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Workshop on methods for assessing status and identifying benchmarks for Conservation Units of the Wild Salmon Policy

Atelier sur les méthodes utilisées pour établir des repères concernant les unités de conservation de la Politique sur le saumon sauvage et pour évaluer l'état de celles-ci

January 5-6, 2009

Vancouver, BC

Les 5 et 6 janvier 2009

Vancouver, C.-B.

Kim Hyatt

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January 2010 | **Janvier 2010**

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings 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.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

The purpose of the workshop was to provide a report on the progress of Wild Salmon Policy (WSP) Strategy 1 and solicit views on further development of methodologies for establishing Conservation Unit (CU) benchmarks. The methods for identifying Conservation Units were peer-reviewed and approved by PSARC in 2006.

The method presented in a working paper provides a toolkit of metrics and benchmarks of status, which will set the stage for future CU assessments. Specifically, a multi-criteria approach is provided that uses information on current abundances, trends in abundance over time, distribution of spawners, and fishing mortality relative to stock productivity.

Quantifiable metrics and candidate benchmarks draw from the scientific literature and previous management experience. The paper further evaluates a subset of those benchmarks on two performance metrics: the probability of extirpation over the long term and the probability of recovery to a target.

Workshop participants accepted the working paper with the revisions noted in these Proceedings. There was reasonable consensus on short term and long term next steps for setting benchmarks.

SOMMAIRE

Le but de l'atelier était de fournir un rapport sur les progrès réalisés relativement à la Stratégie 1 de la Politique sur le saumon sauvage et d'obtenir des points de vue sur l'élaboration d'autres méthodes pour l'établissement des repères concernant les unités de conservation (UC). En 2006, le CEESP a effectué un examen par des pairs des méthodes à utiliser pour définir les unités de conservation, puis les a approuvées.

La méthode présentée dans un document de travail offre un ensemble de paramètres et de repères relatifs à l'état des UC qui définissent les balises des futures évaluations de ces dernières. De façon plus précise, il s'agit d'une approche à plusieurs variables qui repose sur des renseignements sur l'abondance actuelle, les tendances relatives à l'abondance dans le temps, la répartition des reproducteurs ainsi que la mortalité par la pêche par rapport à la productivité du stock.

Les paramètres quantifiables et les repères proposés sont fondés sur la documentation scientifique et des expériences de gestion antérieures. Dans le document de travail, on évalue un sous-ensemble de ces repères en fonction de deux paramètres de rendement : la probabilité de disparition de l'espèce à long terme et la probabilité de rétablissement par rapport à une cible.

Les participants à l'atelier ont accepté le document de travail avec les révisions mentionnées dans le présent compte rendu. Les participants sont parvenus à un consensus acceptable à propos des prochaines étapes à franchir à court et à long termes pour établir les repères.

INTRODUCTION

The Chair, Kim Hyatt, opened the workshop and welcomed participants. The Chair referred to the Agenda (Appendix 1) and explained that the purpose of the workshop was to provide a report on the progress of Wild Salmon Policy (WSP) Strategy 1, and solicit feedback on the PSARC Working Paper, "Indicators of status and benchmarks for Conservation Units in Canada's wild salmon policy", and views on further development of methodologies for establishing Conservation Unit (CU) benchmarks under the WSP. A summary of the working paper is found in Appendix 3. In addition, Carl Walters (UBC) and Andrew Cooper (SFU) presented their experiences with indicators of status. Forty-six participants attended and included representatives from DFO Science, Oceans and Habitat Managers and Fisheries and Aquaculture Management as well as participants from the ENGO and academic communities, the Pacific Fisheries Resource Conservation Council, the Pacific Salmon Commission, First Nations and the general public (Appendix 2). The Terms of Reference for the workshop are in Appendix 4.

Overview of the working paper – Indicators of status and benchmarks for Conservation Units in Canada's Wild Salmon Policy

C. A. Holt, A. Cass, B. Holtby, B.E. Riddell

Carrie Holt and Blair Holtby provided an overview of the methodology explored in the working paper and the conceptual framework for status assessment under the WSP Strategy 1. For context, the authors summarized the 6 Strategies for implementing the WSP:

1) Standardized monitoring of wild salmon status
2) Assessment of habitat status
3) Inclusion of ecosystem values and monitoring
4) Integrated strategic planning
5) Annual program delivery
6) Performance review

Strategy 1 includes the identification of Conservation Units and developing criteria to assess CUs and identify benchmarks to represent biological status. The methods for identifying Conservation Units were peer-reviewed and approved by PSARC in 2006. A methods framework paper is published in the CSAS Research Document Series as are two Science Advisory Reports which provide the results and lists of CUs in BC.

