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National Capital Region

Proceedings of the National Peer Review on Assessing Threats, Ecological Risk, and Ecological Impacts for Species at Risk

May 29 – 31, 2013
Ottawa, Ontario

Chairpersons: Simon Nadeau and Christie Whelan

Rapporteurs: Ashley Kling, Justine Mannion, and Jennifer Shaw

Fisheries and Oceans Canada
200 Kent Street
Ottawa, Ontario K1A OE6

March 2015

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 presentations and discussions of the national science advisory meeting held on 29-31 May 2013 at the Lord Elgin hotel in Ottawa, Ontario. The conclusions and advice resulting from this meeting will be provided in the form of a Science Advisory Report that will be made publicly available on the CSAS website. Meeting participants included experts from various sectors and regions of Fisheries and Oceans Canada, as well as external participants from Environment Canada, Parks Canada, and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). One working paper was distributed prior to the meeting, in addition to several background documents. The purpose of this meeting was to provide science advice on three distinct components of the species at risk process that have never benefitted from such peer review.

THREAT ASSESSMENT

For species assessed as Extirpated, Endangered or Threatened by COSEWIC, assessment and prioritization of threats to survival and recovery of the species need to be provided in the Recovery Potential Assessment (RPA). The RPA provides science advice to the Department to aid in the development of listing decisions, Recovery Strategies and Actions Plans under the *Species at Risk Act* (SARA). Guidance is required on how to address threats in a consistent and standardized manner.

ASSESSING ECOLOGICAL RISKS IN SUPPORT OF SPECIES AT RISK LISTING DECISIONS

The Ecological Risk Criteria is part of the Risk–Based Listing Framework that is developed to facilitate listing decisions for species assessed as at risk by COSEWIC. Guidance is needed on how to apply the Ecological Risk Criteria consistently throughout the Department.

MONITORING ECOLOGICAL IMPACTS OF ACTION PLANS

The department is legally required to assess and report on ecological impacts of Action Plans (SARA s.55) five years after the plan has been approved. The Department is beginning to receive Action Plans for review and these generally lack a proper approach to evaluate ecological impacts. Guidance is required in order for Science to assess ecological impacts of SARA action plan effectively and consistently throughout the Department.

SOMMAIRE

Le présent compte rendu résume les présentations et les discussions pertinentes de la réunion de consultation scientifique nationale qui s'est tenue du 29 au 31 mai 2013 à l'hôtel Lord Elgin, Ottawa (Ontario). Les conclusions et avis découlant de cette réunion seront présentés sous la forme d'un avis scientifique qui sera rendu public sur le site Web du Secrétariat canadien de consultation scientifique (SCCS). Les participants à la réunion comprenaient des spécialistes de différents secteurs et régions de Pêches et Océans Canada ainsi que des participants externes d'Environnement Canada, de Parcs Canada et du Comité sur la situation des espèces en péril au Canada (COSEPAC). Outre plusieurs documents de référence, un document de travail a été distribué avant la réunion. Cette réunion visait à rendre des avis scientifiques sur trois éléments distincts du processus relatif aux espèces en péril qui n'ont jamais fait l'objet d'un tel examen par les pairs.

ÉVALUATION DES MENACES

En ce qui concerne les espèces évaluées comme étant en voie de disparition, disparues du pays ou menacées par le Comité sur la situation des espèces en péril au Canada (COSEPAC), l'évaluation et l'établissement de l'ordre des priorités des menaces qui pèsent sur la survie et le rétablissement des espèces doivent être fournis dans l'évaluation du potentiel de rétablissement (ÉPR). Cette dernière fournit des avis scientifiques au Ministère afin de faciliter l'élaboration des décisions relatives à l'inscription, des programmes de rétablissement et des plans d'action en vertu de la *Loi sur les espèces en péril* (LEP). Des lignes directrices sur la façon de gérer les menaces de façon uniforme et normalisée sont nécessaires.

ÉVALUATION DES RISQUES ÉCOLOGIQUES POUR SOUTENIR LES DÉCISIONS D'INSCRIPTION DES ESPÈCES EN PÉRIL

Les critères de risque écologique font partie du cadre d'inscription fondé sur les risques élaboré pour faciliter la prise des décisions relatives à l'inscription des espèces évaluées comme étant en péril par le COSEPAC. Des lignes directrices sur la façon d'appliquer les critères de risque écologique de manière uniforme dans l'ensemble du Ministère sont nécessaires.

SUIVI DES RÉPERCUSSIONS ÉCOLOGIQUES DES PLANS D'ACTION

Le Ministère est légalement tenu de mener une évaluation et de rendre compte des impacts écologiques des plans d'action (article 55 de la LEP) cinq ans après l'approbation du plan. Le Ministère commence à recevoir des plans d'action à examiner. En général, 'approche utilisée dans ceux-ci pour l'évaluation des répercussions écologiques est inadéquate. Des lignes directrices sont nécessaires afin que le secteur des Sciences évalue les répercussions écologiques des plans d'action de la LEP de façon efficace et uniforme dans l'ensemble du Ministère.

INTRODUCTION

Simon Nadeau (co-chair) and Christie Whelan (co-chair) opened the meeting, welcomed the participants, and provided a general overview of the CSAS peer-review process. The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to provide guidance on three components of the species at risk process: threat assessment, assessing ecological risk criteria in support of species at risk listing decisions, and monitoring ecological impacts of the implementation of Action Plans. Participants and observers introduced themselves via roundtable; meeting participants included DFO Science, DFO Ecosystem and Fisheries Management, and DFO Policy and Economics, as well as external participants from Environment Canada, Parks Canada, and COSEWIC (Appendix 2). The Chairs discussed the role of the participants and observers, and made the distinction that only the participants are invited to contribute knowledge to the process. The meeting ground rules were reviewed and all participants were encouraged to contribute in a constructive manner while searching for consensus. The Chairs reviewed the Agenda (Appendix 3) and Terms of Reference for the meeting, identified the rapporteurs for each section, and confirmed that key meeting materials were made available to the participants two weeks in advance of the meeting for review. The Chairs reviewed the expected timelines for the finalization of the Proceedings and Science Advisory Report.

THREAT ASSESSMENT

PRESENTATION – THREATS: IDENTIFYING, ASSESSING, CATEGORIZING, AND PRIORITIZING

Presenter: Joe Crocker, Fisheries and Oceans Canada (National Capital Region)

Abstract

An overview of the Recovery Potential Assessment (RPA) workshops held in Montreal (March 13-15, 2012) and Winnipeg (June 7-8, 2012) was provided. The purpose of these workshops was to improve the national consistency in RPAs by identifying gaps in the existing guidance and inconsistencies in its applications. In connection to the purpose of this CSAS meeting, the key sections of SARA as they relate to threats and recovery planning were reviewed, and suggestions were presented for best practices for the development of RPAs.

Discussion

A participant requested clarification on the distinction between an *actual* and *current threat*. The participants noted that the term critical habitat should be used with caution in the slide deck presented, as the purpose of an RPA is not to identify critical habitat. This correction will be made so that the sentence refers to habitat that may be important to the species. Following this discussion, concern was raised on the level of information that is currently required in the RPA terms of reference and the subsequent workload for the Science sector. Some of the work is multi-sectoral and relies on the development of management scenarios. This concern will be considered in preparation for the Fall 2013 RPA guidance workshop to summarize and clarify RPA guidance.

PRESENTATION – THREAT ASSESSMENT

Presenters: Nick Mandrak and Lynn Bouvier, Fisheries and Oceans Canada (Central and Arctic Region)

Abstract

The purpose of this presentation was to recommend guidance for assessing threats to the survival and recovery of species at the RPA stage. Existing Departmental guidance, an overview of the approaches currently used by the regions, and available threat assessment tools were reviewed. Recommendations were provided for standardized terminology and two-step standardized approach to threat assessment. Examples from the Central and Arctic Region were provided to exemplify an approach that can be used to address mitigation measures and allowable harm. See Appendix 4 for presentation slides.

Discussion

This portion of the meeting generated discussion throughout the presentation. Emphasis was placed on clarifying terms and concepts and developing the Departmental guidance for threat assessment.

Standardized terminology

The definition of *Jeopardize* was revised as such: *to place a wildlife species or population in a situation where* survival or recovery are *at risk*.

When considering the probability of threats impacting the survival and/or recovery of the species, clarification was made that only survival or recovery of the species needs to be addressed in the Recovery Strategy. The distinction should be clearly stated. Participants agreed to use the most recently proposed Tri-departmental definitions of *survival* and *recovery*.

A participant asked for clarification on the difference between the terms *threat* and *limiting factor*. Mandrak sees the term limiting factor as a biological definition, whereas threat implies human-induced factors. He noted that this needs to be clearer in the guidance. Participants agreed to use a revised version of DFO's (2010) definition of *threat*. The definition was revised to include: *a human activity may exacerbate a natural process.* The definition of *limiting factor* was revised to include "non-anthropogenic".

Participants agreed to use a revised version of DFO's (2010) definition of *harm*. The definition was revised as such: *the adverse result of an activity where a single or multiple events reduce the fitness (survival, reproduction, growth, movement) of individuals.* The presenter clarified that *acceptable harm* refers to the risk management decision, as an acceptable change in the growth rate is used to determine what the allowable harm removal would be. It was clarified that SARA does not define *allowable harm*; the term was adopted by Fisheries and Oceans Canada for permitting purposes. Consensus was reached on the definition of *allowable harm* for the Science Advisory Report. Further, it was noted that the differentiation between *chronic* and *transient harm* was requested by the client in Central and Arctic region to account for activities that may occur once (transient) or may be ongoing (chronic). The definitions of *chronic harm* and *transient harm* were debated, but in the interest of moving forward with the rest of the meeting, participants agreed that the subset terms of harm will not be defined in the Science Advisory Report, but they may be used when requested by the client. It was agreed that the subset definitions of harm would be revisited at future RPA meetings.

The definition of *pathways of effects* will be modified to reflect the existing definition used by the Department. While discussing pathways of effects, it was suggested that the existing national

guidance (see Coker, Ming & Mandrak, 2010) and common lexicon for pathways of effects be incorporated into the RPA guidance. This was noted for the Fall 2013 RPA guidance workshop. A participant asked how cumulative effects are considered in pathways of effects given that they are focused at the activity-level.

The definition of *likelihood*, as defined in the Science Advisory Report, will be considered for incorporation into the Risk Assessment Tool.

Threat assessment

There was lengthy discussion around the merits of each threat assessment tool as outlined in the presentation (IUCN/COSEWIC Threat Calculator, Cambridge Conservation Forum, and the British Columbia Freshwater Fish Threats Assessment Tool). The idea of consistency across all SARA stages was discussed; because the IUCN tool is used in the COSEWIC assessment, a participant highlighted the logic in using elements from the same tool throughout the SARA process. The Conservation Measures Partnership's (2013) report on the Open Standards for the Practice of Conservation was mentioned as a useful document for threat assessment. However, it was clarified that the purpose of the discussion is not to recommend a particular tool, but to recommend what the threats assessment should entail.

When identifying important elements of a threat assessment tool, a participant proposed the idea of 'working backwards' to account for the details that are required throughout the species recovery process. Participants agreed that this approach may help determine how specific the Department needs to be in describing and ranking individual threats in the RPA.

When discussing the challenge of incorporating over-arching threats, a question was posed about whether or not threats that cannot be linked to an activity should be included in the calculator or simply described in the narrative. A participant from Central and Arctic region mentioned that in these cases they would address them in the narrative. Following this, the discussion turned to the challenge of addressing the cumulative effects of multiple threats, from which a participant stated that there is value in reflecting cumulative impact threats in the threat assessment to ensure that it will be considered in the future.

A participant volunteered to revise the threat risk matrix to avoid the transition to a higher risk category when shifting between cells diagonally, horizontally, and vertically (i.e. transitioning from low to high risk by shifting one cell) (Appendix 5). Four matrices were shown: 3x5, 3x4, 3x3, and 4x4. Participants determined that symmetrical axes are needed to avoid the transition. The 4x4 matrix was agreed upon because it discourages users from selecting the middle category by default. The group agreed on threshold values of 10%, 50%, 90% for likelihood and 10%, 30%, 70% for severity. The mean will be used as the boundary risk value; a participant had expressed concern about the risk of subjectivity when using end-range values. The negligible category was deleted.

Two-step standardized approach to threat assessment

A two-step standardized approach to threat assessment was developed at both the population-level and species-level. Options to roll-up the population-level assessment to the species-level were discussed.

The time period for *likelihood* will be defined in the Science Advisory Report to account for projects that are scheduled to occur in the future. The time period of 10 years or 3 generations was agreed upon.

Participants agreed that the category *somewhat likely to occur* would be added to the likelihood table. Changes were made according to the revised threat matrix. Thresholds were added to the table. Request for clarification of the unknown category in the likelihood table; consensus to

include *occurring now or in the future*. It was noted that the Precautionary Approach should be instituted when determining the appropriate category for a species.

Thresholds were added to the table listing the Level of Impact; the scale has been adopted from the British Columbia Freshwater Fish Threat Assessment Tool. The negligible category was deleted. A participant requested that *or* be added between sentences in the categories.

Participants agreed that *scientific evidence* will be deleted from the causal certainty table so that all sources of knowledge will be considered, such as traditional ecological knowledge and local knowledge. The term *productivity* was replaced with *or jeopardy to survival or recovery*.

Historic threat replaced with *historical threat* in the population-level threat occurrence table.

