



GUIDANCE ON ASSESSING THREATS, ECOLOGICAL RISK AND ECOLOGICAL IMPACTS FOR SPECIES AT RISK



Figure 1: Map of the six administrative Regions of Fisheries and Oceans Canada (DFO).

Context

The Minister of Fisheries and Oceans is responsible for aquatic species under the Species at Risk Act (SARA). This Science Advisory Report aims at providing science advice on three distinct components of the current species at risk process.

- (1) **Threat Assessment** – For species assessed as Extirpated, Endangered or Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), assessment and prioritization of threats to survival and recovery of the species are provided in the Recovery Potential Assessment (RPA). The RPA provides science advice to the department to aid in the development of Listing Recommendations, Recovery Strategies and Action Plans. Guidance is required on how to characterize and prioritize threats in a nationally consistent and standardized manner for all species.
- (2) **Assessing Ecological Risk in support of Species at Risk Listing Recommendations** – The Ecological Risk Criteria are part of the Risk-Based Listing Framework that is developed to facilitate Listing Recommendations for species assessed as at risk by COSEWIC. Guidance is needed on how to apply the Ecological Risk Criteria consistently throughout the department.
- (3) **Monitoring Ecological Impacts of Action Plans for Species at Risk** - 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. Guidance is required in order for DFO to be prepared to assess ecological impacts of SARA Action Plans effectively and consistently throughout the department.

This Science Advisory Report summarizes the results of the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat (CSAS) national science advisory meeting of May 29-31, 2013 to develop guidance related to assessing threats, ecological risk and ecological impacts for Species at Risk. Additional publications from this process will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

SUMMARY

Threat Assessment

- For species assessed as Extirpated, Endangered or Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the assessment and prioritization of threats to survival and/or recovery of the species needs to be provided in the Recovery Potential Assessment (RPA).
- A threat is defined as any human activity or process that has caused, is causing, or may cause harm, death, or behavioural changes to a wildlife species at risk, or the destruction, degradation, and/or impairment of its habitat, to the extent that population-level effects occur. A human activity may exacerbate a natural process. A two-step process to characterize and prioritize threats to the survival and recovery of a species is proposed.
- Step 1 – Evaluate threats at the population level. This includes evaluating: Likelihood of Occurrence, Level of Impact, Causal Certainty, Population Threat Risk (the product of Likelihood of Occurrence and Level of Impact), Population-Level Threat Occurrence, Population-Level Threat Frequency and Population-Level Threat Extent.
- Step 2 – Evaluate threats at the wildlife species¹ level. This includes evaluating: Species Threat Risk (a roll-up of Population Threat Risk), Species-Level Threat Occurrence, Species-Level Threat Frequency and Species-Level Threat Extent (a roll-up of Population-Level Threat Extent).

Assessing Ecological Risk in Support of Species at Risk Listing Recommendations

- The purpose of the Risk-Based Assessment Tool is to establish a standard, coherent and transparent approach to developing listing recommendations throughout the department for species assessed by COSEWIC as Endangered, Threatened or Special Concern.
- Science is involved in providing advice to populate the four Ecological Risk Categories: Population and Extinction Risk, Habitat and Distribution, Ecosystem and Biodiversity and Threats
- The “Likelihood of Occurrence” and “Level of Impact” must be assessed in order to evaluate the risk using the risk matrix. The level of impact is measured in terms of negative consequences to the species.
- The “Likelihood of Occurrence” is the probability that an event will occur. The Likelihood of an event occurring can range anywhere from Not Likely to Certain. The timeframe used for assessment of likelihood must be stated.
- Uncertainty and underlying assumptions must be stated and carried through the end of the listing process
- Practitioners should consult the following sources of information when using the tool: COSEWIC Status Report, RPA, Science Advisory Reports and related Proceedings and peer-reviewed information about the species.

¹ Also referred to as a designatable unit by COSEWIC.