This working paper presents a methodology to assess CUs and evaluate benchmarks to represent biological status based on simulation studies. The method provides a toolkit of metrics and benchmarks of status, which will set the stage for future CU assessments. Specifically, a multi-criteria approach for assessing status is provided that uses information on current abundances, trends in abundance over time, distribution of spawners, and fishing mortality relative to stock productivity. The authors further explained that the approach captures the multiple dimensions of population status that will be important to achieve WSP goals better than assessments based on abundances alone. Furthermore, any redundancy in information content among criteria may allow for increased flexibility when assessing stocks that differ widely in data quantity and quality. Quantifiable metrics and candidate benchmarks draw from the scientific literature and previous management experience. The paper further evaluates a subset of those benchmarks on two performance metrics: the probability of extirpation over the long term and the probability of recovery to a target.

General Discussion (overview working paper)

A number of comments from participants were related to the properties of the simulation model. Specifically, participants suggested the model results should include an assessment of the sensitivity to changes and trends in productivity, uncertainty in the underlying stock-recruitment relationship, depensatory mortality, observation errors, outcome uncertainties, and lower limits on fishing mortality. The authors agreed to expanded the sensitivity analysis of the simulation model to include an expanded productivity parameter range, changes in projected productivity over time, different stock-recruitment models (Ricker model, Ricker model with autocorrelation and depensation, Beverton-Holt model, and Larkin model), different levels of depensatory mortality, variability in the magnitude of observation errors, assessment uncertainties, outcome uncertainties, and variability in the fishing mortality from non-commercial and non-harvest sources.

A participant questioned why the stock-recruitment model parameters were not sampled from joint a-b parameter distributions rather than using a fixed b parameter and a random productivity parameter a. The senior author responded that because the intention of the paper was to simulate generic populations within a range of plausible stock-recruitment models and parameters, the systematically examination of plausible ranges of parameters and model structures was more appropriate than sampling joint distributions of parameters from any individual stock.

The authors agreed to include a separate sub-model on observations of abundances to explicitly include variability in abundances due to measurement errors.

It was noted that the observation and population dynamics components of the model were simulated together which makes it difficult to assess their individual effects on model outputs (performance metrics). Those two components should be modeled separately. The authors agreed to modify the model to separate the population dynamics and observation sub-models in the simulation mode and assess their individual effects on performance.

Participants observed that the emphasis of the simulation model was limited to evaluating lower benchmarks on spawner abundances. They suggested that it should be adapted to evaluate benchmarks on other classes of indicators (e.g., fishing mortality). The authors agreed to evaluate lower benchmarks on fishing mortality as well as those on spawner abundances.

For indicators of spawner distribution within a CU, a participant suggested overlaying maps of habitat types with spawner distribution. This could be useful for developing distributional benchmarks based on spatial and temporal distribution of spawners and habitat type, and is suggested as a possible avenue of future work in cooperation with the implementation of Strategy 2 of the Wild Salmon Policy, the assessment of habitat status. It should be noted that the authors did not provide specific benchmarks on metrics of distribution, and instead suggested that status on that class of indicators be evaluated on a case-by-case basis.

There were a number of comments about the particular harvest policies used in the simulations to assess the performance of different choices of benchmarks. The simulation model described in the working paper incorporated a constant escapement and harvest rate policy to evaluate lower benchmarks. Participants questioned why other more realistic harvest strategies were not considered. The senior author pointed out that the model assumed the most aggressive harvest strategy possible that still recognized the lower benchmark (i.e., that was associated with the

highest possible probability of extirpation and lowest possible probability of recovery). In other words, the harvest strategy was associated with the worst-case performance.

For benchmarks on spawner abundances, the harvest strategy was a constant escapement policy equivalent to the lower benchmark, with one exception when evaluating the probability of recovery to a target. All other possible harvest strategies that recognize those lower benchmarks but adapt escapement or fishing mortality according to observed abundances or catches above that benchmark, will result in improved performance (a lower probability of extirpation and higher probability of recovery).

