream electrofishing data (DFO projects, provincial assessments, Environmental Impact Assessments) in British Columbia from the 1970s to the present was compiled. Data were collected for 124 streams and 540 sites. For many streams only one site and one year of data were available. Focal species for much of the data were salmonid (Rainbow/ Steelhead trout, Cutthroat trout, Coho salmon, Chinook salmon and Charr), as other fish were not consistently sampled. Distribution of total biomass of salmonids was presented. The data indicated a fairly narrow range with the standard deviation of 2.5 g/m^2. There were a few cases of high biomass but most streams were within 2-3 g/m^2. Streams for which there were 3 or more years had a higher average biomass but did not have extreme values that were sometimes present in the data where only one year of data was present. The availability of data from multiple sites reduced the variability among streams. An inverse relationship between the density and the mean mass (g) was found. For rainbow trout, individual age classes rarely exceeded a maximum capacity of 4 g/m^2. A cumulative density plot was developed that could allow the selection of a risk-based biomass reference point, for example, that would cover 80% of streams. In summary, this study demonstrated that there is an extensive data set available for BC, basic patterns are similar to patterns described for eastern Canada, and although regional averages can be characterized, and predictions of stream or site specific values will have considerable uncertainty.

Discussion:

Participants discussed the maximum capacity of 4 g/m^2 presented by the author and whether the pattern would differ per region. The author explained that the maximum capacity was based on a visual assessment rather than a formal process such as a quantile regression.

A participant asked about the provincial database and the metrics of habitat quality collected. The author explained that there was a standard sheet- transect of depth and velocity, however the data is inconsistently available to the public.

The number of sites sampled versus the number of years data were available was discussed. The author suggested that more uncertainty be built into an estimate if it is based on only one year of data.

SPATIAL SCALES OF ECOLOGICAL BENCHMARKS

Presented by Derrick de Kerckhove and Jonathan Freedman

Presentation:

The Research Document associated with this presentation was not available prior to the meeting. Spatial scales and techniques that have been used to establish benchmarks in other jurisdictions were presented. A review and evaluation of aquatic ecosystem classifications worldwide (Melles et al. 2013) was discussed. The different scales that have been used to establish classification systems as well as how different attributes are important at different scales was presented. Classification systems are generally hierarchical and often nested but don't have to be, they can also be place dependent (e.g. headwaters). The size of established ecosystem based management areas (EBMA) varies and several classification systems are available in Canada, including both terrestrial and aquatic based classifications. Previous

studies have demonstrated that terrestrial driven classifications do not always explain observed variation in aquatic systems. Ontario Fisheries Management Areas were compared to both terrestrial and aquatic classifications as well as resource use.

A number of case studies that focus on classification systems developed for lakes were presented. There is a balance between coarse scale (fewer regions, broad picture lose detail) and finer scale (more regions, more detail, can lose big picture) but the balance varies with the metric of interest, some work well at large scales, while others work at a small scale. Generally studies showed a positive correlation between primary productivity/ autotrophic activity/ nutrient availability and fisheries production/ Catch per Unit Effort/ abundance/ density.

Discussion:

A participant asked if the datasets that were presented could be used to establish benchmarks. The presenter replied that there is a need to establish benchmarks using local data because it is hard to extrapolate to regions that were not included in the data collection.

The discussion of what benchmarks represent continued. A participant pointed out that many ecosystems are already not at a reference level and expressed concern about floating reference points because habitat quality will continue to decrease. Related to this discussion participants considered the consequences of using an average value compared to a high quantile when establishing a benchmark. Variation is an important factor and error could be incorporated into benchmarks. A suggestion was made to build a framework and identify the current condition of the system in relation to the reference. Risk based decisions related to setting benchmark levels was discussed. Participants felt that some of the issues related to risk were policy questions. Another participant pointed out that Fisheries Management Objectives (FMOs) might help identify the ideal level or reference value. Others felt that FMOs are not always clear and are highly variable.

Participants discussed the use of benchmarks and how to establish them. They also discussed previous approaches used to establish benchmarks and what data is available in Canada.

A review of the previous Science Advisory meetings and advice related to the changes in the *Fisheries Act* was provided to put the benchmark into perspective of previous advice and program request for information. Benchmarks can provide confidence in impact prediction and offset prediction. Other uses of benchmarks were also described.

