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Proceedings of the National Peer Review for Science Advice to Support Development of a Fisheries Protection Policy for Canada

August 29 – 31, 2012

Montreal, Quebec

Meeting Chairpersons: Jake Rice and Roger Wysocki

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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 the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) National Peer Review meeting to provide science advice to support development of a fisheries protection policy for Canada in Montreal, Quebec. Working papers focusing on species and habitats supporting commercial, recreational and aboriginal (CRA) fisheries, ongoing productivity and the contribution of relevant fish to ongoing productivity of CRA fisheries were presented for peer review.

The conclusions and advice resulting from this review will be given in a Science Advisory Report providing advice to DFO Program Policy Sector to inform the interpretation of terms used in the revised *Fisheries Act*.

SOMMAIRE

Le présent compte rendu résume les principales discussions et conclusions découlant de la réunion d'examen national par les pairs du Secrétariat canadien de consultation scientifique (SCCS) de Pêches et Océans Canada (MPO) qui s'est tenue à Montréal (Québec), et qui avait pour but de formuler un avis scientifique pour guider l'élaboration d'une politique sur la protection des pêches au Canada. Des documents de travail portant sur les espèces et les habitats dont dépendent les pêches commerciale, récréative et autochtone (CRA), sur la productivité continue et sur l'importance du poisson visé pour la productivité continue des pêches CRA ont été présentés aux fins d'examen par les pairs.

Les conclusions et l'avis découlant de cet examen seront inclus dans un avis scientifique destiné au Secteur des politiques relatives aux programmes du MPO et visant à éclairer l'interprétation des termes utilisés dans la version révisée de la *Loi sur les pêches*.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS) National Peer Review meeting was held on August 29 – 31, 2012, in Montreal, QC to provide advice that will inform the interpretation of terms used in the amended Fisheries Act. Canada's Fisheries Act, amended via Bill C-38 (last amended June 29, 2012) contains new terminology, some of which requires scientific definitions to deliver the management responsibilities of the Department. In particular, the Act refers to the "ongoing productivity of commercial, recreational and Aboriginal fisheries"; the "fish that support such a fishery", and "the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries". DFO Program Policy Sector requested scientific advice regarding the ecological concepts associated with these new terms in the amended *Fisheries Act*.

The Terms of Reference (TOR) for the science review (Appendix 1) were developed in response to this request for advice from DFO Program Policy Sector. The following working papers (WP) were prepared and made available to meeting participants prior to the meeting:

- Identification of Species and Habitats that Support Commercial, Recreational or Aboriginal Fisheries in Canada; by Kenchington, E., Duplisea, D., Curtis, J., Rice, J.C., Bundy, A., Koen-Alonso, M., and Doka, S.

- A science-based interpretation and framework for considering the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries; by Koops, M.A., Koen-Alonso M., Smokorowski, K.E. and Rice, J.C.

- A science-based interpretation of ongoing productivity of commercial, recreational or Aboriginal fisheries; by Randall, R.G., Bradford, M.J., Clarke, K. D. and Rice, J.C.

- Applying precaution in decisions implementing the Fisheries Protection Policy[1]; by Rice, J.C.

WELCOME AND OPENING REMARKS

The Chairs of the meeting, Jake Rice and Roger Wysocki, welcomed everyone and thanked them for coming to this Peer Review meeting. Participants introduced themselves (Appendix 2). The Chairs explained the purpose of the three day meeting, which was to provide a thorough scientific review of the information presented in the four working papers, with the intent of using this information and the expertise in the room to propose scientific definitions of the terms used in the revised *Fisheries Act.* Participants were encouraged to participate actively in the discussion. The Terms of Reference and agenda were reviewed.

Jake Rice noted the similarities between this meeting and the development of advisory frameworks for implementation of the Species at Risk Act and the Oceans Act. This guidance will not only inform policy and management functions, it will also address mechanisms that DFO

[1] This working paper was accepted as an appendix of "A science-based interpretation and framework for considering the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries"

Science will use to provide support. He noted that this would be in use for the next calendar year regardless of the certainty of the science.

Nick Winfield provided some context about the changes in the legislative framework. He noted that the Act is moving from protection of habitat to protection of fish which means there needs to be a tighter link to the fish themselves. There are questions about productivity and how it will be measured. There is also a need for clarity and simplicity. The kinds of information required will need to be standardized.

PRESENTATIONS AND DISCUSSIONS

PRESENTATION 1: Science Advice on Interpretation of Ongoing Productivity for the Fisheries Protection Policy