The senior author reported that although the harvest strategies explored in the working paper may be unrealistic, they demonstrate the long-term properties of the benchmarks under pessimistic assumptions about the ability of fishery management to restrict effort. Therefore, the simulation model results represent a lower limit on possible performance. The senior author stressed that the evaluation of all possible harvest strategies in a simulation model is beyond the scope of the current analysis. She agreed that an assessment of more realistic harvest rules would be a necessary future step before implementing those rules in the fishery, and the author agreed that this point would be clarified in revisions to the working paper. The discussion on the implications of alternative harvest prompted some participants to recommend that future assessments be considered in the context of a management strategy evaluation (MSE). A more elaborate MSE would explicitly link plausible operating models and management procedures in an overall evaluation of management responses to uncertainty and model structure. One participant commented that the simulation model was constrained to fishery impacts, noting that habitat impacts and land-use issues will also be important.

Participants raised the issue of risk tolerance and its impact on choosing among candidate lower benchmarks. They noted that the choice among benchmarks requires that risk tolerances (classification of risks into acceptable and unacceptable categories) be identified. How will those risk tolerances be chosen? Is there precedence from other DFO initiatives that can provide that classification, at least for a preliminary evaluation of benchmarks? The authors agreed to describe a preliminary risk classification scheme adapted from DFO's "Fishery Decision-Making Framework Incorporating the Precautionary Approach" (2009).

Further to the choice of candidate benchmarks associated with F_{MSY}, a participant asked how the F_{MSY} benchmark compared to those used in the USA and Europe, and those suggested by the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks. The author stated that revisions to the paper would compare their benchmark on F_{MSY} to those used in Europe (North Atlantic Salmon Conservation Organization), the USA (Pacific Fisheries Management Council) and the UN Agreement and present a benchmark that is consistent with those suggested in the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks.

A question raised by an author of the working paper asked whether it is appropriate to use probability of extirpation to evaluate lower benchmarks for the Wild Salmon Policy. [To clarify, the WSP policy states:

> The lower benchmark between Amber and Red will be established at a level of abundance high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC. The buffer will account for uncertainty in the data and control of harvest management. There is no single rule to use for determination of the lower benchmark. (p.17)

> …Within the Red zone, there will be a level of abundance that cannot sustain further mortalities due to fishing or change to freshwater or marine habitats. Further mortality in such a CU will lead to continued decline in the spawner abundance and an increasing probability of extirpation. Determining this level in the zone is a continuing discussion in the salmon assessment literature and is not specified in this policy. The Department will prepare and publish operational guidelines on the estimation of this level. The management response to this level will be determined on a case by case basis, in consultation with First Nations, and others affected by this determination. (p.18).]

Indeed, the WSP provides several example definitions of lower benchmarks, including: "the abundance and distribution of spawners within a CU sufficient to provide confidence that the CU does not have a high probability of extirpation" (p.18) The WSP also states that a "CU in the Amber zone should be at a low risk of loss", and implies an increasing risk of loss in the Red zone (p. 17).

Although the WSP suggests that the level of abundance that cannot sustain further mortality due to fishing or change in freshwater or marine habitat and will result in continued declines lies within the Red Zone (e.g., is not useful for identifying lower benchmarks), it does recommend that the lower benchmark be at a level where probability of extirpation is not high. The senior author agreed to incorporate the probability of extirpation over the long term as one performance metric for evaluating lower benchmarks.

An author emphasized that it will be important to consider COSEWIC criteria in the development of lower benchmarks. He noted that the WSP states that the benchmark between the Red and Amber Zone should be high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC.

The authors were asked to comment on the strategies for assessing status of CUs in the absence of sufficient data to evaluate all classes of indicators. The authors stated that, if available, data on trends in relative spawner data and distribution of spawners across counting locations could be assessed. Although these indicators will only provide a partial assessment of CU status, it would be a first step towards a complete assessment. A “rapid” assessment response may highlight priority CUs where further analyses and/or data are required. The authors agreed to clarify this in their revisions and suggested combining information across data-limited CUs when they are believed to have similar dynamics, responses to stressors, and status.