One year was replaced with *over the next 10 years or 3 generations, whichever is shorter* in the population-level threat frequency table. A participant raised concern that the revised timeline may not be applicable for freshwater fish. However, Central and Arctic region currently use this timeline for short-lived species.

Restricted will replace the title of the *negligible* category in the population-level threat extent table so that it is more consistent with the numerical values. The British Columbia Freshwater Fish Threat Assessment Tool ratings will be used (i.e. 10%, 30%, and 70%).

Participants agreed that the definition for population-level threat frequency will be revised to include *10 years or three generations, whichever is shorter* and to delete *impacts*.

Using the highest level of risk to determine the population-level threat risk was identified as the preferred option. It was noted that it should not be assumed that threats are the same for multiple populations when rolled into the species-level threat risk. Population-level differences should be described when applicable.

Proposed options to roll-up the population-level threat occurrence and population-level threat frequency to the species-level were agreed upon.

Participants discussed the proposed options to roll-up the population-level extent to the species-level extent. Mode, median, mean, and proportion of area of occupancy were discussed. It was recognized that using the proportion of area of occupancy may be difficult because of the inconsistency in the availability of this data. A participant suggested using proportion of populations affected by the threat (i.e. if more than 50% of the populations have a high population-level threat extent, then the species-level extent would be considered widespread and anything less would be considered local). However, this is problematic when population abundance data is unavailable. Following this, another participant suggested using the proportion of populations where the threat is either high or very high in the threat matrix to roll-up to the species-level. Participants expressed concern with this suggestion because the species-level assessment should look at the species as a whole, but on the other hand, Ministerial decisions are made at the population-level. It was unclear which option was preferred.

The group agreed to use the two-step standardized approach of both population-level and species-level extent, except when the client requests otherwise.

PRESENTATION – PROBALISTIC DECISION SUPPORT TOOLS FOR SPECIES ASSESSMENT AND RECOVERY PLANNING

Presenter: Patrick Nantel, Parks Canada (National Capital Region)

Abstract

An overview of the main benefits of using the Bayesian Belief Network for species assessment and recovery planning was presented. American Ginseng was provided as an example of how the Bayesian Belief Network can be used to assess the impacts of possible management measures on species.

Discussion

A question was posed about the origin of the probability values used in the table. It was clarified that the probability values are based on expert opinion, data from experiments, and/or model simulations. When a species is data-poor, as most species at risk are, the user may use a surrogate species with a similar life cycle and demographics.

ASSESSING ECOLOGICAL RISK IN SUPPORT OF SPECIES AT RISK LISTING DECISIONS

PRESENTATION – ASSESSING ECOLOGICAL RISK IN SUPPORT OF SARA LISTING

Presenter: Simon Nadeau, Fisheries and Oceans Canada (National Capital Region)

Abstract

An overview of the ecological risk assessment tool was presented. Clarification was given that the purpose of this part of the meeting is not to change the tool, but to provide better guidance on using the tool. A summary was presented of the risk-based listing framework, issues raised by the regions, the risk-based listing framework categories and associated criteria, the key sources of information that should be used to populate the tool, and the proposed advice in support of the guidance. Communicating uncertainty, predicting level of impact and likelihood, and the range of risk values were also reviewed. Emphasis was placed on the importance of carrying sources of uncertainty throughout the process to ensure transparency.

Discussion

Throughout the discussion emphasis was placed on review of the ecological risk categories, while keeping in mind that only minor changes could be made to the wording as the tool was developed by SARA Policy. The proposed advice was discussed and all changes were made with consensus from the group.

Minor wording changes were made to the *Very High* and *High* categories of the Ecosystem and Biodiversity criteria, and the *Medium* category of the Population and Extinction Risk criteria. In the interest of adhering to the Terms of Reference for this meeting, participants agreed that any revisions to the wording of the tool should be done outside of the meeting.

A participant asked if the *Low* impact in the Ecosystem and Biodiversity category is a product of the biology of the species itself or of population size. It was clarified that this category should be

viewed in a natural context; the user should consider the importance of the species to the ecosystem and biodiversity prior to when it was at risk.

A participant mentioned the difficulty in assessing which Habitat and Distribution category edge-of-range species belong to. These species are challenging because their threats are often linked to natural events. Rocky Mountain Sculpin was provided as an example.

Participants were asked to discuss which scenarios are used to populate the ecological risk tool in their region. Each region uses the following scenarios: Do Not List and additional mitigation measures (status quo); List under SARA with full prohibitions; and List under SARA with exemptions and allowable harm.

Participants expressed concern that the tool has not evolved in conjunction with the changes made to the List and Do Not List scenarios. Participants requested future clarification from SARA Policy on the management scenarios of listing recommendations.

It was clarified that the precautionary principle applies to both scenarios, the List and Do Not List; but when assessing a scenario that involves not listing, assume the highest likely level of risk.

The discussion then shifted to the proposed advice. Unless stated otherwise, consensus was reached on the advice as it was suggested.

In the advice: *clarify management measures associated with a given scenario before the RPA process to allow modelling and provide a sound basis for the risk assessment,* the term *management measures* was replaced with *mitigation measures* to avoid confusion. Some participants cautioned that this may be unrealistic because information from the RPA stage is needed to create a mitigation scenario. A participant suggested that we need to accept the assumption that listing the species will improve its current situation.

The group agreed that the tool does not provide space to state assumptions and are concerned that the information may be lost once the data is extracted from the tool. The participants recognized the limitations in addressing this; however the following advice was revised to account for assumptions: *state uncertainty* and assumptions *and carry them out through the end of the listing process*.

The advice: *when risks show much geographical variation, consider partitioning the ecological risk assessment accordingly* was deleted. However, one participant disagreed with this decision because risks may vary significantly by geography. This can be addressed by putting a range of values in the tool.

With regards to roles and responsibilities, due to the variability amongst the regions of who is responsible for filling out the ecological risk assessment tool, the participants agreed that it should be clear how the tool was produced and who was involved at each stage. It was suggested that the template could be modified to include a section to identify the lead, support, and sectors. Emphasis was put on discussing the final table with a multi-sectoral team assembled in each region for a given species. To account for these suggestions, the following additions were made to the roles and responsibilities: *The ecological risk criteria table will be filled in with input from all relevant Sectors, including Science, led by Species at Risk Management. Involvement of individuals should be acknowledged in the tool. If Science's involvement role goes beyond confirming interpretation of existing peer-reviewed information, and additional science advice is needed, a more formal science advisory process shall be followed.*

In addition, a participant suggested that it would be useful to run sample species through the tool as a trial-run to determine if the results are consistent among various users.

It was noted that not all of the necessary information to populate the tool is provided in the RPA, and as such, the RPA should state why certain information was excluded. This will be added to the RPA Terms of Reference.

The following were highlighted as informal suggestions going forward:

- The SARA Policy group will discuss the policy-related concerns of the risk assessment tool with Senior Management. There was agreement that a national workshop to complete listing guidelines would be beneficial, or at the very least, feedback should be gathered from regional working groups to address the problems with the tool that extend beyond the science scope. In addition, participants would like the management scenarios of listing recommendations clarified. The Do Not List scenario is intended to be used as status quo; however mitigation measures are often added to this scenario, which undermines the benefits of listing a species under SARA.
- Regions will provide a sample of an exemplary ecological risk assessment table that is complete and can be circulated to accompany the guidance.

MONITORING ECOLOGICAL IMPACTS OF ACTION PLANS

PRESENTATION – MONITORING ECOLOGICAL IMPACTS OF ACTION PLANS (SARA S.55)

Presenter: Justine Mannion, Fisheries and Oceans Canada (National Capital Region)

Abstract

The Working Paper: *Species at Risk Act*, S.C. 2002, c.29, s.55: Monitoring Ecological Impacts of Action Plans (Appendix 6) was presented. Under SARA s. 55, Fisheries and Oceans Canada has a legal obligation to assess and report on the ecological impacts of Action Plans five years after the Plan has been approved. The scope of ecological impacts and lack of guidance on this section of the Act were given particular focus. Recommendations were provided on how to address this requirement of SARA.

Discussion

The discussion on SARA s. 55 focused on two points: how to define the scope of ecological impacts and the use of data from existing monitoring programs.

The intention behind SARA s. 55 was not to limit monitoring to the target species itself, but to highlight the benefits of SARA, including ecological benefits beyond the target species. However, participants noted that it would be difficult to monitor ecological impacts beyond the target species due to limited funds and resources to establish monitoring programs and lack of baseline data from which to detect change. This concern was countered with the notion that although the resources to undertake extensive monitoring studies may not be available, the Department should use the best available data from existing monitoring programs, peer-review sources, and expert opinion to detect ecological impacts. To this effect, participants suggested that potential ecological impacts and any associated knowledge gaps should be identified in advance, such as at the RPA stage. The Federal Sustainable Development Strategy indicators were provided as an example of an existing dataset. Ecosystem Recovery Plans were also mentioned as a source of data that would extend beyond the target species.

Participants raised the concern that reporting on ecological impacts five years after the Action Plan is insufficient time to detect any changes to the species and/or ecosystem. In response to

this, the suggestion to monitor threats was offered, from which inferences could be made about the impacts of threat abatement on other species and factors in the ecosystem. The difficulty in capturing the direct link between the action and the potential ecological impact was also addressed.

Lack of resources to monitor ecological impacts effectively was identified as a possible challenge in addressing the legal requirement of SARA s. 55. Participants discussed the possibility of using existing data as a proxy for ecosystem-level monitoring in advance of requesting additional funds for new monitoring studies. The use of entanglement rates for species of whale within the same area was provided as an example. Participants agreed that the possibility of using data from existing monitoring studies should be identified in advance of the reporting requirement, so that the need for additional monitoring studies can be selected accordingly.

Consensus was reached that the five-year report should identify all positive ecological impacts that may have resulted from the Action Plan. Any foreseen potential negative impacts should be identified in advance of the five-year report, preferably in the Action Plan. No consensus was reached on the scope of ecological impacts to be reported on, but it was agreed that it has to go beyond target species.

The suggested guidance on addressing SARA s. 55 was discussed, and unless stated otherwise, was agreed upon.

In the guidance, *If actions proposed will negatively impact non-target species, communities, or ecological processes, the Department should identify these potential impacts as well as appropriate monitoring studies in the Implementation Table of the Action Plan*, the words *negatively impact* were changed to *potential negative impact*.

The guidance of *Monitoring activities identified in the action plan will be undertaken and funded in due time for the results to be available for the 5-year action plan report* was deleted and subsequently revised to the following: *existing accessible monitoring data shall be used to the greatest extent possible, and only when necessary should additional resources be requested for new monitoring efforts, so that the best available monitoring data will be considered before additional funding is requested.*

A participant suggested a structured process-based approach to meeting the requirements of SARA s. 55. Consensus was reached that these points will be included in the Science Advisory Report.

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APPENDIX 1: TERMS OF REFERENCE

ASSESSING THREATS, ECOLOGICAL RISK AND ECOLOGICAL IMPACTS

National Peer Review

May 29-31, 2013
Ottawa, ON

Co-Chairpersons: Christie Whelan and Simon Nadeau

Context

The Minister of Fisheries and Oceans is the responsible Minister for aquatic species under the *Species at Risk Act* (SARA). There are three distinct components of the species at risk process that would benefit from a peer review. This review meeting aims at providing science advice on these components.

1. Threats – For species assessed as Extirpated, Endangered or Threatened by COSEWIC (Committee on the Status of Endangered Wildlife in Canada), assessment and prioritization of threats to survival and recovery of the species needs to be provided in the Recovery Potential Assessment (RPA). This provides science advice to the department to aid in the development of Listing Decisions, Recovery Strategies and Actions Plans. Guidance is required on how to characterize and prioritize threats in a consistent and standardized manner.
2. Ecological Risks – The Ecological Risk Criteria is part of the Risk–Based Listing Framework that is developed to facilitate the Listing Decision for species assessed as at risk by COSEWIC. Guidance is needed on how to apply the Ecological Risk Criteria consistently throughout the Department of Fisheries and Oceans (DFO).
3. Ecological Impacts - The department is legally required to assess and report on ecological impacts of Action Plans (SARA s.55) 5 years after the plan has been approved. The department is beginning to receive Action Plans for review and these generally lack a proper approach to evaluate ecological impacts. Guidance is required in order for Science to be prepared to assess ecological impacts of SARA Action Plans effectively and consistently throughout DFO.

Objectives

1. Threats
    - Review existing guidance pertaining to threats within the Recovery Potential Assessment process.
    - Review tools available to assess, categorize and prioritize threats to species survival and recovery, including but not limited to: Natureserve/IUCN Threat calculator and British Columbia Ministry of the Environment threat spreadsheet.
    - Provide best practices for addressing threats to species survival and recovery in RPAs.

2. Ecological Risks
    - Review the revised guidance pertaining to the Ecological Risk Criteria assessment tool and examples where the ecological risk assessment has been used by various regions.

    - Provide guidance on how to apply the Ecological Risk Criteria consistently and effectively throughout DFO.

3. Ecological Impacts
    - Review how DFO has proposed to assess ecological impacts of Action Plans.
    - Provide recommendations on how DFO could pragmatically assess the ecological impacts of Action Plans.