Presented by Robert Randall

Canada's *Fisheries Act*, amended in 2012, refers to 'sustainability and ongoing productivity of commercial, recreational or Aboriginal fisheries'. A conceptual framework for a science-based interpretation of ongoing productivity of fisheries is described. The productivity of a fish population is determined by vital rates (reproduction, growth and survival) and by life history traits (fecundity, age at maturity). The vital rates regulate population abundance, biomass and fish production. Fish production rate is the rate that biomass is accumulated per unit area per unit of time. Fisheries yield (landings) is a function of total fish production. Fisheries are often comprised of more than one population or species. Fisheries productivity, in the context of the Fisheries Protection Program (FPP), is interpreted as the sustained yield of all component populations and species, and their habitat, which support and contribute to a fishery in a specified area. Sustainability, biodiversity, and measurement uncertainty are key dimensions of ongoing productivity that need to be kept in mind within the conceptual framework. Population abundance is dynamic over time, but to be sustainable, the management of habitat-related physical impacts and other threats must be done such that populations can rebuild within a reasonable period of time if they become temporarily depleted. The new FPP focuses on a larger, functional spatial scale (landscape, population or fishery) than the localized project scale that was the case historically. Three categories of projects that vary in spatial scale and complexity were identified: small scale projects involving loss of habitat area, diffuse projects that impact vital rates through changes in habitat quality, and large projects that result in ecosystem transformation. To be operational and to measure impacts at a landscape scale, the appropriate surrogates of productivity will vary depending on the project category, ranging from habitat-based approaches, where ongoing fish productivity is inferred from the quantity and quality of habitat, to more direct measures of fisheries productivity (such as yield) for larger scale projects. Two pressing needs for implementation are a clear description of the operational tools available to measure productivity at the landscape scale, and a new precautionary framework to guide fishery protection to maintain productivity and ecosystem function.

Discussion

- There was a lot discussion regarding terminology. Some terminology was not used consistently in all of the working papers. The discussion included:
    - clarity of the language in the Act;

    - consistency of terminology such as vital rates, process rates, fish production, and fish productivity;
    - the need for language used to describe cumulative effects and stock exploitation to match the language used by fisheries management;
    - the differences between rates that are related to the individuals such as productivity, survival rates and growth rates, and rates related to a population like production which is a biomass measure; and,
    - the difference between production and productivity. Productivity is the product of vital rate, while production is the integration of that rate over space.

- There was an acknowledgment of the challenges in accounting for cumulative effects. A number of participants noted the importance of aligning with the existing integrated fisheries management plans (IFMP).

- The problem of cumulative effects is difficult but it shouldn't be a roadblock to making progress on this issue. There was a thought that the language around threat analysis may help, including an examination of the threats to the fishery(ies) in question.

- There was discussion on how applicable the fishery reference point system would be (vis-à-vis the Precautionary Approach to Fisheries Management, see DFO, 2006. A Harvest Strategy Compliant with the Precautionary Approach. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/023). Reference points guide decision making about annual allowable catch, but say nothing about individual fisher allocation. Habitat issues are the exact opposite. The fisheries reference point system can't be simply translated to habitats.

- Few people can measure productivity as a vital rate. There is a need for guidance that a member of the public readily interpret; information that can be used by non-experts.

- There was a comment recognizing the difference between habitat quantity versus habitat quality. It is usually defined by the fish community using the physical location rather than the habitat itself. Care has to be taken to identify which of those is being changed.

- The author clarified that the table "Example surrogate measures of productivity" was meant to be a starting point, to be commented on and added to.

- There was a discussion about the geographic scale for application. For an ecologist the landscape scale is the right scale to use but there was a concern that non-expert individuals will struggle to identify and measure impact..

- It was noted that DFO is not responsible for all resource development activities across Canada. Other regulating bodies will be managing much of it through their own regulatory regimes.

- There were some editorial comments on the text to help with clarity.

PRESENTATION 2: Operational guidance for the identification of species and habitats that support commercial, recreational or aboriginal fisheries in Canada, and evaluation of serious harm

Presented by Ellen Kenchington

The changes to Article 35 of the Fisheries Act include a new phrase that contains undefined terminology, i.e., “No person shall carry on any work, undertaking or activity [w/u/a] that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery”. An ecological interpretation of the support functions of an ecosystem are those functions which are essential for sustaining the production of commercial, recreational or Aboriginal (CRA) fishery species within the bounds of natural variability (taking into account managed changes to many populations) over short- and long-term temporal scales. Theoretical and empirical approaches can be used to identify fish that support CRA fisheries by considering the ecological functions that allow CRA fish species to carry out their life cycles. We discuss support functions in terms of direct and indirect support roles. Key prey species and biogenic habitats are considered to be direct support functions while a number of species may indirectly affect the ongoing productivity of the CRA fish species. These include keystone species, wasp-waist species, highly-connected species, apex predators and environment-modifying species all of which have important roles in maintaining ecosystem structure and functioning and therefore indirectly supporting CRA fish species. Changes to the structure of “supporting fish” populations (e.g., in terms of abundance, size structure, spatial structure, genetic structure, distribution) brought about through w/u/a must have the potential to alter the capacity for support species to fulfill their corresponding supporting function(s) in a manner which affects the ongoing productivity of the CRA fish species. Support functions and “supporting fish” populations which affect the productivity of CRA fishery species may occur in areas outside of the distribution of the CRA fishery species and be connected to the CRA fishery species through such mechanisms as food webs, source-sink dynamics or migratory behaviour. When identifying the range of key functional roles played by species supporting CRA fisheries, we describe common characteristics of species fulfilling each role and provide a few examples of such species. We also discuss vulnerability to perturbation and the most common types of human-induced perturbations that will affect support species. For each function, we provide guidance on how to make defensible and consistent decisions on which instances meet our definitions for "support".