The role of hatchery production under the WSP was questioned, acknowledging that the WSP states that possible interactions of wild and enhanced fish will be managed through integrated planning (Strategy 4, p. 24-31) and through appropriate technical practices at enhancement facilities. The question of how to deal with enhanced fish in a status assessment is not addressed in the WSP. An author noted that salmon populations that are dominated by hatcheries (i.e., with little or no contribution of wild fish) are not considered within CUs and are therefore omitted from WSP assessments. For populations that include both wild and hatchery-origin fish there is no completely satisfactory manner to assess status. The working paper proposes to remove first generation hatchery-origin fish from recruitment time series as a reasonable compromise. There was no objection to that proposal by workshop participants.

A participant asked to what degree are other human factors considered in the selection of benchmarks. An author stated that the lower benchmark is selected based on biological

considerations and not on social factors. He noted however that there are a large number of factors to consider in managing CUs including social factors.

Participants agreed that future work is needed to show the trade-offs between different outcomes in a way that decisions can be made based on the multi-dimensions in indicators.

The senior author presented metrics for status and candidate benchmarks to two example CUs, Takla/Trembleur sockeye salmon (Early Stuart run-timing group of the Fraser River) and Hecate Strait Lowlands pink salmon (odd year). These two CUs represent a range of data quality wherein the Early Stuart sockeye CU is considered data rich and the Hecate Strait Lowlands pink salmon are data poor. For the sockeye example, some participants questioned why status would be inferred over a short time frame of 3 generations noting the tendency for false positive status determinations for short time series of data. The author responded that that the time frame is the one used by COSEWIC and was one attribute referred to in the WSP.

Skeena River biodiversity assessment – C. Walters

A multi-stock, Ricker time-series modeling approach to stock-recruitment assessment was presented. The approach accounts for measurement error and time-series bias that are shown to be badly biased for some cases when using standard regression methods. The time-series approach assumes that populations in mixed-stock fisheries have shared exploitation histories and survival patterns. This new approach appears to greatly reduce the positive bias in productivity and the negative bias in habitat capacity estimates apparent in regression methods. In the application of the method to Skeena River salmon the estimates of maximum recruits per spawner can be used to bound the tradeoff between yield, abundance, and proportion of stocks that would be chronically overfished. The results for the trade-off analysis indicate that a large fraction of biodiversity can be achieved with a relatively small cost (i.e. 10%) in yield in mixed-stock fisheries. The approach is useful for incomplete escapement data series given the assumed shared exploitation and survival histories among stocks.

General Discussion (Skeena)

When asked for clarification on implications of measurement errors in escapement estimates, Walters responded that for individual stocks, measurement error is an issue, but when aggregating multiple stocks using the time-series approach, the issue appears to be less of a factor. A participant questioned whether the estimate of fishing mortality F, used as an input to the model, affected the estimate of the shared survival pattern (process error residuals) estimated by the model. Walters responded that if F is accurate then survival is independent of F.

The presentation of the trade-off analysis prompted a discussion on the implications of the WSP. A participant stated that the WSP does not require the management of all stocks within a CU, but rather requires management that maintains adequate biodiversity. Walters emphasized that it is the last increment of harvest to achieve MSY that results in the greatest impact on weak stocks (i.e. should only harvest at no higher than ~ 10% below MSY). It was pointed out that according to the WSP, diversity is not stated in terms of stock numbers. That prompted a response that underlying distributions of stocks in multi-stock assessments does implicitly relate to the number of stocks. Other participants commented that there is a need to consider social factors for choosing a risk tolerance level of acceptable loss of diversity.

Novel methods for combining metrics to assess status – Andrew Cooper

Cooper presented approaches based on his experience with methods for combining metrics within a CU. A basic consideration is to determine whether metrics should be combined in the first place. Examples of techniques for displaying multiple metrics include: a simple "stop-light" approach where each metric is tabulated and colour coded (red, orange, green) to reflect the state of each metric. Spider plots have been used to integrate across metrics. If one does want to combine metrics into a single status there are quantitative and qualitative assessment methods. Quantitative approaches can be in the form of probability statements that integrate the metric into a single probability value. This is difficult when the metrics are not independent and is the case for CU status assessment. Cooper reported that the medical and social disciplines have investigated multi-metric conditional probability approaches. Research there has not resulted in satisfactory quantitative approaches for combining metrics because of the complex interaction among metrics. Cooper suggested the assessment for salmon CUs would be very data intensive or require very complex simulation models. It is important therefore to determine if single status determinations over multiple metrics in a probalistic sense is really required. Qualitative, expert-driven methods may be more suitable. This can be done by weighting metrics with qualitative scores and averaging the results to get an overall score of status. Another qualitative approach could be related to the number of metrics in each red, amber or green zone.