Participants agreed that a benchmark approach is feasible but the context within which they are set is important. For example, if you are going to use regional benchmark, the data has to be comparable. Data collection and validation of benchmarks was discussed. Life history plays a role in feasibility.

PRESENTATION OF UNIVERSITY OF CALGARY SALMONID META-ANALYSIS

S. Mogenson, K. Wilson and J. Post, presented by Derrick de Kerckhove

Presentation:

A salmonid productivity meta-analysis study was presented. A database of riverine salmonid productivity is being compiled to ground truth modelling outputs. The focus of the database is outside of Canada, it includes estimates of measured production (425 measurements of species specific histograms of total annual productivity) from the primary and grey literature. The data is mostly from inland resident populations, however it does include some data for coastal ecosystems and contains information on density, biomass, P:B ratios (biotic) and abiotic variables. Relationships from the data were presented as an example of what could be done

with Canadian data. For example, benchmarks were used to inform model development and to assess the estimates derived from modelling. A decrease in P:B ratios (as well as P and B individually) at high densities may demonstrate a density dependent effect on productivity. Future work by the University of Calgary was presented.

Discussion:

A participant asked whether the database included all life stages. The presenter stated that there was no column that specifies life stage. The production calculations presented did not include life stages but the presenter felt that some of this data would be available. The presenter clarified that the database was created for target species and only some data was available for other species, therefore they were not included in the analysis.

A participant noted that the species of concern is important when examining relationship between temperature and biomass because those relationships are species dependent.

A MODEL FRAMEWORK TO ESTIMATE FISH PRODUCTIVITY DERIVED FROM COASTAL HABITATS

Melisa Wong and M. Dowd, presented by Melisa Wong

Presentation:

Melisa Wong presented work on developing a model framework for estimating fish production in coastal marine inshore habitats (e.g., seagrass beds, shallow subtidal macroalgal beds, soft-sediment bottom, rocky reefs). A working paper was available to participants for review prior to the meeting. The work is ongoing and was presented to get feedback for a subsequent Canadian Science Advisory Secretariat (CSAS) meeting that will focus on marine estimates of benchmarks.

Limited data availability and wide range of habitat use by fish were presented as challenges when estimating inshore fish productivity. The model framework was discussed as being appropriate for data and information poor situations such as those in coastal ecosystems, because of its reliance on only few data. The model structure was presented as a Leslie matrix from an age-structured population, coupled with growth and length-weight functions. Model inputs include species specific density of at least one age class from field observations, and various growth and population parameters available in the literature. Uncertainty associated with model estimates of production are determined using Monte Carlo simulations that account for dependence among life history parameters. Production is estimated across the entire lifespan of the fish using field data of density (in one age class) in the particular habitat of interest, regardless if the fish spends its entire lifespan in that habitat or not. This allows calculation of three possible production metrics from the model output: production potential (total lifetime production, includes both present and absent life stages in the habitat), production present (production in the habitat during period of interest) and adult equivalent production (production above age of maturity, regardless if ages use habitat or not). The model was applied using data from seagrass and bare soft sediments in Atlantic Nova Scotia; field sampling and data analyses were presented. The possibility discounting metrics for external pressures and for seasonal migration and juvenile use of habitat was discussed.

Discussion:

The presentation was followed by questions of clarification. Many of the questions of clarification concerned the model, including questions about the equation and how mortality was incorporated into the model. Some participants offered suggestions of modifications to the model. Potential modifications included;

- Use of a per-recruit approach instead of the Leslie matrix,
- The inclusion of length-dependent natural mortality instead of constant mortality in the Leslie matrix,
- The inclusion of a catchability coefficient in the model; and,
- Accounting for production foregone in the production calculations.

Other comments about the model included the importance of immigration and transient use of habitats. It was also suggested that the equation for production be revisited as it may currently overestimate production. It was stated that the model presented was appropriate for adult equivalency. The author agreed to consider the comments in further development of this work.

It was felt that the production metrics presented may not apply for transient species. Other comments were provided about assumptions related to survival and possible changes were suggested to address the assumptions. It was acknowledged that dealing with natural mortality is a common challenge for stock assessment models.

Issues related to catchability were discussed and the development of gear calibrations in different types of habitats.

Participants stated that there is age class data available for shellfish. Oyster reef and shellfish beds benchmarks could be developed as well as benchmarks for lobster.