Discussion

- The working paper used the definition of serious harm to include aquatic plants as fish. There was concern about defining aquatic plants as fish for the purposes of the act. It was agreed that aquatic plants would not be defined as plants and the research document would be changed to reflect that.
    - It is unlikely that the aquatic plants are in different geographic areas than the CRA fishery. Damaging aquatic plants would damage the spawning bed or smother the fisheries and would be managed directly.
    - Aquatic plants can be managed as damage to fish shelter in a CRA fishery.
    - There was consensus that aquatic plants were sufficiently captured under fish habitat.
- Ecologically there is a long list of supporting functions for a CRA fishery and, of that list, a small portion may be outside of the geographical area of the fishery. Most of the

supporting functions are part of the productivity of the fish of the CRA fishery and not an additional consideration.

- Defining species which indirectly support fisheries will be more challenging operationally and more challenging to clearly demonstrate.

- It was emphasized that it is not the role of Science to redefine terms which already have regulatory definitions

- It was noted that vulnerable extremely specialized predators are normally protected through another mechanism such as the *Species at Risk Act*.

- One participant noted that sometimes DFO deals with species at the periphery of their range. A species is on the margins of its range may not play the same role that it does in the center of its range. This is a danger of identifying things by name rather than by ecosystem function.

- There was concern about the scope of the working paper being too broad. There were two competing themes in the working paper – "serious harm" and "supports to the fishery".
    - The ecological aspects should be clearly separated from the operational section. The operational section can make clear what will be managed by other agencies.
    - The ecological portion should include whether any of the supporting functions potentially expand the geographic location beyond the location of the CRA fishery and explain how to take them into account.
    - The paper should be clear about what is meant by structure providing species.
- The working paper will be upgraded to a research document with the above changes.

PRESENTATION 3: A science-based interpretation and framework for considering the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries.

Presented by Marten Koops

Amendments to the *Fisheries Act* include the need to consider the "*contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries*" when making decisions on activities that may affect fish that are part of the fisheries and their habitats, and the fish that support the fisheries and their habitats. Here we consider that the *contribution* is measured by the impact that would be expected on the productivity of commercial, recreational or Aboriginal (CRA) fishery species if the change to the potentially affected species or habitats, associated with a work, undertaking or activity (w/u/a) takes place. We conceptualize the c*ontribution* as a relationship between the productivity of the fishery and state of the affected species or habitats. The shape of this relationship, the potential presence and position of inflections points and its slope can inform management decisions about risks associated with changes to the state of the affected species or habitats. Here we describe this contribution framework and outline the information needed for its application within a precautionary framework. This framework does not make the decisions automatically, but it does provide a structure for organizing information and bringing consistency to decision-making.

Discussion

- There was a discussion about whether or not the *y*-axis of Figure 1 should be "net impact"

- The *x*-axis and *y*-axis of Figure 1(this is the figure as it was presented in the working paper) were changed to potential impacts.

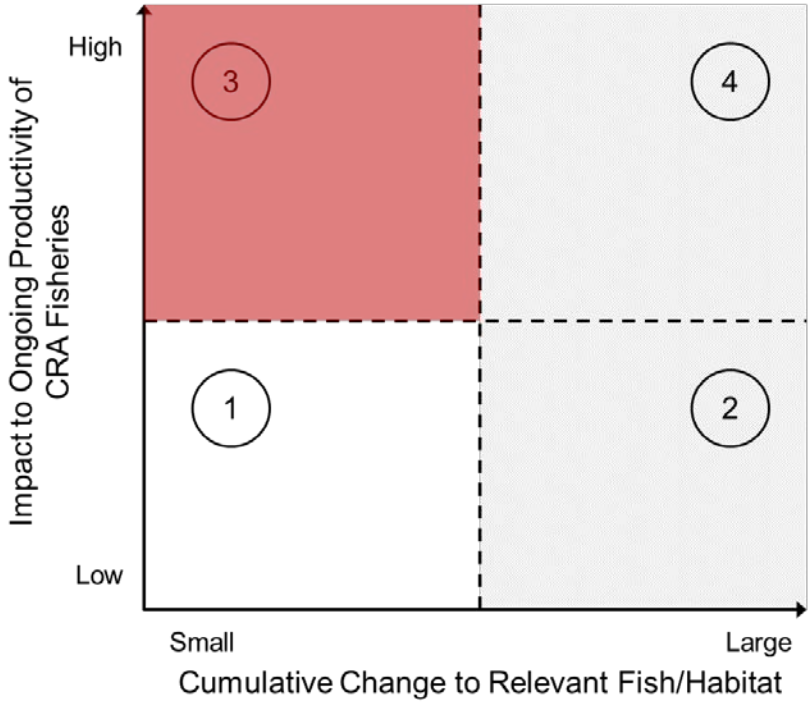

Figure 1. Schematic representation of a framework mapping the relationships between cumulative change to the relevant fish/habitat and the consequent impact to the ongoing productivity of CRA fisheries. The grey areas represent larger cumulative changes to the relevant fish/habitat, including serious harm. The red area represents conditions where the productivity of CRA fisheries is very sensitive to even small amounts of cumulative change to the relevant fish/habitat. Note: both axes are continuous variables; the dashed lines dividing the space into four quadrants are included for heuristic purposes and do not imply an a priori categorization.

- There was a question about whether P1 in Figure 2 is the "pristine" condition even though that may be unquantifiable. The authors used the terminology as though it was in the absence of human induced change but it doesn't have to be pristine conditions. There was also a suggestion for P1 to represent a baseline reference condition rather than a pristine condition.