Cooper summarized the issues by noting:

- Multi-dimensional aspects provide better actionable information than a single metric;
- Analysts should determine how managers want to use the status determinations before combining them;
- It may be possible to combine metrics to make probabilistic statements regarding status, but it will be challenging;
- Straight-forward but subjective methods exist for combining metrics but don't allow for probabilistic statements.

General Discussion (multiple metrics)

There was discussion about whether a single determination of status was needed for the WSP or if multi-metric methods, such as the stop light approach, would be sufficient. Overall, there was no consensus on whether a single determination of status was needed for each CU. Much of the discussion focussed on how to take the multi-dimensional metric information and use it to arrive at a single status determination.

Others questioned how uncertainty in a single status determination could be portrayed. Another suggestion was to create a set of decision rules that would describe the process for using, weighting, or scaling inferences for a variety of metric.

The discussion transitioned into questions about how information on biological status of CUs would be used. The WSP describes a process of how information on biological status contributes to integrated strategic planning (WSP Strategy 4), which considers multiple aspects of decision making of which biological status is one part. Participants noted that as part of a pilot study for WSP implementation, there is an integrated planning process for Barkley Sound. Some thought that knowledge of the management options was needed in order to prepare advice about status under different fishery management options. For example, perhaps the

focus should be on advising managers of fishery policy/decision alternatives, e.g. trade-off diagrams for different harvest rates.

Workshop Conclusions

Meeting participants accepted the working paper with the revisions noted in these Proceedings. Over the ensuing six months, the author agreed to finalize the working paper for publication in the CSAS Research Document Series and explore the Ricker time-series model for determining abundance-based benchmarks. Over the longer term, DFO Science should consider: 1) exploring methods for exploring trade-offs between harvest and biodiversity; 2) developing stock assessment frameworks by species and CU that assess methods for integrating information from all metrics; 3) providing DFO Areas with assessment tools for determining benchmarks in a phased approach that would be updated over time; 4) assessing impacts of alternative harvest control rules with management decision support rules

.Appendix 1. Agenda

Indicators of Status and Benchmarks for Conservation Units in Canada's Wild Salmon Policy

Authors: Holt, C.A., Cass, Al, Holtby, B., and Riddell, B.E.

Workshop Contributors: Carl Walters (UBC), Andrew Cooper (SFU)

Location: Simon Fraser University (Segal Rooms 1400&1410, downtown campus, 515 West Hastings Street, Vancouver)

Day 1: Monday, Jan. 5, 2008

9:00	• Overview of paper, " Indicators of Status and Benchmarks for Conservation Units in Canada's Wild Salmon Policy" (C. Holt)
9:15	• Introduction: A conceptual assessment framework (B. Holtby)
9:30	Discussion
10:00	• Carl Walters: Metrics of status and benchmarks for Skeena River salmon
10:45	• Wild Salmon Policy: A multidimensional approach to status assessment (C. Holt)
11:15	Discussion
12:00	Lunch
1:00	• Metrics of status and candidate benchmarks (C. Holt) • Evaluation of candidate benchmarks using simulation modeling (C. Holt)
2:00	Discussion
4:00	Synthesis of Day 1 and outline of future steps resulting from discussions (C. Holt)
4:30	Adjourn

Day 2: Tuesday, Jan. 6, 2008

9:00	• Review of Day 1 and further response to comments from participants (C. Holt)
9:30	• Andrew Cooper: Novel methods for combining metrics to assess status
10:15	• Application of candidate metrics and benchmarks to two example Conservation Units (C. Holt)
10:45	Discussion
11:45	• Outline of future steps (C. Holt)
12:30	Adjourn