Metrics presented were discussed. The implications for different species depending on their ecology and use of the habitat may need to be considered. The relative contribution of habitat was discussed.

It was mentioned that the term adult equivalent used here is different from previous definition. It was felt that a more appropriate term would be adult production to remain consistent with previous usage of the term adult equivalency in a previous Science Advisory Report.

BENCHMARKS OF PRODUCTIVITY FOR THE COASTAL AREAS OF THE MARITIMES PROVINCES

Gérald Chaput

Presentation:

An alternative approach to establish benchmarks was presented for diadromous species for which the majority of biomass production takes place in the Ocean. The presentation was prepared at the meeting in response to work presented to develop benchmarks for salmonid species. Examples were provided for the Miramichi River where salmon and trout are minor components of fish in CRA fisheries. Although abundance data is limited, there is harvest data which can be used as a proxy for yield. The assumption related to this method is that if yield is sustained over the years then this may represent a ‘sustainable yield’. Harvest data was presented for a variety of species from 1978- 2002. Reported landings were from 3000 to 9000 tonnes annually. This data was used in combination with estimates of habitat areas in the river to determine g per m^2. The average yield was 26 g per m^2, with variation in the three provinces.

Differences in species habitat use and spatial use were presented. The author concluded that landings are an interesting metric that could be used and that production was higher than the salmon data presented in terms of biomass.

Discussion:

Participants acknowledged the availability of various types of data that could be used to derive benchmarks and that all the data have limitations. For example using a yield approach as presented is a coarse estimate and does not include consideration of changes in effort. Data was calculated for Coho Salmon in BC using this method.

Relationship between yield and production was discussed.

Participants discussed the potential to establish a variety of benchmarks using different metrics.

FRAMEWORK FOR BENCHMARKS OF FISH PRODUCTIVITY

Ken Minns

Presentation:

This presentation was prepared at the meeting in response to presentations and discussions in order to provide a framework for benchmarks of productivity. The presentation was done on a white board and thus there is not presentation available in the appendices. The first element of the framework is to start off by clearly articulating how benchmarks will be used. The presenter expressed concern over discussing benchmark development before talking about uses. The intention of the use of regional benchmarks was later described based on previous Science Advice to include a broad range of project development and follow up monitoring of effectiveness. The second element of the framework is a nested hierarchy (3 axes). Productivity indicators for example can be a nested hierarchy total productivity, total aquatic productivity, total fish productivity, CRA fish productivity and individual species productivity (y axis). The next element is the size of the habitat or area being considered Patch, Reach or whole system scale (e.g. a lake). The author felt that most of the presentations at this meeting for benchmarks were at the patch level. The third element is the metric of choice (ie. production indicators or other metrics). At a system level, the metric could be primary production. Within one hierarchical level a suite of indicators could be considered. Consistency between elements of hierarchy can be shown, for example, the relationship between total production and CRA production can be defined. The third element of the framework is the relationship between measured productivity and the stress on the system or the state of the system (i.e. is the system at carrying capacity) and the uncertainty related to that relationship. The fourth element of the framework is how to delineate regions given there are tradeoffs at different scales. The presenter recommended looking at relationships at the outset to inform the type of regional division you end up with. For example, productivity is related to climate, geology and other variables. The scale for establishing relevant regions gets built with these relationships in mind.

Discussion:

Participants discussed the different components of usage and specific applications. For example, standing stock indicators would work well for like for like replacement.

Participants discussed how it will be important to communicate how a benchmark was established and when using a particular benchmark would be appropriate. Participants stated

that the data presented is at the reach scale rather than the patch scale along the continuum. It was felt that a lot more data is available to establish benchmarks and could be mobilized.

Setting data standards was discussed and the available tools that are available. Some felt that that outlining any one specific approach would be too prescriptive, as many manuals already exist.

Content of the SAR was revisited and additions were made based on the presentation.

GENERAL DISCUSSION AND NEXT STEPS

The participants revisited the TOR and considered how the various presentations addressed the original objectives for the meeting. Participants discussed the various lines of evidence for regional variation in fish productivity.

It was agreed that a combined figure would be developed for the SAR which includes data presented in Figure 14 (Randall et al. unpublished manuscript[1]). Participants discussed how the data would be presented given not all the rivers were at carrying capacity. It was decided that all rivers would be presented and caveats would be provided for those that are thought to not be at carrying capacity. BC data and oil sand data presented will also be added to the figure.