- There was a question about the *x*-axis of Figure 2 being representative of just one or multiple fisheries. The response was that it is changes to a relevant fish or habitat. That could be a target fish or it could be a support fish. At this point the graph is not a cumulative change across all habitats but it could be rolled up that way.

- There was concern about the initial shelf in Figure 2 (from the *y*-axis to R1). Participants did not want to leave the impression that there are thresholds before productivity is changed. There was agreement to bring R1 closer to the origin on the graph.

- There was concern that there could be misunderstandings about R2, that once R2 was reached, further movement along the *x*-axis would not result in lowered productivity.

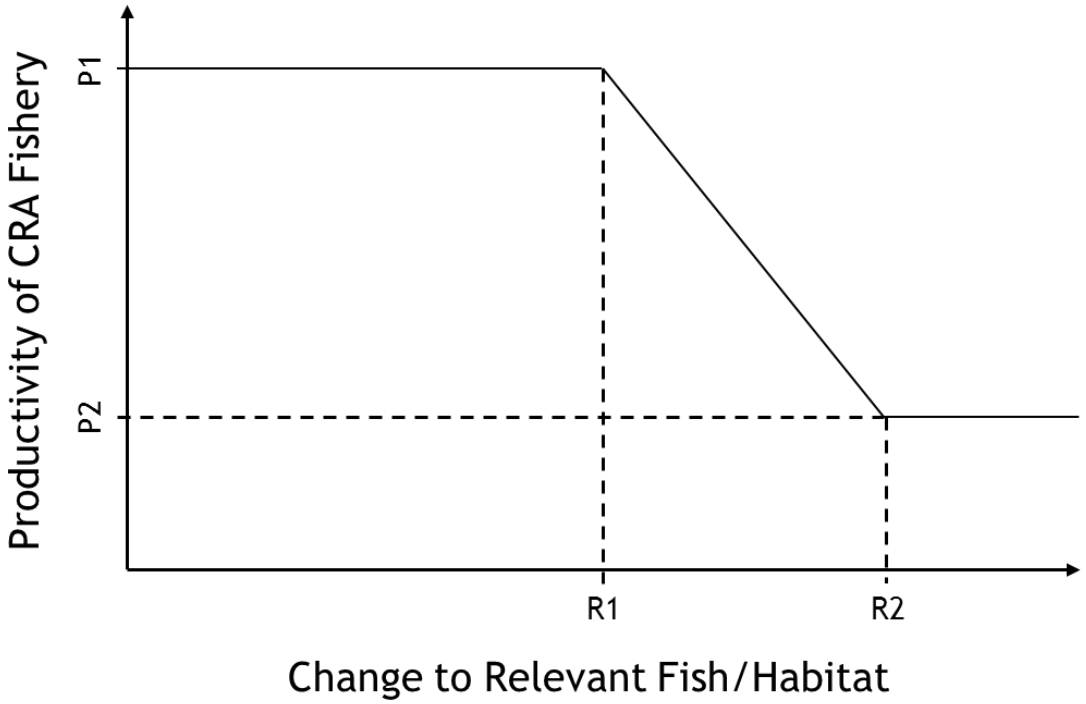

Figure 2. Schematic framework of how the ongoing productivity of a CRA fishery may be impacted by change to the relevant fish/habitat. Three reference points are identified: R1 is the threshold below which change to the fish/habitat has little or no impact on fishery productivity but above which additional change to the fish/habitat translates into reduced productivity of the fishery; R2 represents the point where cumulative change to the relevant fish/habitat is great enough that its contribution to the ongoing productivity of the CRA fishery is eliminated and the fishery is depressed; P1 represents the productivity of the fishery in the absence of human-induced change; P2 represents the depressed productivity of the fishery under maximum cumulative change to the relevant fish/habitat.

- There was a comment that one way of evaluating the change on the *y*-axis is the recoverability of productivity. If you can go down to P2 and recover to P1, then you're in a different state than if the productivity can't be recovered.

- It was suggested that Departmental decision making will be guided by how significant the change in the *y*-axis is rather than the change in the *x*-axis.

- One participant suggested that the bottom row of plots in Figure 3 wasn't necessary because even a big change in the *x*-axis wouldn't have a big change in productivity. However, other participants felt that the bottom row was due diligence. The proponent knows what the activity will change and can see that they are on one of the lower graphs.

- It was unclear to some participants what the step function, column C, in Figure 3 would represent. The author clarified that it shouldn't have been identified as a step function. The shape of the relationship is unspecified. One example for column C could be an oxygen or temperature change that causes lethality.

- There was consensus that the 12 graphs in Figure 3 are good.

- There was disagreement about what the *x*-axis should represent.