Expected Publications

- Proceedings
- Science Advisory Report

Participation

- DFO Science
- DFO Ecosystem and Fisheries Management
- DFO Policy and Economics
- Environment Canada
- Parks Canada

APPENDIX 2: MEETING PARTICIPANTS

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Name	Affiliation
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Shaw, Jennifer (Rapporteur)	Science (National Capital)
Simpson, Mark	Science (Newfoundland)
Smith, Darlene	CSAS (National Capital)
Spence, Koren	Regional SARA Program (Maritimes)
Stalberg, Heather	Regional SARA Program (Pacific)
Ziai, Chad	Ecosystems and Fisheries Management (National Capital)

External Participants

Name	Affiliation
Dunford, Wendy	Environment Canada
Nantel, Patrick	Parks Canada
Ray, Justina	COSEWIC
Seburn, Carolyn	Environment Canada

Observers from Fisheries and Oceans Canada

Name	Affiliation
Chiu, Scott	SARA Program Management (National Capital)
Keatley, Bronwyn	Habitat Policy (National Capital)
Magnusson, Gisele	SARA Policy (National Capital)
Makkay, Kristina	SARA Policy (National Capital)
Simmons, Wendy	SARA Program Management (National Capital)
Woodward, Laura	SARA Policy (National Capital)

APPENDIX 3: MEETING AGENDA

Assessing Threats, Ecological Risk and Ecological Impacts

National CSAS Meeting

May 29-31, 2013 Ontario Room, Lord Elgin Hotel, Ottawa, ON

Co-Chairs: Simon Nadeau and Christie Whelan

Wednesday, May 29

Time	Topic
9:00	Opening Remarks, Introductions and Overview of Day 1 *(Dr. Simon Nadeau)*
9:15	Introduction - Assessing Threats *(Presentation Joe Crocker, DFO*)
9:30	Threats Assessment *(Presentation Dr. Nick Mandrak, DFO)*
10:30	*Break*
10:45	Discussion – Assessing Threats
11:40	Probabilistic decision support tools for species assessment and recovery planning (Presentation Dr. Patrick Nantel, Parks Canada Agency)
12:00	*Lunch (not provided)*
13:00	Discussion – Assessing Threats
15:00	*Break*
15:15	Discussion – Assessing Threats Formulation of Science Advice - Assessing Threats
17:00	*Adjournment*

Thursday, May 30, 2013

Time	Topic
9:00	Recap of Day 1 and Overview of Day 2 *(Christie Whelan)*
9:15	Formulation of Science Advice - Assessing Threats
10:30	*Break*
10:45	Assessing Ecological Risk *(Presentation Simon Nadeau)*
11:00	Discussion – Assessing Ecological Risk
12:00	*Lunch (not provided)*
13:00	Discussion – Assessing Ecological Risk
15:00	*Break*
15:15	Formulation of Science Advice – Assessing Ecological Risk
17:00	*Adjournment*

Friday, May 31, 2013

Time	Topic
8:30	Recap of Day 2 and Overview of Day 3 *(Simon Nadeau and Christie Whelan)*
8:45	Assessing Ecological Impacts (*Presentation by Justine Mannion, DFO*)
9:00	Discussion – Assessing Ecological Impacts
10:30	*Break*
10:45	Formulation of Science Advice – Assessing Ecological Impacts
12:00	*Adjournment*

APPENDIX 4: PRESENTATION – THREAT ASSESSMENT

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Threat Assessment
Ottawa, ON
29-31 May 2013

Lynn Bouvier[1], Simon Nadeau[2] & Nick Mandrak[1]

[1]Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada, Burlington, Ontario
[2]Fisheries Population Science, Fisheries and Oceans Canada, Ottawa, Ontario

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Outline

- Overview
- Review of existing guidance
- Review of challenges
- Review of tools available to assess threats
- Review of approaches used by regions
- Approach to mitigation measures – C&A example
- Approach to allowable harm – C&A example
- Recommendations

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Terms of Reference

For species assessed as Extirpated, Endangered or Threatened by COSEWIC, assessment and prioritization of threats to survival and recovery of the species needs to be provided in the Recovery Potential Assessment (RPA). This provides science advice to the department to aid in the development of Listing Decisions, Recovery Strategies and Actions Plans. Guidance is required on how to characterize and prioritize threats in a consistent and standardized manner.

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ToR - Objectives

- Review existing guidance pertaining to threats within the Recovery Potential Assessment process.
- Review tools available to assess, categorize, and prioritize threats to species survival and recovery including, but not limited, to: Natureserve/IUCN Threat calculator and BC MOE threat spreadsheet.
- Provide best practices for addressing threats to species survival and recovery in RPAs.

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What is an RPA?

- RPA = Recovery Potential Assessment
- The RPA is a process developed by DFO Science to provide the information and scientific advice required to meet the various requirements of the *Species at Risk Act*
- Describes the current state of knowledge of the biology, ecology, distribution, population trends, habitat requirements, threats, mitigation measures, and alternative activities

Currently based on two documents:

[1] DFO. 2007a. Revised Protocol for Conducting Recovery Potential Assessments. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/039

[2] DFO. 2007b. Documenting habitat use of species at risk and quantifying habitat quality. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/038

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Review of existing guidance

REVISED PROTOCOL FOR CONDUCTING RECOVERY POTENTIAL ASSESSMENTS

Step 9

- Best estimates possible should be provided for **the mortality, depressed productivity, or reduction in habitat quality or quantity** associated with each threat.
- **Uncertainties** in these estimates should also be provided for subsequent steps.
- By considering **threats involving reduced productivity**, and not just threats involving mortality, it should be possible to address non-lethal sources of harm to a species, and the cumulative effects of chronic or recurrent but relatively low-level stresses on populations and their habitats.
- Quantitatively, risk is the product of the **likelihood** of an event and its **consequences** if it does occur.
- Providing risk-based advice from RPAs should allow the information on **imminence** and **severity** to be used in this and subsequent steps in the Protocol.

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Review of existing guidance

REVISED PROTOCOL FOR CONDUCTING RECOVERY POTENTIAL ASSESSMENTS

Step 11

- The same considerations regarding information quality and quantity that were discussed for step 9 also apply to quantifying threats to habitat.
- Important that threats considered include threats that **decrease the quality or quantity of habitat** that could be used by a species, and threats that **reduce or prevent access to suitable habitats**.
- Threats to habitat should be interpreted broadly to include threats that would be expected to indirectly reduce habitat quality or quantity, such as loss of riparian vegetation that would result in changes to temperature regimes and sediment loads in a stream.

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Review of existing guidance

DFO. 2010. Guidelines for Terms and Concepts Used in the Species at Risk Program. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/065

- "Because SARA is specific about threats of serious or irreversible damage to listed species, it is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.
- For clarity and maximum utility, the distinction should be made between general threats (e.g. agriculture) and specific threats (e.g. siltation from tile drains).
- The causal certainty of each threat must be assessed and explicitly stated; threats may be identified based on hypothesis testing (lab or field), observation, expert opinion or speculation."

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Review of existing guidance

DFO. 2010. Guidelines for Terms and Concepts Used in the Species at Risk Program. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/065

- The assessment of threats would be improved if:
  - standardized terminology was used;
  - the assessment included the magnitude and impact of the threat;
  - vague descriptions (e.g. agriculture, urbanization) were replaced with more specific wording (e.g., erosion from farming practices causing siltation and eutrophication).
  - threats of serious or irreversible damage to listed species were identified and distinguished from chronic, background or landscape threats;
  - threats are distinguished between those that can and cannot be addressed through SARA or recovery strategies and actions plans;
  - cumulative threats are addressed; and,
  - threats are linked to the DFO Fish Habitat Management's Standard Operating Procedures (linking habitat-related threats to the Pathways of Effects).

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Why is threat assessment necessary?

- To determine and prioritize the activities or processes that have caused, are causing, or may cause the future destruction, degradation, and/or impairment of a species

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What should the assessment include?

- Probability that a threat would occur
- Probability that it would jeopardize the survival and recovery of the species
- Quantification of harm to individuals and mortality rate by life stage (allowable harm)
- Magnitude of reduction in habitat quantity and quality

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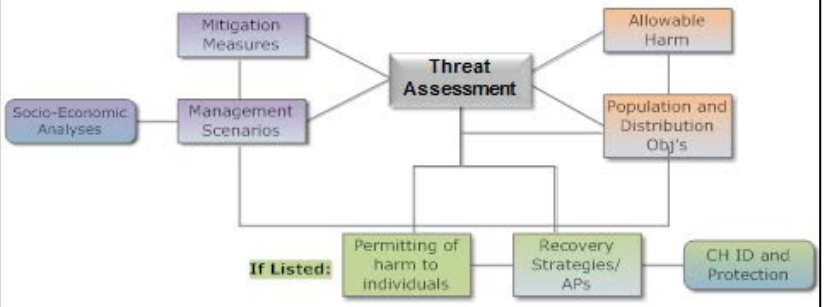
Where are the results used?



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REVIEW OF CHALLENGES

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Review of Challenges

- Consistency with threat classification
- Use of standardized terms
  - Scope, severity/impact, likelihood, timing, uncertainty
- Standardized approach of including uncertainty in assessment
- Individual bias in qualitative threat classification (i.e., use of expert opinion)
- Data rich vs. data poor species – may not be able to apply same method of classification
- Actual/current threats vs. future/predicted threats (level of likelihood?)

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Review of Challenges

- Differentiating threats and limiting factors
- Incorporation of over-arching threats (e.g., climate change – unknown direct effects – how to incorporate?)
- Scale of threat classification (i.e. based on threats? populations? knowledge available?)
  - Across designatable units?
- Qualitative vs. quantitative estimates on the direct effect of threat on species/individuals
- Threats to individuals vs. threats to habitat needs to be distinguished

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Review of Challenges

- Relative contribution of each threat
- Cumulative effect of multiple threats
- Consistency in approach used to provide advice on allowable harm
- Consistency in the inclusion of proposed mitigation
  - What if results/effects of mitigation are unknown?
- Difference between prioritizing threats and prioritizing mitigation measures

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REVIEW OF TOOLS AVAILABLE TO ASSESS THREATS

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Review of Tools

- IUCN/COSEWIC threat calculator
- Cambridge Conservation Forum
- British Columbia Guide to Recovery Planning for Species and Ecosystems
  - Appendix 5 – Guidance for Threat Assessments

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IUCN/COSEWIC Threat Calculator

- Based on Salafsky et al. (2008) and Birdlife International
- Developed standard terms for documenting threats
- Uniform classification allows for comparisons between taxonomic groups
- Includes 11 broad threat categories:

1. Residential & commercial development
2. Agriculture & aquaculture
3. Energy production & mining
4. Transportation & service corridors
5. Biological resource use
6. Human intrusions & disturbance
7. Natural system modifications
8. Invasive & other problematic species & genes
9. Pollution
10. Geological events
11. Climate change & severe weather

- Additional secondary (level 2) threats included

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IUCN/COSEWIC Threat Calculator

- Threat impact is calculated considering only present and future threats
- Threats are characterized in terms of **scope, severity**, and **timing**
  - Threat "**impact**" is calculated from **scope and severity**
- Natural phenomena (fire, hurricane, flooding) included in definition of threat

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IUCN/COSEWIC Threat Calculator

Scope

- proportion of the species or ecosystem that can reasonably be expected to be affected by the threat within 10 years with continuation of current circumstances and trends

IUCN-CMP Scope of Threats Scoring	
Pervasive	Affects all or most (71–100%) of the total population or occurrences
Large	Affects much (31–70%) of the total population or occurrences
Restricted	Affects some (11–30%) of the total population or occurrences
Small	Affects a small (1–10%) proportion of the total population or occurrences

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IUCN/COSEWIC Threat Calculator

Severity

- level of damage to the species or ecosystem from the threat that can reasonably be expected with continuation of current circumstances and trends (including potential new threats)
- assessed within a 10-year or three-generation timeframe, whichever is longer (up to 100 years)

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IUCN/COSEWIC Threat Calculator

IUCN-CMP Severity of Threats Scoring	
Extreme	Within the scope, the Threat is likely to destroy or eliminate the occurrences of an ecological community, system or species, or reduce the species population by 71–100%
Serious	Within the scope, the Threat is likely to seriously degrade/reduce the effected occurrences or habitat or, for species, to reduce the species population by 31–70%
Moderate	Within the scope, the Threat is likely to moderately degrade/reduce the effected occurrences or habitat or, for species, to reduce the species population by 11–30%
Slight	Within the scope, the Threat is likely to only slightly degrade/reduce the effected occurrences or habitat or, for species, to reduce the species population by 1–10%

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IUCN/COSEWIC Threat Calculator

Impact

- degree to which a species or ecosystem is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest

		Scope (%)			
		Pervasive	Large	Restricted	Small
Severity (%)	Extreme	50–100	22–70	8–30	1–10
	Serious	22–70	10–49–	3–21	1–7
	Moderate	8–30	3–21	1–9	0.1–3
	Slight	1–10	0–7	1–3	<1

Very High
High
Medium
Low

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IUCN/COSEWIC Threat Calculator

Timing of Threat

- Timing recorded but not used in calculation of threat impact

IUCN-CMP Timing of Threats Scoring	
High	Continuing
Moderate	Only in the future (could happen in the short term [less than ten years or three generations]), or now suspended (could come back in the short term)
Low	Only in the future (could happen in the long term), or now suspended (could come back in the long term)
Insignificant/ Negligible	Only in the past and unlikely to return, or no direct effect but limiting

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IUCN/COSEWIC Threat Calculator

Uncertainty - Additional categories can be selected to express uncertainty in classification