The process for the development of the SAR and the opportunity to provide further comments was described by the Chair. It was clarified that no substantive changes can be made to the document after the meeting.

Participants felt that more data needs to be mobilized to establish benchmarks, as only certain habitats were sampled. Participants felt that there was a lot of data available that could potentially increase coverage across Canada.

Participants felt that a logical next step would be to develop a guideline for benchmark development, assemble more data and create benchmarks.

The meeting for the most part addressed freshwater benchmarks and future work will include the development of benchmarks for fisheries productivity in marine ecosystems.

REFERENCES CITED

Melles, S., N. Jones, and B. Schmidt. 2013. Aquatic Research Series 2013-04: Review and evaluation of aquatic ecosystem classifications worldwide . Ontario Ministry of Natural Resources. 80 pp.

[1] Randall, R.G., M.J. Bradford, D.T de Kerckhove and A. Van Der Lee. Unpublished manuscript. Determining regional benchmarks of fish productivity using existing electrofishing data from rivers: proof of concept. CSAS Research Document under review.

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
Mike Bradford	Fisheries and Oceans Canada, Pacific Region
Cindy Breau	Fisheries and Oceans Canada, Gulf Region
Gerald Chaput	Fisheries and Oceans Canada, Gulf Region
Cindy Chu	Ontario Ministry of Natural Resources and Forestry
Julie Dahl	Fisheries and Oceans Canada, Central and Arctic Region
Derrick de Kerckhove	Ontario Ministry of Natural Resources and Forestry
Andrea Doherty	Fisheries and Oceans Canada, Central and Arctic Region
Susan Doka	Fisheries and Oceans Canada, Central and Arctic Region
Sophie Foster	Fisheries and Oceans Canada, Ottawa
Jonathan Freedman	Research Associate at University of Florida and Independent Environmental Consultant
Jamie Gibson	Fisheries and Oceans Canada, Maritimes Region
Sarah Hasnain	Queens University
Donald Humphrey	Fisheries and Oceans Canada, Maritimes Region
Don Jackson	University of Toronto
Roger Johnson	Fisheries and Oceans Canada, Newfoundland and Labrador Region
Bronwyn Keatley	Fisheries and Oceans Canada, Ottawa
Marten Koops	Fisheries and Oceans Canada, Central and Arctic Region
Chantal Ménard	Fisheries and Oceans Canada, Ottawa
Ken Minns	University of Toronto/ Fisheries and Oceans Canada
Anne Phelps	Fisheries and Oceans Canada, Ottawa
Robert Randall	Fisheries and Oceans Canada, Central and Arctic Region
Guy Robichaud	Fisheries and Oceans Canada, Gulf Region
Brian Shuter	University of Toronto
Simon Trépanier	Fisheries and Oceans Canada, Québec Region
Adam Van Der Lee	Fisheries and Oceans Canada, Central and Arctic Region
Doug Watkinson	Fisheries and Oceans Canada, Central and Arctic Region
Melisa Wong	Fisheries and Oceans Canada, Maritimes Region

APPENDIX II- TERMS OF REFERENCE

Science Advice on Regional Productivity Benchmarks

National Peer Review - National Capital Region

September 29 - October 1, 2015
Toronto, Ontario

Chairpersons: Karen Smokorowski and Keith Clarke

CONTEXT

The *Fisheries Act* was amended in 2012 to include new provisions for fisheries protection which came into force in 2013. The amended Act focuses on managing threats to the sustainability and ongoing productivity of commercial, recreational or Aboriginal fisheries and contains a prohibition against serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Serious harm to fish is defined in the Act as the death of fish, the permanent alteration to, or destruction of, fish habitat. If serious harm to fish cannot be avoided, proponents of projects may apply for authorizations.

Although productivity is not part of determining whether serious harm to fish has occurred, Fisheries Protection Program (FPP) considers fisheries productivity, among other factors, when considering whether an authorization is appropriate (section 6, 6.1 in the *Fisheries Act*)[2].

The FPP aims to support its project review and decision-making processes with the development of quantitative metrics that can be coupled with decision criteria to assist FPP staff when determining whether to authorize serious harm to fish.