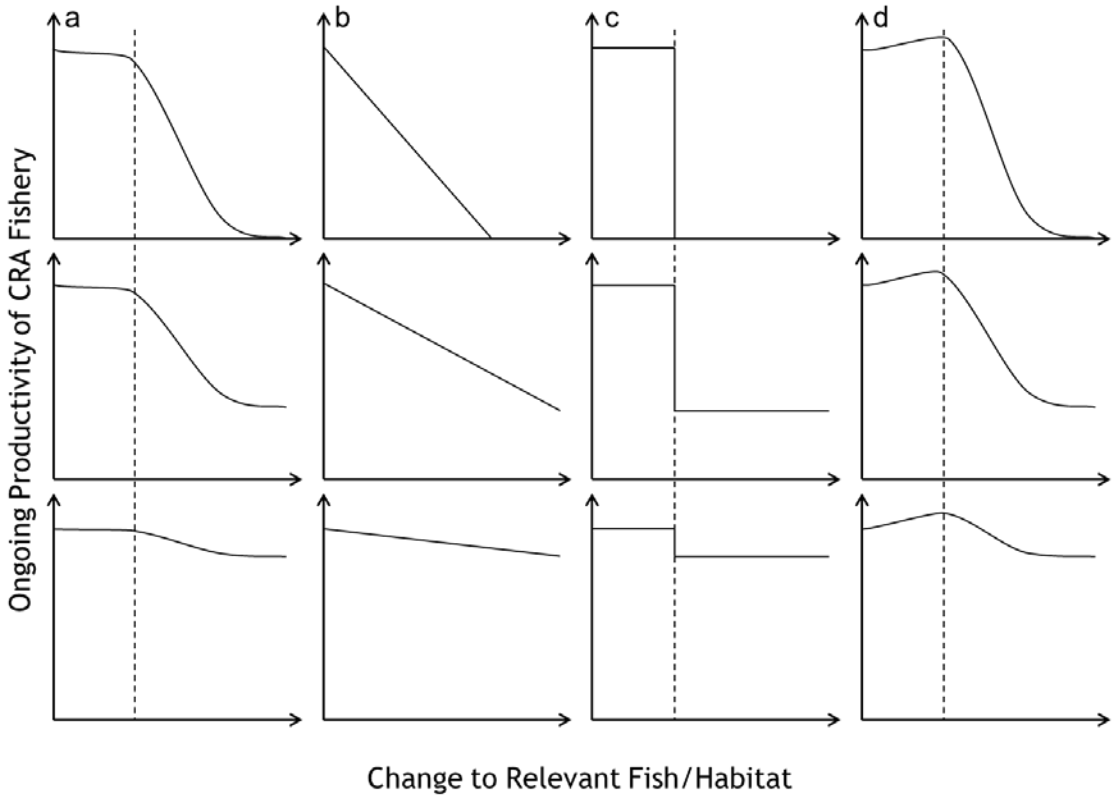

Figure 3. Representations of some of the different shapes of the productivity-change curve: (a) curvilinear response (similar to the lines in figures 2 & 3), (b) linear response (difficult to identify a threshold), (c) step response, and (d) subsidy-stress response. Three different forms of each shape are presented representing low, moderate, and high potential impacts to the productivity of the fishery from the cumulative change to the relevant fish (from bottom to top). The vertical dotted lines represent the threshold (R1) beyond which impacts to the productivity of the fishery increases more quickly. Note: there is no point that objectively represents this threshold when the response is linear (column b).

- There was considerable discussion about the *x*-axis:
    - A participant wanted to have the *x*-axis as something measurable. It's hard for an individual to know the state of the fish. It's much easier to know the state of the habitat.
    - Another participant suggested that the *x*-axis would be better as just habitat and not include relevant fish.
    - There are some classes of development projects that are more amenable to a habitat based assessment but some that are more amenable to a fish based assessment (for example a hydro dam).

    - There was a concern about having the *x*-axis reflect population status. It is dependant on the state of the fishery. As well, killing 100 fish means something very different if there is a total population of 2000 fish or a total population of 200 fish.
    - It was suggested that habitat could be used as a proxy for fish abundance.
    - It was noted that using habitat for the *x*-axis was measurable and practical but there would be large data requirements for it to be successful. Habitat inventories are updated slowly but fish populations are updated more regularly.

- There was a discussion of the word "*relevant*" and whether it should be used. It is defined in the Act and needs to be used appropriately. The meaning should not be confused: it is not fish that are relevant to the fishery; it is fish that are relevant because they are the subject of the serious harm.

- There was a lot of discussion about creating a framework that can be applied by individual proponents effectively. Some of the comments included:
    - How will a proponent know how their activity changes the abundance of a particular fish? It isn't reasonable to expect that an individual would know how killed fish fit into the population status of that species.
    - The *x*-axis has to be something that proponents are able to self-judge. Policy staff added that DFO will not be able to provide support to thousands of proponents each year.
    - There will be policy guidance to proponents about what the expectations of their due diligence will be. It will need to be a self assessment tool.
- One participant noted that there are essentially three variables: resilience of the ecosystem, rate of ecosystem response, and the limits of ecosystemic change beyond which the ecosystem will no longer respond.

- There was disagreement on how to deal with prey species.

The discussion for this working paper was halted because of time restrictions. During the course of the meeting the key concepts of this working paper were developed further (see section "Further Development of the Framework"). The working paper was accepted for publication as a research document subject to incorporation of those revisions. The final working paper, "Applying Precaution in Decisions Implementing the FPP Provisions" was accepted as an appendix of this research document.

PRESENTATION 4: Applying Precaution in Decisions Implementing the Fisheries Protection Provisions (FPP)

Presented by Jake Rice

Decision-making in the implementation of the Fisheries Protection Provisions (FPP) should include the application of precaution, because the two key Privy Council Office criteria for application of precaution are met. First there will be uncertainty about both the consequences of projects for CRA fisheries and the effectiveness of avoidance and mitigation measures to address those consequences. Second, there will be a risk of serious harm, in some cases from Individual projects with large potentially impacts, but also from the cumulative effects of project with small impacts in cases when such projects are numerous in a water body supporting CRA fisheries.