Proposed IUCN-CMP Individual Threats Scoring Values			
Scope	**Severity**	**Impact**	**Timing**
Pervasive	Extreme	Very High	High
Large	Serious	High	Moderate
Restricted	Moderate	Medium	Low
Small	Slight	Low	Insignificant/ Negligible
Value ranges that can be used to express uncertainty			
Pervasive–Large	Extreme–Serious	Very High–High	High–Moderate
Pervasive–Restricted	Extreme–Moderate	Very High–Medium	High–Low
Large–Restricted	Serious–Moderate	High–Medium	Moderate–Low
Large–Small	Serious–Slight	High–Low	Moderate–Insignificant/ Negligible
Restricted–Small	Moderate–Slight	Medium–Low	Low–Insignificant/Negligible

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IUCN/COSEWIC Threat Calculator

Concerns

- Too coarse for many of our species (i.e., freshwater fishes, freshwater mussels)
- Does not list habitat loss as a threat – difficult to collect and assess data on what is widely recognized as the most important mechanism currently threatened biodiversity (Balmford et al. 2009)
- Threat mechanism and source mutually exclusive, and not logically linked
  - First level threat headings both sources (e.g., agriculture and aquaculture) and mechanisms (e.g., pollution)

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Cambridge Conservation Forum

- Proposes three major classes of threatening mechanisms
  - Habitat destruction
  - Habitat degradation or fragmentation
  - Direct reduction of survival or fecundity (all threats that have their effect other than through changes to habitats)

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Outcome:

- Provides threat categories, but does not provide a means to classify or rank threats
- Authors suggest that threat categories should be used in the next version of the IUCN threat calculator

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- Based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership)
- Differences:
  - Creates distinction between threat sources and mechanisms
  - Focuses on results to be used for planning purposes
  - Collects information on information gaps and possible management actions
  - Considers whether a threat can be mitigated, and includes an 'actions' rating system to help prioritize where mitigation should be focused
  - Results are collated so that threats, actions, and information can be ranked and compared
  - Focused on threat sources relevant to freshwater fishes

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Scope

- Same definition as IUCN
- Difference: Included category to account for negligible, or unknown scope, as well as the option to leave blank if assessor is lacking expertise

Scope Ratings	
Pervasive	Affects all or most (71 – 100%) of the total population.
Large	Affects much (31 – 70%) of the total population.
Restricted	Affects some (11 – 30%) of the total population.
Small	Affects a small (1 – 10%) part of the total population.
Negligible	Affects less than 1% of the total population.
Unknown	The scope is unknown (i.e., no data).
Blank	The user lacks sufficient expertise to rate the threat.

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Severity

- Same definition as IUCN
- Difference: Included category to account for negligible, or unknown severity, as well as the option to leave blank if assessor is lacking expertise

Severity Ratings	
Extreme	Within the scope, the threat is likely to reduce the population by 71 – 100%.
Serious	Within the scope, the threat is likely to reduce the population by 31 – 70%.
Moderate	Within the scope, the threat is likely to reduce the population by 11 – 30%.
Slight	Within the scope, the threat is likely to reduce the population by 1 – 10%.
Negligible	Within the scope, the threat is likely to reduce the population by less than 1%.
Unknown	Within the scope, the severity is unknown (i.e., no data).
Blank	The user lacks sufficient expertise to rate the threat.

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Impact

- Difference: Adjusted to include negligible, unknown and blank

		Severity Ratings						
		Extreme	**Serious**	**Moderate**	**Slight**	**Negligible**	**Unknown**	**Blank**
Scope Ratings	**Pervasive**	Very High	High	Medium	Low	Negligible	Unknown	Blank
	Large	High	High	Medium	Low	Negligible	Unknown	Blank
	Restricted	Medium	Medium	Low	Low	Negligible	Unknown	Blank
	Small	Low	Low	Low	Low	Negligible	Unknown	Blank
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Unknown	Blank
	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Blank
	Blank	Blank	Blank	Blank	Blank	Blank	Blank	Blank

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Timing

- Timing categories different from IUCN
- Timing is recorded but not used in calculation of rating

Residual only (threat is no longer occurring but residual effects continue)
Ongoing but diminishing
Ongoing and stable
Ongoing but increasing
Future only

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- Creation of 'actions' rating
- Potential actions are rated on 0-5 scale
- Action score = Threat Rating x Action Rating

Score	Definition
0	There are no management actions that could cost-effectively address this issue.
1	The threat could be mitigated to a small degree, but at high cost.
2	The threat could be mitigated to a moderate degree at a high cost, or mitigated to a small degree at a moderate cost.
3	The threat could be mitigated to a moderate degree at a moderate cost.
4	The threat could be mitigated to a large degree but at high cost, or mitigated to a moderate degree at a low cost.
5	This threat could be well-mitigated in a cost-effective manner.

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Pros

- Consideration of threats from the perspective of freshwater fishes
- Ability to include unknown rankings, aid in direction of future research

Cons

- Focus on mitigation prioritization - outside of RPA scope
- To date, it has only been used at species, not population, level

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APPROACHES BY REGION
THREAT ASSESSMENT

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Pacific Region – Umatilla Dace (2011)

	Columbia and Kootenay	Kettle	Similkameen	Pend d'Oreille
Hydro dams	Stranding during ramping: loss of margin habitat and fish death. Brilliant Reservoir impoundment effect on riverine habitat. IPP proposal.	Cascade Project: Possible Impacts to upstream speckled dace.	US: Shanker's Bend: high dam option unlikely to proceed but major loss of habitat will occur in Canada if high dam option built.	Expansions: minor changes to flow and slight improvements to TGP.
Invasive species (Predation)	Predation pressure by invasive species (e.g. Pike and Walleye) could increase. New invasive species from US. may in the future enter Canada. Invasives may restrict dace habitat use.	Possibility of new invasive species from US.	Fewer listed AIS than in other systems. Predation by brook trout should decline.	Possibility of new invasive species from US.
Water Use (Seasonal Low Flow)	Not a problem; water withdrawal is a very small proportion of total flow, and flows are regulated. Minor tributaries may be impacted in late summer.	Current habitat is in main channel and flows are considered adequate for Umatilla Dace. Could become an issue if water demand increases and precipitation patterns change.	Serious concern in Aug-Sept. Will get worse as use increases and if precipitation patterns continue to change. Habitat loss of exposed riffles.	Not considered a problem: water withdrawal is perceived to be a small proportion of total flow, and flows are regulated.

No quantitative assessment – descriptive text only

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Central & Arctic Region – Silver Shiner (2012)

Term	Definition
Threat Likelihood	
Known (K)	This threat has been recorded to occur at site X.
Likely (L)	There is a >50% chance of this threat occurring at site X.
Unlikely (U)	There is a <50% chance of this threat occurring at site X.
Unknown (UK)	There are no data or prior knowledge of this threat occurring at site X.
Threat Impact	
High (H)	If threat was to occur, it would jeopardize the survival or recovery of this population.
Medium (M)	If threat was to occur, it would likely jeopardize the survival or recovery of this population.
Low (L)	If threat was to occur, it would be unlikely to jeopardize the survival or recovery of this population.
Unknown (UK)	There are no prior knowledge, literature or data to guide the assessment of the impact if it were to occur

Linkage to guidance:
Threat Likelihood = Likelihood
Threat Impact = Severity

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Central & Arctic Region – Silver Shiner

Certainty associated with Threat Impact
1 – Causal certainty
2 – Correlative certainty
3 – Expert opinion

	Grand River				Thames River				Bronte Creek				Sixteen Mile Creek			
	TLH	TI	C	Ref	TLH	TI	C	Ref	TLH	TI	C	Ref	TLH	TI	C	Ref
Turbidity and sediment loading	K	M	3	1,6,7, 10,11,12	K	M	3	1,6,7, 10,11,12	K	H	3	1,6,7, 10,11,12	K	M	3	1,6,7, 10,11,12
Contaminants and toxic substances	K	H	3	1,2,3, 13,14	K	H	3	1,2,3, 13,14	K	H	3	1,2,3, 13,14	K	H	3	1,2,3, 13,14
Nutrient loading	K	H	3	1,4,5,6	K	H	3	1,4,5,6	K	H	3	1,4,5,6	K	H	3	1,4,5,6
Barriers to movement	K	M	3	15,16, 17	K	M	3	15,16, 17	U	M	3	15,16, 17	U	M	3	15,16, 17
Flow management	K	M	3	18	K	M	3	18	L	M	3	18	K	H	3	18
Exotic species	K	M	3	1,8	L	L	3	1,8	K	M	3	1,8	K	M	3	1,8
Incidental harvest	L	L	1	1,9	L	L	1	1,9	L	L	1	1	L	L	1	1

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Central & Arctic Region – Silver Shiner

Threat Likelihood	Threat Impact: Low (L)	Medium (M)	High (H)	Unknown (UK)
Known (K)	Low	Medium	High	Unknown
Likely (L)	Low	Medium	High	Unknown
Unlikely (U)	Low	Low	Medium	Unknown
Unknown (UK)	Unknown	Unknown	Unknown	Unknown

	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Turbidity and sediment loading	Medium (3)	Medium (3)	High (3)	Medium (3)
Contaminants and toxic substances	High (3)	High (3)	High (3)	High (3)
Nutrient loading	High (3)	High (3)	High (3)	High (3)
Barriers to movement	Medium (3)	Medium (3)	Low (3)	Low (3)
Flow management	Medium (3)	Medium (3)	Medium (3)	High (3)
Exotic species	Medium (3)	Low (3)	Medium (3)	Medium (3)
Incidental harvest	Low (1)	Low (1)	Low (1)	Low (1)

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Québec Region – Atlantic Salmon Anticosti Island Population (2012)

Probability of Threat Occurrence	
Known	This threat has been observed
Likely	There is more than a 50% chance that this threat will occur
Somewhat likely	There is less than a 50% chance that this threat will occur
Unknown	There are no data or information available indicating that this threat could occur
Threat Impact Level	
High	The presence of the threat endangers the survival or recovery of the species
Moderate	The presence of the threat is likely to endanger the survival or recovery of the species
Low	The presence of the threat is not likely to endanger the survival or recovery of the species
Unknown	There are no data or information available indicating that this threat could endanger the survival or recovery of the species.

Linkage to guidance:
Probability d'occurrence (Probability of occurrence) = Likelihood
Niveau d'impact (Threat Level) = Severity

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Québec Region – Atlantic Salmon Anticosti Island Population

Potential Threats	Likelihood	Impact Level
Sport fishing in rivers[1]	Known	Low[2]
Illegal fishing in rivers	Known	Low[3]
Marine mixed stock interception fisheries (targeting salmon)	Known	Low
Commercial fishery bycatch	Known	Unknown
Climate change in rivers	Known	Unknown
Climate change at sea	Known	Unknown[4]
Oil and gas exploration and development	Known	Unknown[5]

Similar approach used for Central & Arctic and Québec zonal meetings:
Channel Darter and Eastern Sand Darter

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Gulf – Atlantic Cod (2012)

THREATS, LIMITING FACTORS AND MITIGATION MEASURES

FISHING

The estimated fishing mortality exerted on southern Gulf cod increased throughout the 1950s, 1960s and early 1970s (Fig. 33). This resulted in the first collapse of the stock in the 1960s and early 1970s and in apparent genetic changes in life history (i.e., early age at maturation). As abundance increased due to exceptional recruitment, fishing mortality then declined, particularly on the younger commercially-available ages. Fishing mortality increased rapidly in the late 1980s and early 1990s, particularly on older ages, and the stock collapsed a second time. Since the stock collapse in the early 1990s, fishing mortality has been relatively low, particularly during the moratoria on directed fishing in 1994-1997, 2003 and since 2009. During the directed

Provided descriptive narrative on threats

NATURAL MORTALITY

The lack of recovery (and continued decline) of southern Gulf cod is primarily due to high natural mortality of older (5+) cod. The mortality patterns experienced by cod, with *M* declining for young (small) cod and increasing for older (larger) cod, are seen throughout the marine fish community in the southern Gulf (Benoît and Swain 2008; Swain et al. 2009a; Benoît and Swain 2011). A comprehensive suite of hypotheses has been examined to determine which factors are most likely to be important causes of the elevated *M* of 5+ cod (Swain et al. 2011a). The factors examined were: unreported catch, emigration, disease, contaminants, poor fish condition, life-history change, parasites, and predation (in particular predation by grey seals). The conclusions, based on the weight of evidence, were as follows.

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Gulf – Striped Bass (2006)

Potential sources of mortality/harm	Source	Relative rank	Cause	Effect	Alternatives or mitigation
Domestic					
Directed Fishing	Illegal (poaching)	High	Targeted captures	Direct mortality	Education, Increased enforcement
Bycatch in Fisheries	Commercial Gaspereau	Moderate	Incidental captures	Direct mortality, Handling related mortality	Season / area closures, Gear modifications, Best management practice in effect
	Commercial Rainbow smelt	High	Incidental captures, Inefficient culling	Direct mortality, Handling related mortality	Season / area closures, Gear modifications

Linkage to guidance:
No linkage to Likelihood
Relative rank ≈ Severity

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Maritimes – Southern Upland Atlantic Salmon

- Provides definitions for threat category, specific threat, level of concern, location/extent, and occurrence and frequency
- Provides categorical definitions for severity and causal certainty

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Southern Upland Atlantic Salmon - Severity

Table A1. Definitions/examples of how severity has been evaluated.