Consistency in decision-making by the FPP would be aided by the development of a methodology that can accommodate a diverse range of project impacts, from fish mortality to the destruction of fish habitat. Previous advice has been provided on using the concepts of "Equivalent Adults", area per recruit, and production foregone in regulatory decision-making framework. This advice was largely conceptual and at coarse scale (lakes versus rivers) across Canada, noting that further regional and habitat stratifications may provide more precise estimates.

Fisheries and Oceans Canada (DFO) Ecosystems Management is requesting advice from DFO Science to understand how fisheries productivity varies regionally across Canada, in support of implementation of the fisheries protection provisions. The regional productivity benchmarks are anticipated to be used in the following ways:

- To refine the estimates of equivalent adults and area per individual for informing decisions about whether an authorization is required.
- To provide estimates of regional productivity that can be used for understanding baselines for the purposes of impact assessment in the absence of site-specific data for small-medium impact projects.
- To provide estimates of regional productivity that can be used to reasonably estimate targets of potential gains in productivity expected from offsetting.

[2] More information on the Fisheries Protection provisions of the *Fisheries Act* can be found in the Fisheries Protection Policy Statement.

OBJECTIVES

Participants will review Research Documents to address the following questions:

1. Is it feasible to use estimates of regional fisheries productivity to determine productivity losses and gains expected from project impacts and offsetting?
2. What are reasonable stratifications / spatial units (e.g., watersheds, fisheries management zones, etc.) within which to assess regional variations in fisheries productivity across Canada?
3. How does fisheries productivity vary regionally across Canada and how can this be incorporated into previous advice on the decision-making framework?

These questions and feasibility will be addressed using data and models mainly from freshwater ecosystems. However, some quantitative bottom trawl survey data from coastal marine areas and an appropriate model framework to determine production derived from coastal ecosystems will be presented to initiate discussion of possible application in marine coastal ecosystems.

EXPECTED PUBLICATIONS

- Science Advisory Report
- Proceedings
- Research Document(s)

PARTICIPATION

- Fisheries and Oceans Canada (Ecosystems and Oceans Science, Fisheries Protection Program)
- Academia
- Other invited experts

APPENDIX III- AGENDA

Tuesday, September 29th

Time	Topic	Presenter
9:00 – 10:00	• Introduction to CSAS advisory process • Introduction of participants • Review Terms of Reference • Overview of goals and objectives of meeting • Background to Benchmarks • Potential Application of Benchmarks • Overview of the Fisheries Protection Program: o Changes to Fisheries Act o New Fisheries Protection Policy o How this advice will be used by the Program	Chair Chantal Ménard
10:00-10:30	• Presentation: Determining Regional Benchmarks of fish productivity (fishery management zone) - Research Document	Bob Randall
10:30	Break	-
10:45 – 12:00	• Discussion: Determining Regional Benchmarks of fish productivity (fishery management zone) - Research document	Bob Randall
12:00 – 1:00	Lunch Break	-
1:00 – 1:30	• Stream electrofishing data from BC	Mike Bradford
1:30 - 2:30	• Presentation: Regional Scales of Productivity • Discussion	Derrick de Kerckhove (Dak)/Jonathan Freedman
2:30	Break	-
2:45 – 4:30	• Discussion of Spatial scales • Presentation of University of Calgary productivity work (S. Mogenson, K. Wilson and J. Post)	Derrick de Kerckhove (Dak)

Wednesday, September 30th

Time	Topic	Presenter
8:30 – 9:30	• Re-cap of day 1 (progress).	Chair
9:30- 10:30	• *Model framework to determine baseline estimates of fish productivity from coastal habitats - Working Paper*	Melisa Wong
10:30	Break	-
10:45 – 11:15	• Identification of key themes for the SAR	All
11:15- 12:00	• Begin drafting Science Advisory Report	All
12:00 – 1:00	Lunch Break	-
1:00 – 2:30	• Continue drafting Science Advisory Report	All
2:30	Break	-
2:45 – 4:30	• Continue drafting Science Advisory Report	All

Thursday, October 1st

Time	Topic	Presenter
8:30 – 10:30	• Re-cap of day 2 • Continue drafting SAR	Chair All
10:30	Break	-
10:45 – 12:00	• Drafting Science Advisory Report • Wrap Up / Next Steps • Workshop Ends	Chair/ All