DFO has adopted a formal framework for application of precaution in fisheries decision-making, and this WP explained an approach for adapting that framework for use in application of the FPP. The fisheries framework takes four considerations into account

a) how productivity depends on stock (the overall S-R relationship that determined the position of the reference points and levels on the precautionary plot),
b) the current state of the stock, including how past harvests have altered the stock (the assessed biomass and fishing mortality that positions the case in the Precautionary Approach (PA) plot for a given year),
c) the resilience of the stock to perturbations at its present size (the removal reference for the current stock biomass, determined in turn by the shape of the S-R plot)
d) Uncertainties (the width of the cautious zone and the rate of decline in the removal reference within the cautious zone)

IN FPP applications there are four very similar considerations:

a) how productivity depends on habitat quantity and quantity (the overall shape of 1, discussed above),
b) the current state of the habitat, including how past and present-day activities in the habitat and adjacent landscape have altered the habitat (where the area is on the habitat status axis of the precautionary plot)
c) the resilience of fish productivity to habitat perturbations at the current state of the habitat (the slope of relationship 1 in the neighborhood of the current state of the habitat)
d) How large and where are the Uncertainties

Just as the Fisheries PA framework is structured fundamentally around how recruitment varies with stock size, and the knowledge of current stock biomass, the FPP framework would be structured around the relationship of how productivity of a CRA fishery varies with habitat status, and knowledge of the current state of the habitat. The working paper presents the details for how this framework would operate.

Discussion

- One participant noted that some provinces have codified the level of risk tolerance they will accept. If there is generic guidance for some geographic locations, there could be different risk tolerances applied at different parts of the *x*-axis. That would be a separate decision from the choice of framework.

- There was discussion about what the baseline condition of the habitat should be. It was suggested that if it's an impacted ecosystem, the current state would be acceptable. An important part of the question is whether the system is stable or has a declining trend; that rate of ecosystem response is key.

- It was suggested that column b) in Figure 3 should be the default. A linear change with no plateau.

- The change in productivity with declining habitat was discussed. Some questions raised were:
    - How does fish productivity change?
    - Is there a plateau to the relationship?
    - How quickly does it decline ones it starts declining?
- The discussion kept coming back to specific development activities, although activity was not being measured:
    - It is possible that a development activity could result in a small habitat change which could increase productivity. For instance one could allow some shoreline degradation but require culvert repair resulting in a net increase in productivity.
    - There was a discussion about whether to use different relationships (graphs) to represent different development activities.
- There was agreement that there needs to be potential to learn as we go along (adaptive management).
- There was a discussion of the feasibility of the work that needs to be done before January 2013.
- One participant cautioned that using too many graphs may be confusing for some individuals. The relationships need to be described in a practical way that a proponent will understand.
- Ideally we can provide a tool that can tell a proponent the parts of the habitat that will be affected and they way it will be affected by a particular activity.

It was decided to incorporate this working paper into the Research Document “A science-based interpretation and framework for considering the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries” (Presentation 3) as an appendix.

FURTHER DEVELOPMENT OF THE FRAMEWORK

Although the participants felt the framework presented in the Koops et al paper, “A science-based interpretation and framework for considering the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries” (Presentation 3) showed promise, there was concern about what the *x*-axis and *y*-axis represented. After further reflection one of the participants had a suggestion that was supported by consensus of the group. It was decided that the *x*-axis would represent the state of the affected species or habitat and the *y*-axis would represent the productivity of the CRA fishery species (Figure 4, 5). The Koops et al working paper was changed to reflect this in the research document.

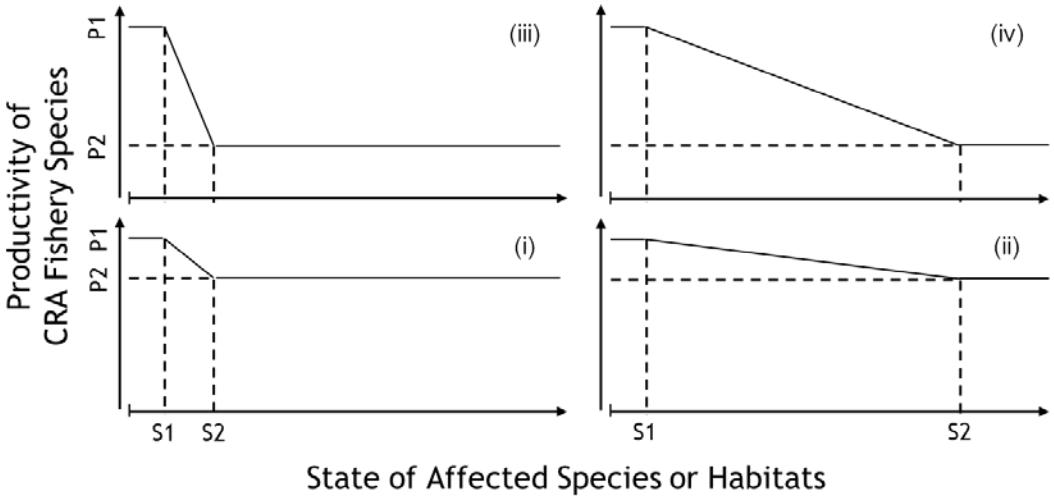

Figure 4. Four representations of the productivity-state relationship demonstrating how the positioning of thresholds S2 and P2 determine the relative location of the relationship in the cumulative change-impact space of Figure 1. The X-axis indicates state as measured along a continuum from good (left) to poor (right). The Y-axis indicates productivity as measured along a continuum from low (bottom) to high (top).