Category	Definition/Examples
Negligible	• Habitat alteration within acceptable guidelines that does not lead to a reduction in habitat quality or quantity. • No change in population productivity.
Low	• Minor or easily recoverable changes to fish habitat (e.g. seasonal or changes <1 year). • Little change in population productivity (< 5% decline in spawner abundance)
Medium	• Moderate impact to fish habitat with medium term for habitat recovery (3-5 years). • Moderate loss of population productivity (5-30% decline in spawner abundance)
High	• Substantial damage to fish habitat such that the habitat will not recover for more than 5 years. • Substantial loss of population productivity (> 30% decline in spawner abundance)
Extreme	• Permanent and spatially significant loss of fish habitat • Severe population decline with the potential for extirpation.

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Southern Upland Atlantic Salmon – Causal Certainty

Table A2. Definitions/examples of how causal certainty has been evaluated.

Causal certainty	Description
Negligible	Hypothesized.
Very Low	< 5%: Unsubstantiated but plausible link between the threat and stresses to salmon populations.
Low	5% - 24%: Plausible link with limited evidence that the threat has stressed salmon populations.
Medium	25% - 75%: There is scientific evidence linking the threat to stresses to salmon populations.
High	76% - 95%: Substantial scientific evidence of a causal link where the impact to populations is understood qualitatively.
Very High	> 95%: Very strong scientific evidence that stresses will occur and the magnitude of the impact to populations can be quantified.

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Threat Category	Specific Threat	Level of Concern	Location or Extent	Occurrence and Frequency	Severity	Causal Certainty	
		for the DU as a whole	of the threat in the DU	of the threat in the DU	of population level impacts	evidence linking the threat to stresses in general	evidence for changes to viability of SU salmon populations
Freshwater Environment							
Water quality and quantity	Acidification	**High**	Very High (78% of assessed populations affected)	H, C and A Continuous and recurrent	Extreme	Very High	Very High
	Extreme temperature events	**Medium**	High to Very High (anecdotal information suggests the majority of rivers are affected)	H, C and A Seasonal	High	High	Medium
	Altered hydrology	**High**	High to Very High	H, C and A Seasonal	High	High	Medium

Linkage to guidance:
Occurrence/Frequency ≈ Likelihood (but more closely related to timing)
Severity = Severity

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Newfoundland Region - South Newfoundland Atlantic Salmon

Potential Sources of Mortality /Harm Permitted and Un-permitted Activities Conservation Unit 5	Source (with examples)	Proportion of Salmon Affected LOW < 5%, MEDIUM 5% to 30%, HIGH > 30%, UNCERTAIN	Cause/ Time Frame Historic (H) Current (C) Potential (P)	Effect on Population (LOW < 5% spawner loss, MEDIUM 5% to 30% spawner loss, HIGH > 30% spawner loss, UNCERTAIN)	Management Alternatives/ Mitigation *(relative to existing actions)*
Directed Salmon Fishing	Aboriginal: South Coast	Not applicable – no directed Aboriginal fisheries in this CU.			
	Recreational: retention and release	Medium (season open from June 1 to Sept. 7). Moderate effort on some rivers.	H C	Medium	Estimated at 12% for DU 4. Reductions in retention fisheries; increase use of catch-and-release; direct effort controls; season modifications; closures; environmental protocols.
	Commercial (domestic)	N/A – all commercial fisheries closed	H		
	Aboriginal: Labrador	Low	H C P	Low	
	CUMULATIVE EFFECT	Low – Medium	C	Low - Medium	New 5-year Integrated Fisheries Management Plan with major elements including river classification and adaptive management strategy.

Included: Qualitative classification of cumulative effect

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Newfoundland Region - South Newfoundland Atlantic Salmon

Atlantic salmon Conservation Unit	Salmon Affected : Spawners Lost												
	Regulated Habitat Alterations										Other		
	Municipal waste water	Industrial effluents	Hydroelectric & dams	Water extraction	Urbanization (hydrology)	Transportation Infrastructure	Aquaculture siting	Agriculture forestry mining	Dredging	**Cumulative**	Shipping transport	Air pollutants/acid rain	Ecosystem change
5. SE Coast	L:L	L:L	L:L	L:L	L:L	M:M	L:L	M:M	L:L	**U:U**	U:U	MU:MU	LU:LU
6. South Coast	L:L	- :L	M:M	L:L	L:L	L:L	M:M	L:L	L:L	**U:U**	- : -	MU:MU	LU:LU

Where 'salmon affected' symbol 'L' is < 5% of salmon affected; 'M' is 5-30% are affected, and 'U' is uncertain; 'salmon lost' symbol 'L' is < 5% of salmon spawners are lost; 'M' is 5-30% are lost, and 'U' is uncertain; N/A = Not Applicable and "-" = Not Assessed.

Linkage to guidance:
No linkage to Likelihood
L, M, U ranking = Severity

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Summary

- Varying level of detail across regions
- Similar, but different terms used to describe severity, likelihood, certainty and scope
- Linkage between survival and recovery of species and threat is missing
- Certainty associated with classification not necessarily represented

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APPROACH TO MITIGATION MEASURES - C&A EXAMPLE

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Mitigation Guide – Pathways of Effects

- Threats to freshwater fishes are often related to destruction and degradation of habitat
- DFO-Fish Habitat Management (FHM) manages habitat threats through a series of Pathways of Effects (PoE)
- Attempt to break the links of those pathways to minimize the threat or mitigate the effects on habitat
- Species at Risk threats match up to threats identified by FHM for freshwater fishes

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Mitigation Guide for the Protection of Fishes and Fish Habitat to Accompany the Species at Risk Recovery Potential Assessments Conducted by Fisheries and Oceans Canada (DFO) in Central and Arctic Region

Version 1.0

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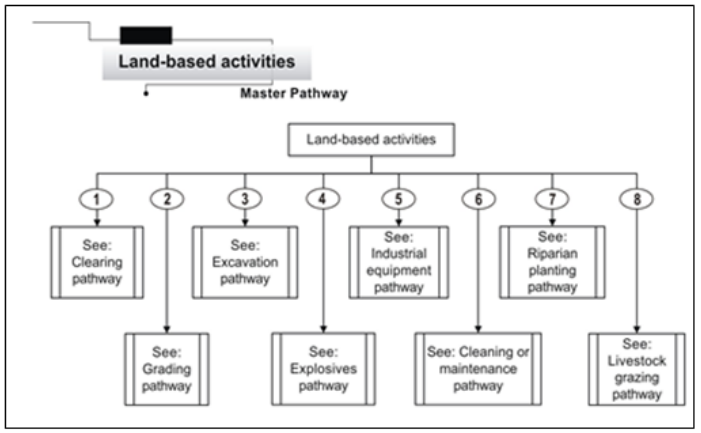
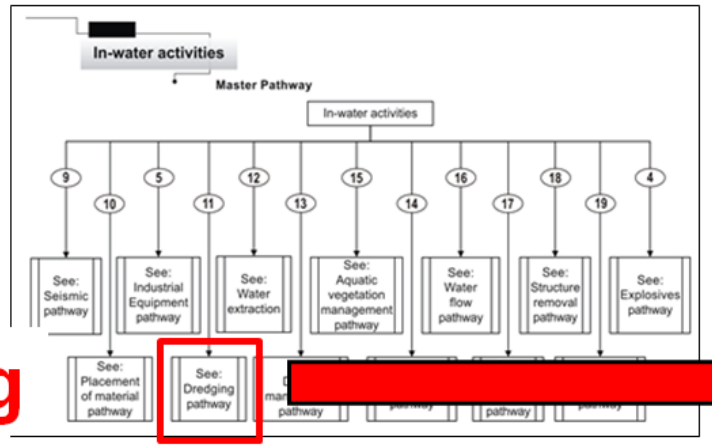
2010

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2904





For example: Dredging

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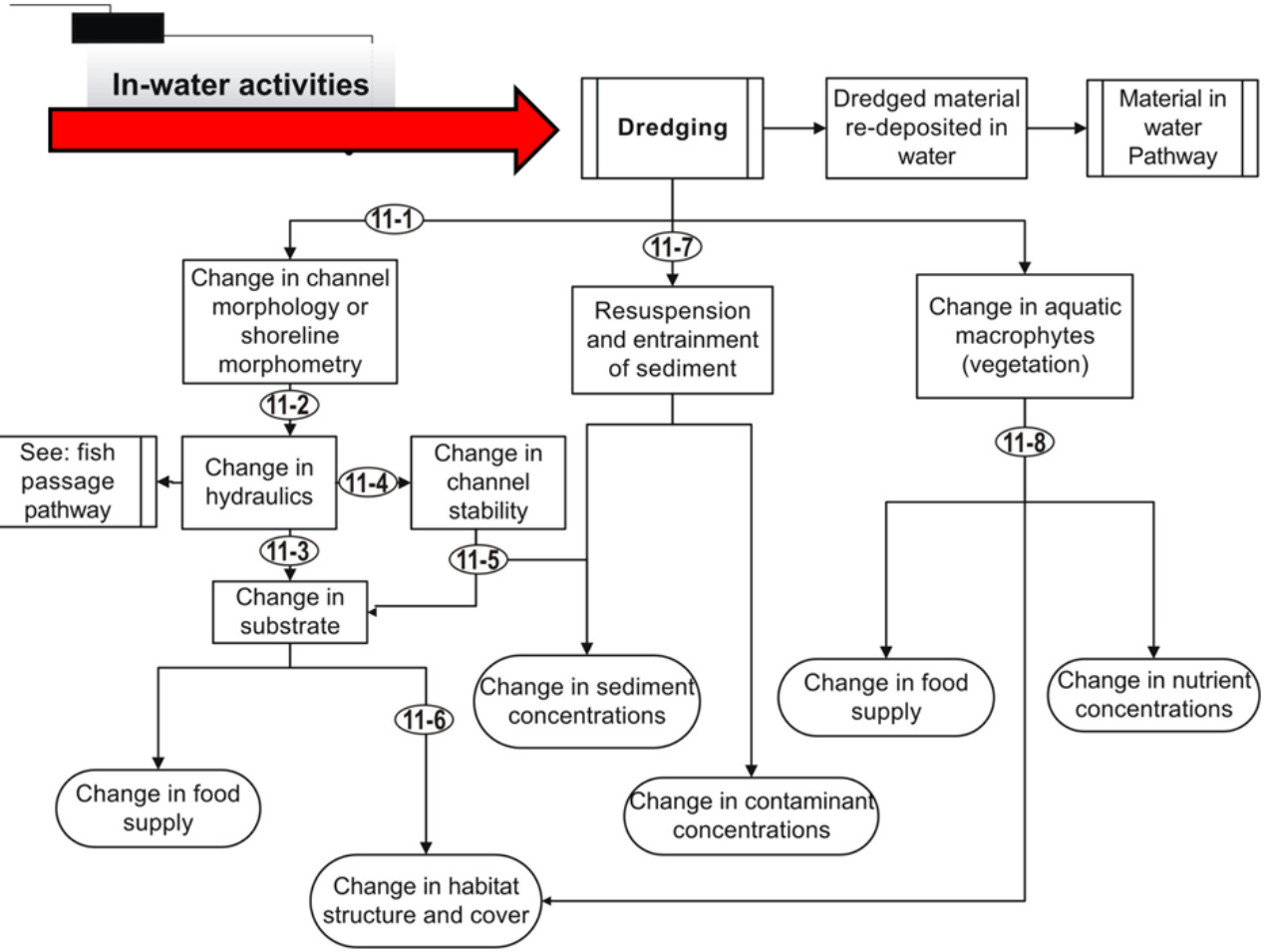

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Link	Mitigation
11-1	Rehabilitation of stream morphology and substrate to pre-disturbance condition or better.
	Stabilize/reinforce stream banks using tree and shrub plantings, root wads, boulders, vortex weirs, etc.
11-2	Adjust channel morphology to maintain appropriate hydraulics (e.g., addition of riffles to slow upstream velocities; modification of width and/or depth to adjust velocities).
11-3	Rehabilitation of stream morphology and substrate to pre-disturbance condition or better.
11-4	Stabilize/reinforce stream banks using tree and shrub plantings, root wads, boulders, vortex weirs, etc.
11-5	Rehabilitation of stream morphology and substrate to pre-disturbance condition or better.
11-6	Add/establish appropriate instream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Match structure/substrate type with previous or adjacent types where possible. This may entail the salvage and reinstatement of existing instream structure such as large wood debris, boulders, or instream aquatic vegetation.
11-7	Design and implement isolation/containment plan to isolate temporary in-water work zones to maintain clean flow downstream/around the work zone at all times. The design should: • use only clean materials free of suspendable matter for temporary coffer dams. • situate or otherwise manage flow withdrawal and discharge (e.g., see dewatering discharge) so as to prevent erosion and sediment release to the waterbody. • ensure the work zone is stabilized to the extent practical against the impacts of high flow events during the work period. • remove fish from isolated in-water work zones if necessary.
11-8	Add/establish appropriate instream structure and cover for habitat, in such a way as to not destabilize the channel through negative impacts to hydraulics. Match structure/substrate type with previous or adjacent types where possible. This may entail the salvage and reinstatement of existing instream structure such as large wood debris, boulders, or instream aquatic vegetation.