**Note, morning and afternoon coffee breaks at the discretion of the PSARC chair*

Appendix 2. List of Attendees

First Name	Last name	Affiliation
EXTERNAL PARTICIPANTS		
Atkinson	Mary-Sue	Pacific Fisheries Resource Conservation Council
Cooper	Andy	Simon Fraser University
Cox	Sean	Simon Fraser University
Korman	Josh	University of British Columbia
MacDuffie	Misty	Raincoast
Marliave	Jeff	Pacific Fisheries Resource Conservation Council
Michielsens	Catherine	Pacific Salmon Commission
Orr	Craig	Watershed Watch Salmon Society
Parkinson	Eric	Ministry of Environment
Peterman	Randall	Simon Fraser University
Pollard	Sue	Ministry of Environment
Porzt	Erin	Simon Fraser University
Staley	Mike	Fraser River Watershed Committee
Taylor	Greg	
Walsh	Michelle	Shuswap First Nation
Walters	Carl	University of British Columbia
Wilson	Ken	Watershed Watch Salmon Society
Young	Jeffery	David Suzuki Foundation
DFO PARTICIPANTS		
Baillie	Steve	
Bailey	Richard	
Bradford	Mike	
Brown	Gayle	
Cass	Al	
Cross	Carol	
Dobson	Diana	
Folkes	Michael	
Grant	Sue	
Hargreaves	Brent	
Holt	Carrie	
Holtby	Blair	
Hop Wo	Leroy	
Huang	Ann-Marie	
Hyatt	Kim	
Irvine	Jim	
Lauzier	Ray	
Mar	Amy	
Mathias	Karin	
McHugh	Diana	
McNicol	Rick	
Parken	Chuck	

Riddell	Brian	
Ryall	Paul	
Sawada	Joel	
Singer	Kris	
Tadey	Joe	
Whitehouse	Timber	

.

Appendix 3. Terms of Reference

Regional Advisory Meeting

Pacific Scientific Advice Review Committee (PSARC)
Salmon Subcommittee Review

January 5-6 2009
Simon Fraser University (Harbour Centre) Vancouver BC

Chairperson: Kim Hyatt

Background

As part of implementing Strategy 1 of Canada's Wild Salmon Policy (WSP), DFO is developing indicator benchmarks to evaluate the biological status of WSP Conservation Units for Pacific salmon. This science review will explore methods for selecting benchmarks in a workshop setting. A suite of methods will be reviewed that are intended to cover the range of potential indicator benchmark for salmon in the Pacific Region including Conservation Units with varying data quality. As specified in Strategy 1, the focus will be on population indicators such as spawner abundance and trend, distribution and harvest impacts or proxies thereof. Methods for identifying higher and lower benchmarks that delimit the three status zones (green, amber and red) will be explored. Workshop participants will review a working paper that describes methods and classes of benchmarks based on examples from BC salmon.

Experts are invited to participate in this review of the methodology and help identify classes of measurable benchmark indicators for different salmon species and their Conservation Units.

Objectives

Specifically review methodologies for identifying benchmarks under WSP Strategy 1 based on a working paper entitled: Methods for assessing status and identifying benchmarks for Conservation Units of the Wild Salmon Policy (Holt et al.)

Products

- CSAS Proceedings document summarizing the discussion
- CSAS Research document
- CSAS Science Advisory Report

Location and Date

Simon Fraser University (Harbour Centre), Vancouver, BC, January 5-6 2009

Participants

Participants (approx. 30) will include internal DFO representatives and invites from academia, First Nations, NGO's, industry and the Pacific Salmon Commission.

Appendix 4. Working paper summary

Indicators of status and benchmarks for Conservation Units in Canada's wild salmon policy.

C.A. Holt, A. Cass, B. Holtby, B. Riddell

The goal of Canada's Wild Salmon Policy (WSP) is to restore and maintain healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity. To achieve that goal, the WSP requires that biological status be assessed for all geographically, ecologically, and genetically distinct populations, or Conservation Units (CUs). One component of that assessment is identifying quantifiable metrics of biological status and benchmarks along those metrics. Here, we provide a toolkit of metrics and benchmarks of status, which will set the stage for future CU assessments. Specifically, we propose a multi-criteria approach for assessing status that uses information on current abundances, trends in abundance over time, distribution of spawners, and fishing mortality relative to stock productivity. That approach captures the multiple dimensions of population status that will be important to achieve WSP goals better than assessments based on abundances alone. Furthermore, any redundancy in information content among criteria may allow for increased flexibility when assessing stocks that differ widely in data quantity and quality. Here, we identify quantifiable metrics and candidate benchmarks drawn from the scientific literature and previous management experience. Using a simulation model, we further evaluate a subset of those benchmarks on two performance metrics: the probability of extirpation over the long term and the probability of recovery to a target. Finally, we apply those metrics and candidate benchmarks to two example CUs, Takla/Trembleur sockeye salmon (Early Stuart run-timing group of the Fraser River) and Hecate Strait Lowlands pink salmon (odd year).