Figure 5. Representations of some of the different shapes of the productivity-state relationship: (a) curvilinear response (similar to the lines in figures 2), (b) linear response (difficult to identify a threshold), (c) step response, and (d) subsidy-stress response. Three different forms of each shape are presented representing low, moderate, and high potential impacts to the productivity of CRA fishery species from changes to the state of the affected species or habitats (from bottom to top). The vertical dotted lines represent the threshold (S1) beyond which impacts to the productivity of the fishery species increases more quickly. Note: there is no point that objectively represents this threshold when the response is linear

(column b). The X-axis indicates state as measured along a continuum from good (left) to poor (right). The Y-axis indicates productivity as measured along a continuum from low (bottom) to high (top).

The discussion around this suggestion follows:

- The suggestion was made that it might be easier to use the status of relevant fish. Status could go from good to bad. It would measure the impact of the perturbation on fisheries productivity. The *y*-axis would be productivity and the *x*-axis would be status and would a variable that measures perturbation. If the level of that status is defined properly, change would be movement along the *x*-axis.

- For evaluating an individual project, it would be how large the step to the right is (if right is towards decline). The way it was originally designed, one would have to integrate everything that has happened in that ecosystem. If the *x*-axis is status then only the current state is needed.

- One participant noted the importance of clarity in terminology. The discussion around the *y*-axis included:
    - One participant felt the *y*-axis should be productivity and not fisheries yield
    - Does the *y*-axis infer a maximum yield from the fishery? Or a maximum production? Does it assume the limiting factors are known?
    - The *y*-axis could be survival or a vital rate of some kind.
    - If survival is used on the *y*-axis then one would infer that it has an impact on productivity or yield.
    - The consensus was to have the *y*-axis represent the ongoing productivity of the CRA fishery species.
- Using status for the *x*-axis allows a different pathway to restore habitat without it being penalized as change. An improvement can move the other direction along the curve.

- Participants agreed that it will be easier to set management objectives for the state of the habitat rather than some of the other options discussed.

- There was a discussion on how to orient the *x*-axis. Typically this type of graph shows declining habitat moving to the right with a pristine or baseline condition at the *y*-axis. One reason to have the *x*-axis oriented the other way is to allow for an unknown reference condition off the end of the graph to the right. It was decided to follow the convention of good to bad running from the left to the right. It was felt that this would be more intuitive for non-expert proponents.

- It needs to be clear that the graphs have a reference state not a pristine condition. In some places the reference conditions may be the management conditions.

- It was wondered if the step function (column C) in Figures 3 and 5 is less useful than the other columns. The author stated that the four shapes in Figures 3 and 5 were chosen to demonstrate general ideas about the relationships. What is the rate of decline when you're on the descending slope? Is it a gradual or rapid decline?

- Policy participants noted that except in the largest projects, the *x*-axis and *y*-axis will be determined by the proponent with some guidance from the Department.

- The importance of integrating this framework with fisheries management was restated.

SCALE

There was a discussion about how to manage questions of scale, both in terms of geographical scale and in terms of the scale of projects (cumulative effects).

- One participant described a part of the system used in British Columbia. A 1 – 5,000 m map gives a human scale of the habitat and a 1 – 20,000 m map provides a better sense of the ecosystem. It can be harder to make a decision for smaller projects in the larger system but it provides context.

- One participant noted that more than one scale is needed to work in. Another participant noted that the challenge can be moving from one scale to another.

- It was suggested that one would start at the 20,000 m scale and move to the 5,000 m scale if there are identifiable concerns.

- A participant noted that the value of the habitat would play a role as well. Some habitat components make a disproportionate contribution to the productivity of the habitat such as a nursery area or spawning ground.

- It was concluded that the landscape scale was the best approximation to the functional ecosystem scale.

FOLLOW UP ACTIVITIES

There were some follow up activities that were discussed during the meeting. These activities would help prepare the Department for the implementation of the advice from this meeting:

- In the short term a possible follow up project would be a feasibility study of preparing tabulations of important prey for fish that are part of CRA fisheries, based on literature and exiting data sets on spatial scale of watershed or larger.

- The default shapes for productivity state need to be developed.

- There is more work to be done to develop the risk framework

- A couple test cases should be run – a data rich one and a data poor. Possibly using the Arctic for the data poor test case and the Gulf for the data rich.

CONCLUSION

The chairs concluded the meeting by thanking the authors for their hard work done under time constraints. The Chairs also thanked the participants and adjourned the meeting.

APPENDIX 1: Terms of Reference

Science Guidance for Fisheries Protection Policy

National Peer Review - National Capital Region

August 29-31, 2012
Montréal, Québec

Chairperson: Dr. Jake Rice and Roger Wysocki

Context

Fisheries and Oceans Canada (DFO) Program Policy Sector has requested scientific guidance towards the development and implementation of policies, regulations and operational practices resultant to recent amendments of the *Fisheries Act*. This will be achieved via a framework to guide how DFO Ecosystems and Oceans Science will provide support to Policy and Management Sectors of the Department.