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Work/Project/Activity	Threats (associated with work/project/activity)						Watercourse / Waterbody (number of works/projects/activities between 2009-2011)			
	dity and ment ng	aminants lc tances	ent ng	Barriers to movement	Exotic species	Incidental harvest	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Applicable pathw effects for threat mitigation and project alternatives	10, 11, 12, 13, 15, 16, 18	,13 ,14, 15, 16 ,18	12, 13, 14, 15, 16	10, 16, 17						
Water crossings (e.g., bridges, culverts, open cut crossings)	✓	✓		✓			23	14	9	4
Shoreline, streambank work (e.g., stabilization, infilling, retaining walls, riparian vegetation management)		✓					7	3	1	1
Dams, barriers (e.g., maintenance, flow modification, hydro retrofits)	✓			✓	✓		2	2		
Instream works (e.g., channel maintenance, restoration, modifications, realignments, dredging, aquatic vegetation removal)	✓	✓	✓				3	3	7	1

Work/Projects/Activities known to occur

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Work/Project/Activity	Threats (associated with work/project/activity)						Watercourse / Waterbody (number of works/projects/activities between 2009-2011)			
	Turbidity and sediment loading	Contaminants & toxic substances	Nutrient loading	Barriers to movement	Exotic species	Incidental harvest	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Applicable pathways of effects for threat mitigation and project alternatives	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12,	1, 4, 5 ,6 ,7 ,11 ,12 ,13 ,14,	1, 4, 7, 8, 11, 12, 13,	10, 16,						
Water crossings (e.g., bridges, culverts, open cut crossings)								14	9	4
Shoreline, streambank work (e.g., stabilization, infilling, retaining walls, riparian vegetation management)	✓	✓					7	3	1	1
Dams, barriers (e.g., maintenance, flow modification, hydro retrofits)	✓						2	2		
Instream works (e.g., channel maintenance, restoration, modifications, realignments, dredging, aquatic vegetation removal)	✓	✓	✓				3	3	7	1

The number of times
The work/project/activity has occurred

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Work/Project/Activity	Threats (associated with work/project/activity)						Watercourse / Waterbody (number of works/projects/activities between 2009-2011)			
	Turbidity and sediment loading	Contaminants & toxic substances	Nutrient loading	Ba... to ... ent	Ex... species	In... ha...	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Applicable pathways of effects for threat mitigation and project alternatives	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18	1, 4, 5 ,6 ,7 ,11 ,12 ,13 ,14,	1, 4, 8, 11 12, 13	10, 16,						
Water crossings (e.g., bridges, culverts, open cut crossings)	✓	✓		✓			23	14	9	4
Shoreline, streambank work (e.g., stabilization, infilling, retaining walls, riparian vegetation management)	✓	✓					7	3	1	1
Dams, barriers (e.g., maintenance, flow modification, hydro retrofits)	✓			✓	✓		2	2		
Instream works (e.g., channel maintenance, restoration, modifications, realignments, dredging, aquatic vegetation removal)	✓	✓	✓				3	3	7	1

At a specific location

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Over a specified time frame

Work/Project/Activity	(asso						Watercourse / Waterbody (number of works/projects/activities between 2009-2011)			
	Turbidity and sediment loading	Contaminants & toxic substances	Nutrient loading	Barriers to movement	Exotic speci	Incidental harvest	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Applicable pathways of effects for threat mitigation and project alternatives	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18	1, 4, 5 ,6 ,7 ,11 ,12 ,13 ,14, 15, 16 ,18	1, 4, 7, 8, 11, 12, 13, 14, 15, 16	10, 16, 17						
Water crossings (e.g., bridges, culverts, open cut crossings)	✓	✓		✓			23	14	9	4
Shoreline, streambank work (e.g., stabilization, infilling, retaining walls, riparian vegetation management)	✓	✓					7	3	1	1
Dams, barriers (e.g., maintenance, flow modification, hydro retrofits)	✓			✓	✓		2	2		
Instream works (e.g., channel maintenance, restoration, modifications, realignments, dredging, aquatic vegetation removal)	✓	✓	✓				3	3	7	1

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Threats associated with Works/Projects/Activities

	Threats (associated with work/project/activity)						Watercourse / Waterbody (number of works/projects/activities between 2009-2011)			
	Turbidity and sediment loading	Contaminants & toxic substances	Nutrient loading	Barriers to movement	Exotic species	Incidental harvest	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Applicable pathways of effects for threat mitigation and project alternatives	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18	1, 4, 5 ,6 ,7 ,11 ,12 ,13 ,14, 15, 16 ,18	1, 4, 7, 8, 11, 12, 13, 14, 15, 16	10, 16, 17						
Water crossings (e.g., bridges, culverts, open cut crossings)	✓	✓		✓			23	14	9	4
Shoreline, streambank work (e.g., stabilization, infilling, retaining walls, riparian vegetation management)	✓	✓					7	3	1	1
Dams, barriers (e.g., maintenance, flow modification, hydro retrofits)	✓			✓	✓		2	2		
Instream works (e.g., channel maintenance, restoration, modifications, realignments, dredging, aquatic vegetation removal)	✓	✓	✓				3	3	7	1

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Pathways of Effects from Mitigation Guide

Work/Project/Activity	Threats (associated with work/project/activity)						Watercourse / Waterbody (number of works/projects/activities between 2009-2011)			
	Turbidity and sediment loading	Contaminants & toxic substances	Nutrient loading	Barriers to movement	Exotic species	Incidental harvest	Grand River	Thames River	Bronte Creek	Sixteen Mile Creek
Applic[illegible]e pathways of effects for [illegible] and pr[illegible]	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18	1, 4, 5 ,6 ,7 ,11 ,12 ,13 ,14, 15, 16 ,18	1, 4, 7, 8, 11, 12, 13, 14, 15, 16	10, 16, 17						
Water crossings (e.g., bridges, culverts, open cut crossings)	✓	✓		✓			23	14	9	4
Shoreline, streambank work (e.g., stabilization, infilling, retaining walls, riparian vegetation management)	✓	✓					7	3	1	1
Dams, barriers (e.g., maintenance, flow modification, hydro retrofits)	✓			✓	✓		2	2		
Instream works (e.g., channel maintenance, restoration, modifications, realignments, dredging, aquatic vegetation removal)	✓	✓	✓				3	3	7	1

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Challenges

- Mitigation guide for marine activities does not currently exist
  - PoE published for finfish and shellfish aquaculture[1]
  - PoE model developed for Capelin [2]
- Current freshwater guide may not include activities of concern in other regions
- Only accounts for habitat-related threats
  - Required to provide mitigation measures and alternatives for non-habitat related threats

[1] DFO. 2010. Pathways of Effects for Finfish and Shellfish Aquaculture. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/071

[2] Gilguère, N., Perreault, L., Nellis, P., Savenkoff, C., Bilodeau, F, Glangloppi, M., Tremblay, G.H., Dufour, R., Comtois, S. and Grégoire, F. 2011. Pathways of Effects (PoE) model development for capelin conservation as part of a risk analysis process. Can. Tech. Rep. Fish. Aquat. Sci.. 2934: vii+71 pp

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APPROACH TO ALLOWABLE HARM - C&A EXAMPLE

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Definitions

- Harm (as defined in DFO 2010): The adverse result of an activity where a single or multiple events reduce the likelihood of survival or recovery of the species/population by impacting the fitness (survival, reproduction, growth, movement) of individuals.
- Harm (as defined in most recent C&A RPA): actions that jeopardize the survival or recovery of the species
- Allowable harm: harm to the population that will not jeopardize population recovery or survival

DFO. 2010. Guidelines for Terms and Concepts Used in the Species at Risk Program. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/065

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Definitions

- Chronic harm: a negative alteration to a vital rate that reduces a population growth rate permanently or over the long term
- Allowable chronic harm: harm which does not cause the long-term population growth rate to decline

Examples:

- Survival of adult Species X should be reduced no more than 15%
- Fecundity of species X should be reduced no more than 4%

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Allowable Chronic Harm

Difficulties

- Provides advice at the population level
- Can be applied to long-term alterations
  - e.g., permanent loss of habitat
- Clients were having difficulties applying results of Chronic Harm analysis to a one-time event (i.e., permitting harm)
- Lead to creation of Transient Allowable Harm analysis

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Definitions

- Transient harm: a one-time removal of individuals that reduces the mean population growth rate temporarily over a specific time frame
- Allowable transient harm: removal of individuals that does not exceed a pre-determined reduction in population growth rate over a specific time-frame

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Simulation Method

- Create 4 matrices with random parameters
- Reduce survival in one matrix by X% to simulate a one-time removal of X% of abundance
- Compare the mean growth rate before and after the removal
- Repeat several thousand times to get a distribution of changes for various removal rates

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Example: Pugnose Minnow

- Difficult to quantify because of high level of uncertainty
- Data-poor species
- Limited information available on life history parameters and vital rates

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Example: Pugnose Minnow

- Determine which life stages are most sensitive to perturbations
  - YOY survival and fecundity
  - Adult survival much less sensitive
- Since population trajectories are unknown, sensitivities simulated for three populations
  - Declining population, stable population, growing population

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Example: Pugnose Minnow

- Given the generation time of 1.2 years, a time-frame of 4 years (~3 generations) was considered for transient harm
- Able to determine the decline in average population growth rate over 4 years, as a function of the percent of individuals removed from the population in one of 4 years

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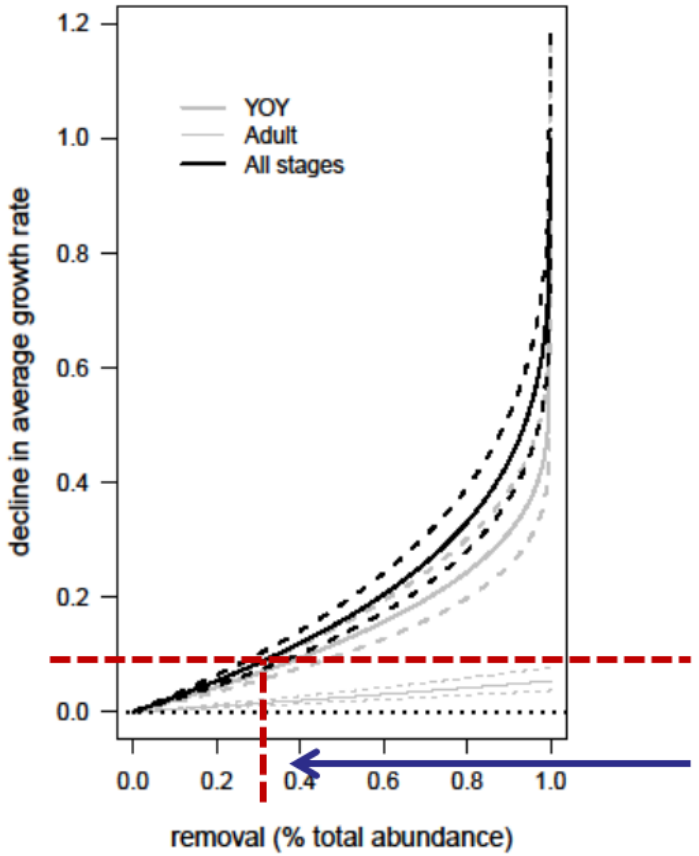
Determining allowable harm



Allowable removal =
Allowable Removal *Rate*
x Population Abundance

Acceptable change in growth rate

Acceptable removal (% total abundance) per X years timeframe

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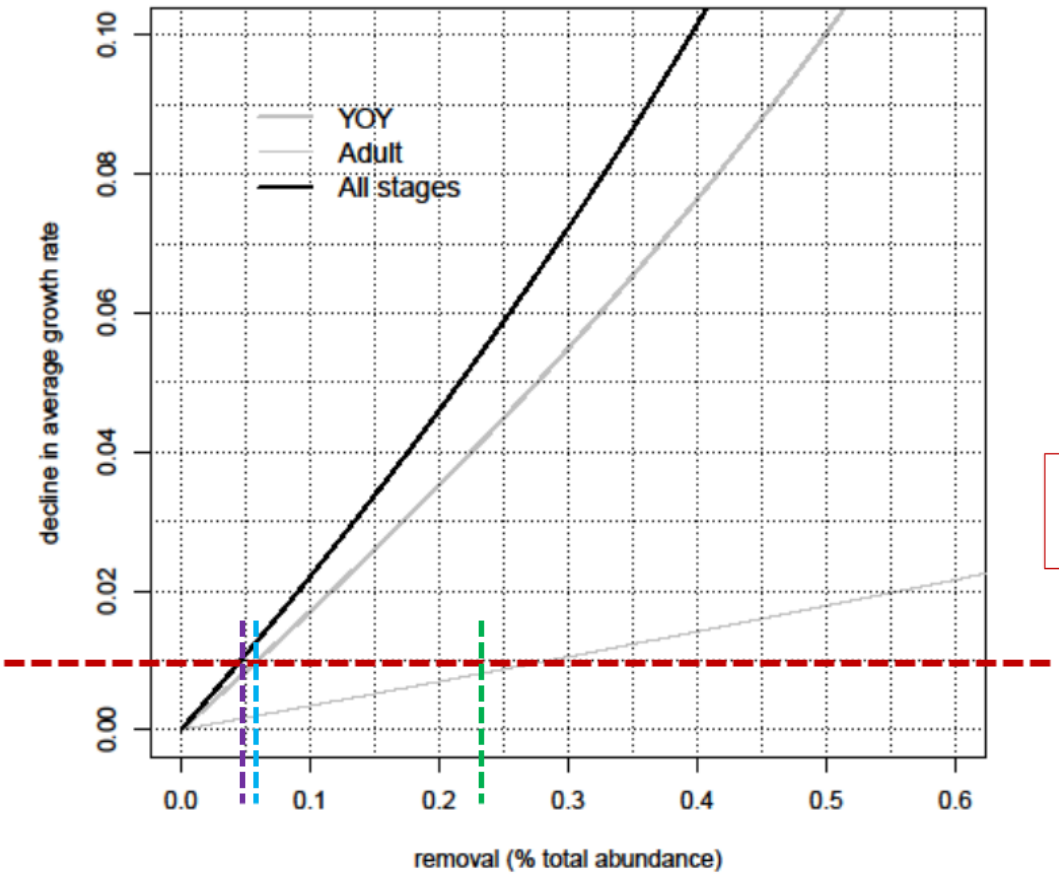

% removal resulting in 1% decline in mean population growth rate over 4 years:

- YOY – 5.5%
- Adult – 28.5%
- All – 4.5%

Allowable removal = Allowable Removal *Rate* x Population Abundance

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Challenges

- Need to know population abundance (i.e., cannot allow the removal of 100 fish if you do not know 100 fish are present)
- Managers need to decide what is considered "acceptable" change in the average growth rate over the fixed timeframe (especially for stable or declining populations)

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Science advice on allowable harm

NB: Each element of allowable harm advice is independent and assumes no additional sources of harm. If there is harm from multiple sources, allowable harm should be reduced.

Allowable Chronic Harm

- When population trajectory is declining, there is no scope for allowable chronic harm (at the population level).
- When population trajectory is stable and exceeds the recovery target (MVP) then chronic harm may be considered that does not result in a decline of the population growth rate.
- When population trajectory is unknown, the scope for allowable chronic harm can only be assessed once population data are collected.
- Scientific research to advance the knowledge of population data should be allowed.

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Science advice on allowable harm

NB: Each element of allowable harm advice is independent and assumes no additional sources of harm. If there is harm from multiple sources, allowable harm should be reduced.

Allowable Transient Harm

- When population trajectory is declining or unknown, even low levels of transient harm may compromise recovery or shorten the time to extirpation.
- When population trajectory is increasing, there is scope for allowable transient harm.
- When population abundance is unknown, the scope for allowable transient harm can only be assessed once population data are collected.

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RECOMMENDATIONS

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Standardized terminology

- Use of common terminology will:
  - Facilitate completion of zonal or national RPAs
  - Allow for comparisons between species
  - Facilitate the creation of multi-species recovery strategies
  - Ease the creation of links between recovery efforts and species

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Standardized terminology

General

- Jeopardize: To place a species or population in a situation where it is at risk.
- Survival: The state of continuing to exist (i.e., the persistence of a species or population).
- Recovery: The process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed and threats are removed or reduced to improve the likelihood of the species' persistence in the wild (as defined in the RS guidance).
- Impact: An alteration to a vital rate.

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Standardized terminology

Threats

- Threat: Human activity that negatively impacts a species or population, either directly or indirectly (e.g., through habitat). A human activity (e.g., tile drainage) may exacerbate a natural process (e.g., siltation).
- Limiting factor: Factor that, within a range of normal variation, limits the growth or development of an organism or a population (e.g., age at first reproduction, fecundity, age at senescence, prey abundance, mortality rate).
- Underlying causes: A set of economic, social, cultural, political or institutional factors that favour the appearance or persistence of anthropogenic threats.

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Standardized terminology

Harm

- Harm (as defined in most recent C&A RPA): actions that jeopardize the survival or recovery of the species
- Allowable harm: harm to the population that will not jeopardize population recovery or survival
- Chronic harm: a negative alteration to a vital rate that reduces a population growth rate permanently or over the long term
- Allowable chronic harm: harm that does not cause the long-term population growth rate to decline

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Standardized terminology

Harm (con't)

- Transient harm: a one-time removal of individuals that reduces the mean population growth rate temporarily over a specific time frame
- Allowable transient harm: removal of individuals that does not exceed a pre-determined reduction in population growth rate over a specific time-frame

Mitigation

- Pathway of effects (PoE): Description of the mechanisms through which potential environmental effects of a threat may cause a stress on a species

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A two-step standardized approach

Step 1 – Evaluate threats at the population level

- Likelihood (L)
- Severity (S)
- Causal certainty (CC)
- Population threat risk (PTR; product of likelihood and severity)
- Population-level threat occurrence (PO)
- Population-level threat frequency (PF)
- Population-level threat extent (PE)

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A two-step standardized approach

Step 2 – Evaluate threats at the species level

- Species threat risk (STR) – Roll-up of PTR
- Species-level threat occurrence (SO)
- Species-level threat frequency (SF)
- Species-level threat extent (SE) – Roll-up of PE

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Standardized approach – Likelihood (L)

Likelihood: The probability of the threat occurring for a given population.

Likelihood	Definition	Symbol
Known to occur	This threat has been recorded to occur at site X	K
Likely to occur	There is >50% chance that this threat is occurring at site X.	L
Unlikely to occur	There is <50% chance that this threat is occurring at site X.	UN
Unknown	There are no data or prior knowledge of this threat occurring.	U

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Standardized approach – Severity (S)

Severity: Level of impact caused by a given threat, and the level to which it affects the survival or recovery of the population.

Severity	Definition	Symbol
Extreme	Severe population decline with the potential for extirpation.	E
High	Substantial loss of population productivity. Threat would jeopardize the survival or recovery of the population.	H
Medium	Moderate loss of population productivity. Threat is likely to jeopardize the survival or recovery of the population.	M
Low	Little change in population productivity. Threat is unlikely to jeopardize the survival or recovery of the population.	L
Negligible	No change to population productivity.	N
Unknown	No prior knowledge, literature or data to guide the assessment of threat severity on population.	U

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Standardized approach – Causal certainty (CC)

Causal certainty: The strength of evidence linking the threat to the survival and recovery of the population.

Casual certainty	Definition	Rank
Very high	Very strong scientific evidence that threat is occurring and the magnitude of the impact to the populations can be quantified.	1
High	Substantial scientific evidence of a causal link between threat and declines in population productivity.	2
Medium	There is some scientific evidence linking the threat to declines in population productivity.	3
Low	There is a theoretical link with limited evidence that threat is leading to a decline in population productivity.	4
Very low	There is a plausible link that the threat is leading to a decline in population productivity.	5

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Standardized approach – Threat Risk Matrix

		Threat Severity					
		Negligible	Low	Medium	High	Extreme	Unknown
Threat Likelihood	Known	Very Low	Low	Medium	High	Very High	Unknown
	Likely	Very Low	Low	Medium	High	Very High	Unknown
	Unlikely	Very Low	Very Low	Low	Medium	High	Unknown
	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

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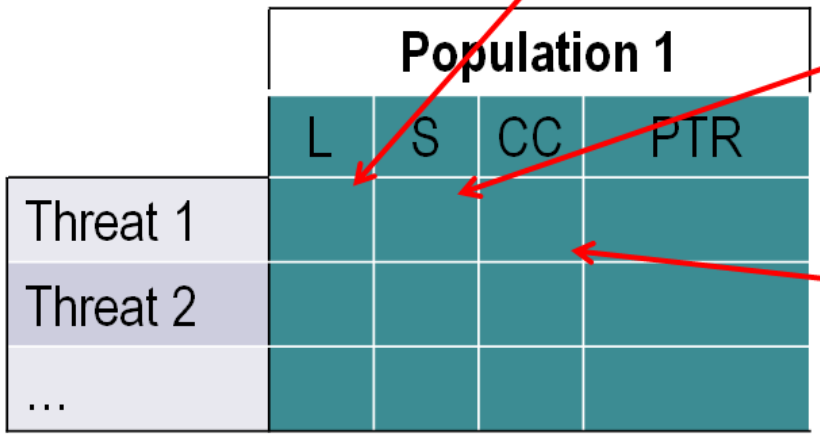
Likelihood	Definition	Symbol
Known to occur	This threat has been recorded to occur at site X	K
Likely to occur	There is >50% chance that this threat is occurring at site X.	L
Unlikely to occur	There is <50% chance that this threat is occurring at site X.	UN
Unknown	There are no data or prior knowledge of this threat occurring.	U

Example

Severity	Definition	Symbol
Extreme	Severe population decline with the potential for extirpation.	E
High	Substantial loss of population productivity. Threat would jeopardize the survival or recovery of the population.	H
Medium	Moderate loss of population productivity. Threat is likely to jeopardize the survival or recovery of the population.	M
Low	Little change in population productivity. Threat is unlikely to jeopardize the survival or recovery of the population.	L
Negligible	No change to population productivity.	N
Unknown	No prior knowledge, literature or data to guide the assessment of threat severity on population.	U



Casual certainty	Definition	Rank
Very high	Very strong scientific evidence that threat is occurring and the magnitude of the impact to the populations can be quantified.	1
High	Substantial scientific evidence of a causal link between threat and declines in population productivity.	2
Medium	There is some scientific evidence linking the threat to declines in population productivity.	3
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Very low	There is a plausible link that the threat is leading to a decline in population productivity.	5

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		Threat Severity					
		Negligible	Low	Medium	High	Extreme	Unknown
Threat Likelihood	Known	Very Low	Low	Medium	High	Very High	Unknown
	Likely	Very Low	Low	Medium	High	Very High	Unknown
	Unlikely	Very Low	Very Low	Low	Medium	High	Unknown
	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

To incorporate Causal Certainty – place level of certainty in brackets after classification

	Population 1			
	L	S	CC	PTR
Threat 1	L	H	4	High (4)
Threat 2	K	L	1	Low (1)
…				

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Standardized approach – Population-level occurrence (PO)

Population-level threat occurrence: Provides context on timing of the occurrence of the threat. Describes whether a threat is historic, current or anticipatory for a given population.

Population level occurrence	Definition	Symbol
Historic	A threat that is known to have occurred in the past and negatively impacted the population.	H
Current	A threat that is ongoing, and is currently negatively impacting the population.	C
Anticipatory	A treat that is anticipated to occur in the future, and will negatively impact the population.	A

Proposed generic guidance on mitigation based on occurrence.
Historic – Ensure that the threat does **not** re-occur.
Current – Remove/reduce current threat, and minimizing effects of threat.
Anticipatory – Minimize the potential effects of the threat that is to occur.

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Standardized approach – Population-level frequency (PF)

Population-level threat frequency: Temporal extent of the impacts of the threat over a given year.

Note: Should be classified in terms of the impacts of the threat not the threat itself

Population level frequency	Definition	Symbol
Single	The impacts of the threat occur once yearly.	S
Recurrent	The impacts of the threat occur periodically, or repeatedly.	R
Continuous	The impacts of the threat occur without interruption.	C

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Standardized approach – Population-level extent (PE)

Population-level threat extent: **Proportion** of the population affected by the threat.

Population Extent	Definition	Symbol
Extensive	>95% of the population is affected by the threat.	E
Broad	>50% of the population is affected by the threat.	B
Narrow	<50% of the population is affected by the threat.	NA
Negligible	<5% of the population is affected by the threat.	NE

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Step 1 – Population Level – Input table

	Population 1							Population 2						
	L	S	CC	PTR	PO	PF	PE	L	S	CC	PTR	PO	PF	PE
Threat 1														
Threat 2														
…														

NB: PTR = Likelihood*Severity (Causal Certainty)

Memory jogger:
L – Likelihood
S – Severity
CC – Causal certainty
PTR – Population-level threat risk
PO – Population-level threat occurrence
PF – Population-level threat frequency
PE – Population-level threat extent

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Step 1 – Population Level – Final table

	Population 1				Population 2			
	PTR	PO	PF	PE	PTR	PO	PF	PE
Threat 1								
Threat 2								
…								

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A two-step standardized approach

Step 1 - Population level

- Likelihood (L)
- Severity (S)
- Causal certainty (CC)
- Population-level threat risk (PTR)
- Population-level occurrence (PO)
- Population-level frequency (PF)
- Population-level extent (PE)

Step 2 - Species level

- Species-level threat risk (STR)
- Species-level occurrence (SO)
- Species-level frequency (SF)
- Species-level extent (PE)

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Population-level threat risk (PTR)

Threat Likelihood	Threat Severity: Negligible	Low	Medium	High	Extreme	Unknown
Known	Very Low	Low	Medium	High	Very High	Unknown
Likely	Very Low	Low	Medium	High	Very High	Unknown
Unlikely	Very Low	Very Low	Low	Medium	High	Unknown
Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

How to roll up?

Species-level threat risk (STR)

Options:

- Mode (value that appears most often)
- Median (mid value)
- Mean
- Highest level (Precautionary Approach)

How to incorporate causal certainty? Lowest level of certainty carried forward?

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Population-level occurrence (PO)

Population level occurrence	Definition	Symbol
Historic	A threat that is known to have occurred in the past and negatively impacted the population.	H
Current	A threat that is ongoing, and is currently negatively impacting the population.	C
Anticipatory	A treat that is anticipated to occur in the future, and will negatively impact the population.	A

Species-level occurrence (SO)

Only option:

- Include all categories that have been identified in population-level assessment (e.g., threat could be classified as 'H, C, A', or any combination thereof)

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Population-level frequency (PF)

Population level frequency	Definition	Symbol
Single	The impacts of the threat occur once yearly.	S
Recurrent	The impacts of the threat occur periodically, or repeatedly.	R
Continuous	The impacts of the threat occur without interruption.	C

Species-level frequency (SF)

Only option:

- Include all categories that have been identified in population-level assessment (e.g., threat could be classified as 'S, R, C', or any combination thereof)

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Population-level extent (PE)

Population Extent	Definition	Symbol
Extensive	>95% of the population is affected by the threat.	E
Broad	>50% of the population is affected by the threat.	B
Narrow	<50% of the population is affected by the threat.	NA
Negligible	<5% of the population is affected by the threat.	NE

How to roll up?