Objectives

1. Discuss the ecological concepts associated with new terms in the amended *Fisheries Act*: "ongoing productivity"; fish that support a commercial, recreational or Aboriginal fishery, and; the contribution of the relevant fish to the ongoing productivity of fisheries.

2. Consider how these concepts can be used as a basis for guidance on development and implementation of policies, regulations and operational practices under the new provisions of the Act.

3. Review how well prepared DFO Ecosystems and Oceans Science and operational sectors are to apply the guidance considered in #2 above, and what actions, if any, might address important gaps identified.

4. Inform the design of a framework for the provision of science advice to support the new Fisheries Protection Program.

5. Identify any additional or on-going Science work required to support the new Fisheries Protection Policy.

Expected Publications

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

Participation

- Fisheries and Oceans Canada (DFO) (Ecosystems and Oceans Science, and Ecosystems and Fisheries Policy and Management sectors)
- Other invited experts

APPENDIX 2: List of Participants

Name	Affiliation
Jake Rice	DFO Science, NHQ
Keith Clarke	DFO Science, NL
Mariano Koen-Alonso	DFO Science, NL
Ellen Kenchington	DFO Science, Maritimes
Daniel Duplisea	DFO Science, Quebec
Robert Randall	DFO Science, C&A
Marten Koops	DFO Science, C&A
Karen Smokorowski	DFO Science, C&A
Mike Bradford	DFO Science, Pacific
Janelle Curtis	DFO Science, Pacific
Roger Wysocki	DFO Science, NHQ
Susan Doka	DFO Science, C&A
Bob Gregory	DFO Science, NL
Gérald Chaput	DFO Science, Gulf
Jake Schweigert	Habitat, Pacific
Xinhua Zhu	DFO Science, C&A
Nicholas Winfield	Habitat Policy, NHQ
Glen Hopky	Habitat Policy, NHQ
Jason Hwang	Habitat, Pacific
Julie Dahl	Habitat, C&A
Alain Guitard	Habitat, Quebec
Michelle Roberge	Habitat, NL
Guy Robichaud	Habitat, Gulf
Donald Humphrey	Habitat, Maritimes
Erika Thorleifson	DFO Science, NHQ
Marc Clemens	Program Policy, NHQ
Barb Best	Economic Policy, NHQ

APPENDIX 3: Meeting Agenda

Fisheries and Oceans Canada

Canadian Science Advisory Secretariat (CSAS)
National Science Advisory Workshop

Science guidance for Fisheries Protection Policy

August 29-31, 2012

Time	**Wednesday August 29, 2012**
09:00 – 10:30	o Welcome and Context (15 min.) o Introduction of participants (5 min.) o Review Terms of Reference (5 min.) o Overview Presentation: Science support required for Fisheries Protection Policy Development (Nick Winfield. 10 min. presentation; 10 minutes questions) **Max. time = 60 minutes (approx.)**
10:00 – 10:45	Break
10:45 – 12:00	o **Review and Discussion of Working Papers (Session 1)** o Presentation A: "*Productivity* of CRA fisheries" (Randall et al) ▪ discussion and review o Presentation B: "*Contribution* of the relevant fish" (Koops et al) ▪ discussion and review **Max. time = 90 minutes (approx.)**
12:00 – 1:00	Lunch Break (on your own)
1:00 – 2:30	o **Review and Discussion of Working Papers (Session 2)** o Presentation C: "Fish that *support* a CRA fishery" (Duplisea/Kenchington et al) ▪ discussion and review o Presentation D: "Use of Precautionary Approach" (Rice et al) ▪ discussion and review **Total = 90 minutes (approx.)**
2:30 – 3:00	Break
3:00 – 4:30	Review progress from Day 2 in context of provision of scientific advice and guidance. Highlight key points to address on Day 3. **Time = 90 minutes**

Time	Thursday August 30 (note 8:30 a.m. start)
8:30 – 10:00	o Re-cap of day 1 (review progress) including discussion (30 minutes). o Review of objectives for provision of advice to managers. o Drafting of Science Advisory Report (SAR) **Total = 90 minutes**
10:00 – 10:30	Break
10:30 – 12:00	o Drafting of Science Advisory Report (SAR) **Total = 90 minutes**
12:00 – 1:00	Lunch Break (on your own)
1:00 – 2:30	o Drafting of Science Advisory Report (SAR) **Total = 90 minutes**
2:30 – 3:00	Break
3:00 – 4:30	Review progress from Day 2 in context of provision of scientific advice and guidance. Highlight key points to address on Day 3.

Time	Friday, August 31, 2012 (note 8:30 a.m. start)
8:30 – 10:00	o Re-cap of days 1 and 2 o Review of objectives for provision of advice to managers. o Drafting of Science Advisory Report (SAR) **Total = 90 minutes**
10:00 – 10:30	Break
10:30 – 12:00	o Drafting of Science Advisory Report (SAR) and guidance to managers. **Total = 90 minutes**
12:00 – 1:00	Lunch (on your own)
1:00 – 3:00 pm	o Finalize drafting of Science Advisory Report (SAR) o Review and endorse summary bullets of SAR **Total = 60 minutes**
3:00 pm.	Conclusion