Species-level extent (SE)

Should provide context to the extent of the threat to the species by considering the proportion of the populations or the proportion of the overall population affected by the threat.

Options:

- Mode (value that appears most often)
- Median (mid value)
- Mean
- Proportion of area of occupancy
- Other?

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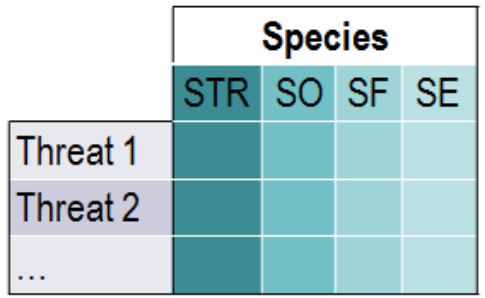
Step 2 – Species Level – Final table



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Summary

- Provided review of existing guidance
- Reviewed threat assessment tools available
- Reviewed approaches by regions
- Reviewed approach that can be used to standardize advice on mitigation measures
- Reviewed approach that can be used to standardize advice on allowable harm
- Provided standardized terms and an approach to threat assessment

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Questions? Comments?

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APPENDIX 5: FIGURE – THREAT RISK MATRIX

Likelihood of Occurrence	Level of Impact: low	med	high	extreme
known	Very Low	Low	Medium	High
likely	Very Low	Low	Medium	High
unlikely	Very Low	Very Low	Low	Medium
remote	Very Low	Very Low	Low	Medium

Risk categories based on consideration of:

1. Boundary thresholds
2. Mean values of categories
3. Consistency, i.e. a horizontal or vertical move within the matrix only shift risk by a single category
4. Betweeness, i.e. diagonal moves within the matrix only shift risk by a single category

Resulting risk thresholds are 5% and 30%.

APPENDIX 6: WORKING PAPER – MONITORING ECOLOGICAL IMPACTS OF ACTION PLANS

Species at Risk Act, S.C. 2002, c. 29, s. 55, Monitoring Ecological Impacts of Action Plans

CSAS Meeting: Assessing Threats, Ecological Risks, and Ecological Impacts

Introduction

This discussion paper has been prepared for the CSAS meeting: Assessing Threats, Ecological Risks, and Ecological Impacts. The purpose of this paper is to provide the background information to aid in the discussion on assessing the ecological impacts of action plans. This will support the development of a national guidance document to ensure that SARA s. 55 of the *Species at Risk Act* is addressed consistently and effectively throughout the Department.

Monitoring Ecological Impacts of Action Plans (SARA s. 55)

> ***Species at Risk Act* (S.C. 2002, c. 29, s.55)**
>
> (55) The competent minister must monitor the implementation of an action plan and the progress towards meeting its objectives and assess and report on its implementation and its ecological and socio-economic impacts five years after the plan comes into effect. A copy of the report must be included in the public registry.

The article as it appeared initially in Bill C-5 submitted by the Government, and tabled on November 1, 2001 at the first session of the 37th Parliament read:

> "55. The competent minister must monitor the implementation of an action plan and assess and report on its implementation and its socio-economic impact five years after the plan comes into effect. A copy of the report must be included in the public registry."

An amendment was proposed by Bernard Bigras of the Bloc Québécois to include in this report an evaluation of environmental impacts ("*On souhaiterait inclure dans ce rapport l'évaluation des répercussions environnementales*"…). The Amendment was sub-amended to change the word "environmental" to "ecological" before the amendment was carried. The rationale was that the word "ecological" related more specifically to nature, to balance monitoring of socio-economic impacts that relate to humans. The amended article was renumbered as 55 and was proclaimed in 2003 with all other SARA articles.

As such, under SARA s. 55, Fisheries and Oceans Canada has a legal obligation to assess and report on the ecological impacts of an action plan five years after the plan is approved. This section of the Act has not yet been addressed, as the first 5-year report will not be required until 2017.[1]

Ecological impacts may be defined as "any and all changes in the structure and function of ecosystems" (United States Environmental Protection Agency, 1994). Further, Treweek (1999) defines ecological impact assessment as "the process of identifying, quantifying, and evaluating the potential impacts of defined actions on ecosystems or their components". The evaluation of ecological impacts may be limited to species, their immediate habitats, or general natural resource categories (United States Environmental Protection Agency, 1994), or may be broader to capture more aspects of the ecosystem(s) as well as threats to the species.

[1] Fisheries and Oceans Canada finalized the first Action Plan in 2012 for Northern Abalone.

The Tri-departmental Template for Action Plans contains a section that is intended to be useful in meeting the 5-year reporting requirements of SARA s. 55[2]. This section, entitled Measuring Progress, instructs the user to insert the following sentence in preparation for addressing s. 55 of the Act:

> "Reporting on the ecological and socio-economic impacts of the action plan (under s. 55 of SARA) will be done by assessing the results of monitoring the recovery of the species and its long term viability, and by assessing the implementation of the action plan".

However, due to the generalized nature of the above sentence, and that the notion of ecological impacts goes beyond the targeted species, clearer guidance is needed to develop a specific and effective way to plan for the monitoring of ecological impacts, as part of the action planning process. As a way to connect requirements of the species at risk process, it may be useful to address aspects of SARA s. 55 through the Strategic Environmental Assessment (SEA) of the Recovery Strategy. The SEA looks at the impacts of recovery actions on other species and the environment, and could be used to consider potential ecological impacts in advance of the 5-year reporting requirements of SARA s. 55.

Other species at risk legislation was consulted in an effort to find similar monitoring and reporting requirements to be used as guidance in the discussion[3]. Most of the legislation requires 5-year reporting on species recovery progress, and often includes a section on the indirect benefits to other species that may result from the proposed recovery objectives. This is similar to the section in the SARA Recovery Strategy template, "Effects on the Environment and Other Species"[4]. However, none of the legislation included a requirement to monitor the ecological impacts of recovery actions, nor did the associated recovery plans and/or action plans, with the exception of one in New Brunswick. The New Brunswick Maritime Ringlet joint Recovery Strategy/Action Plan lists the potential ecological impacts of the recovery actions; these ecological impacts focus on other rare species and other species found within the ecosystem. This section is however not required under the New Brunswick *Endangered Species Act*. The table from the Maritime Ringlet joint Recovery Strategy/Action Plan can be found in Table 1.

Next Steps

Although little information is available to support the discussion on SARA s. 55, it is anticipated that through discussion with meeting participants, proposed methods to identify and monitor ecological impacts will be brought forth, which will aid in developing guidance and determining a national approach.

[2] Tri-departmental Template for Action Plans, part of the Species at Risk Action Plan Series, is available on the Species at Risk Program Guidance Materials and Templates intranet site

[3] Legislation included: Alberta's *Wildlife Act* (Alta Reg 143/1997); Saskatchewan's *Wildlife Act (*SS 1998, c W-13.12); Manitoba's *Endangered Species Act* (CCSM c E111); Manitoba's *Wildlife Act (*CCSM c W130); Ontario's *Endangered Species Act (*SO 2007, c 6); Quebec's *Act Respecting Threatened or Vulnerable Species* (RSQ, c E-12.01); New Brunswick's *Endangered Species Act* (NB Reg 96-26); Prince Edward Island's *Wildlife Conservation Act* (RSPEI 1988, c W-4.1); Nova Scotia's *Endangered Species Act* (SNS 1998, c 11); Newfoundland and Labrador's *Endangered Species Act* (SNL 2001, c E-10.1); Yukon's *Wildlife Act* (RSY 2002, c 229); Northwest Territories' *Species at Risk Act* (SNWT 2009, c 16); Nunavut's *Wildlife Act* (SNu 2003, c 26); United States' *Endangered Species Act* (16 U.S.C. 1531-1544, 87 Stat. 884)*;* European Union's *Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (*92/43/EEC); United Kingdom's *Wildlife and Countryside Act* (1981 c.69); Australia's *Environment Protection and Biodiversity Conservation Act* (Act No. 91 of 1999)*;* New South Wales' *Threatened Species Conservation Act* (1995 No.101).

[4] Tri-departmental Template for Recovery Strategy, part of the Species at Risk Recovery Strategy Series, is available on the Species at Risk Program Guidance Materials and Templates intranet site

Possible Process Elements:

1. Monitoring of ecological impacts shall be scoped out at both the Recovery Potential Assessment (RPA) and recovery planning stages through:
    a. Identification and prediction of potential ecological impacts – should this include both positive and negative impacts?
    b. Identification of an appropriate scope and scale of monitoring efforts
    c. Identification of existing environmental monitoring efforts within the area occupied by the species
    d. Identification of proposed new monitoring efforts as part of this and other recovery strategies/action plans for all species at risk within the area occupied by the species
    e. Evaluation of the potential of these data to respond to SARA s. 55 requirement
    f. Evaluation of the potential strength of the relationship between specific recovery action undertaken and a given ecological impact
    g. Selection of a subset of potential indicators

    Elements to consider while scoping monitoring of ecological impacts:

    - Species interactions (e.g. predator-prey, host-parasite, mutualistic relationships, competitors, exotic species, etc.)
    - Species at risk co-occurring and impacted by similar threats
    - Species at risk co-occurring but having divergent ecological requirements
    - The diversity and magnitude of threats impacting biodiversity in the area occupied by the target species.
    - Proportion of a watershed/ecosystem “affected” by actions undertaken
2. If actions proposed will negatively impact non-target species, communities, or ecological processes, the Department should identify these potential impacts as well as appropriate monitoring studies in the Implementation Table of the action plan.
3. Monitoring activities identified in the action plan will be undertaken and funded in due time for the results to be available for the 5-year action plan report.
4. Access to and analysis of existing monitoring data for selected indicators will take place in due time for the results to be available for the 5-year action plan report.
5. Ecological impacts of action plan implementation will be reported in the 5-year report by reporting on actions undertaken that were intended to have an impact on the environment (e.g. threat abatement), documenting the ecological impacts through selected indicators (threat abatement, abundance of different species at risk, water chemistry parameters, etc.) and describing the strength of the relationship between the result, if any, and the action/group of actions undertaken. Please note that it will be difficult to capture the direct link between the action and the potential ecological impact. Many individuals and groups contribute to recovery of species at risk in Canada, and as a result, it may not always be evident how Fisheries and Oceans Canada has been instrumental to the outcome.

Works Cited

New Brunswick Maritime Ringlet Recovery Team. (2005). Recovery Strategy and Action Plan for the Maritime Ringlet (*Coenonympha nipisiquit*) in New Brunswick. New Brunswick Department of Natural Resources. Fredericton, New Brunswick.

Treweek, Jo. (1999). Ecological Assessment. Oxford: Blackwell Science.

United States Environmental Protection Agency (EPA), Office of Federal Activities. (1994). Evaluation of Ecological Impacts from Highway Development. (Report no. EPA 300-B-94-006). Washington, DC.

Table 1: Recovery Strategy and Action Plan for the Maritime Ringlet: Costs and benefits of proposed recovery actions for Maritime ringlets in New Brunswick. (New Brunswick Maritime Ringlet Recovery Team, 2005).

Activity	**Potential Gain**	**Direct Cost**	**Potential Socioeconomic Impact**	**Potential Ecological Impact**
1.0 Monitoring & Assessment				
1.1 Comprehensive survey of potential habitat	Detection of previously unknown sites	Moderate; once	Potential negative impact on landowner activities at new sites	-
1.2 Monitoring of abundance at existing sites	Essential data: measure of success of recovery strategy	Moderate; annual	-	-
1.3 Investigate mosquito control program protocols	Clarification of existence of potential threat	Low; once	-	May benefit other rare invertebrates
1.4 Assess risks of mosquito control to Maritime ringlets	Identification of impact and extent of threat	Low; once	-	May benefit other rare invertebrates
1.5 Assess presence of pesticides and wetting agents at ringlet sites	Clarification of existence of potential threat	Moderate; once	-	May benefit other rare invertebrates
1.6 Assess impact of pesticides and wetting agents to Maritime ringlets	Identification of impact and extent of threat	Low – moderate; once	Potential cost to improve waste treatment practices if threat exists	May benefit other rare invertebrates
2.0 Stewardship and Education				
2.1 Landowner awareness	Stewardship potential	High; several years	-	-

Activity	Potential Gain	Direct Cost	Potential Socioeconomic Impact	Potential Ecological Impact
2.2 Conservation opportunities	Stewardship potential	Moderate; several years	-	May benefit other salt marsh species
2.3 Education: land use & Maritime ringlets	Habitat protection; threat mitigation	Moderate; several years	-	May benefit other salt marsh species
2.4 Partnerships & long-term stewardship programs	Habitat protection; threat mitigation	Moderate; several years	-	May benefit other salt marsh species
2.5 Education: general Species at Risk issues	Public support for recovery and stewardship initiatives	Low; ongoing	-	May benefit other species at risk
3.0 Protection				
3.1 Enforcement policies	Habitat protection; threat mitigation	Low; several years	-	May benefit other species at risk
3.2 Staff training within regulatory agencies	Habitat protection; threat mitigation	Moderate; several years	-	May benefit other species at risk
3.3 Measures to raise awareness of existing laws and regulations	Reduction in conflicts between land use and regulations	Moderate; several years	-	May benefit other species at risk
4.0 Research				
4.1 Population viability analysis	Assessment of probability of long-term success of recovery strategy	High; several years	-	-
4.2 Assessment of ecological and socioeconomic impacts of introductions	Assistance in determining future recovery goals	High; long-term	-	May provide insights of value to other recovery strategies