Monitoring Ecological Impacts of Action Plans

- Under the SARA (s.55), Fisheries and Oceans Canada (DFO) has a legal obligation to assess and report on the ecological impacts of an Action Plan five years after the plan is approved.
- Information necessary to plan for the monitoring of ecological impacts shall be provided where possible in the RPA through:
 - Identification and prediction of potential ecological impacts of a threat and/or threat abatement (e.g. mitigation measures);
 - Identification of knowledge gaps of potential ecological impacts;
 - Identification of existing monitoring efforts for both the target species and its ecosystem; and
 - Evaluation of the potential of these data to respond to the SARA (s.55) requirement.
- Planning for the monitoring of ecological impacts shall take place at the recovery planning stages through :
 - Identification and prediction of potential ecological impacts of a recovery action;
 - Prioritization of recovery measures based on how likely they are to help achieve recovery objectives
 - For each priority recovery measure, understanding the pathways of effects
 - Identification of elements most vulnerable to ecological impacts
 - Screening out activities of low ecological impact
 - For activities of higher ecological impact, identification of those with existing monitoring data (data should be robust enough to infer trends). Specify how this information will be accessed and reported on
 - Identification of knowledge gaps associated with potential ecological impacts;
 - If necessary, identification of new monitoring efforts to address knowledge gaps; and
 - Evaluation of the potential strength of the relationship between the specific recovery action undertaken and a given ecological impact (this may be qualitative or quantitative).
- Planning for the monitoring of ecological impacts during the RPA and recovery planning stages shall not require data analysis or modeling. Data analysis will occur during the implementation of the Action Plan. Existing monitoring data shall be used to the greatest extent possible when available, and only when necessary should additional monitoring efforts be proposed.

BACKGROUND – 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 RPA. 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* (SARA). The RPA process relies on best available scientific information, data analyses and modeling and expert opinions. The assessment and prioritization of threats provides science advice to aid in the

development of Listing Recommendations, Recovery Strategies and Actions Plans. The purpose of this section of the Science Advisory Report is to provide guidance on how to characterize and prioritize threats to species survival and recovery in a consistent and standardized manner nationally. Dealing with scientific uncertainty is integral to this process and according to the SARA, providing science advice in support of species survival or recovery measures should not be postponed for a lack of full scientific certainty.

ANALYSIS – THREAT ASSESSMENT

Standardized Terminology for Threat Assessment

An assessment of threats should include the use of common terminology to:

- link recovery efforts to anthropogenic factors affecting species;
- facilitate completion of zonal or national RPAs;
- facilitate the creation of multi-species recovery strategies; and
- allow for comparisons between species;

Definitions

Jeopardize: to place a wildlife species or population in a situation where its survival or recovery is at risk

Recovery: a return to a state in which the population and distribution characteristics and the risk of extinction are all within the normal range of variability for the wildlife species

Survival: the achievement of a stable or increasing state where a wildlife species exists in the wild in Canada and is not facing imminent extirpation or extinction as a result of human activity

Threat: any human activity or process that has caused, is causing, or may cause harm, death, or behavioural changes to a wildlife species at risk, or the destruction, degradation, and/or impairment of its habitat, to the extent that population-level effects occur. A human activity may exacerbate a natural process

Limiting factor: a non-anthropogenic factor that, within a range of natural variation, limits the abundance and distribution of a wildlife species or a population (e.g., age at first reproduction, fecundity, age at senescence, prey abundance, mortality rate)

Harm: The adverse result of an activity where a single or multiple events reduce the fitness (e.g. survival, reproduction, growth, movement) of individuals

Stress: a wildlife species at risk is stressed when a key ecological or demographic attribute of a population, or behavioural attributes of individuals, are impaired or reduced resulting in a reduction of the species viability (Salafsky et al. 2003)

Allowable harm: harm to the wildlife species that will not jeopardize its recovery or survival

Pathway of effects: description of the mechanisms through which potential environmental effects of a threat may cause a stress on a wildlife species

A Two-step Standardized Approach to Threat Assessment

Many different tools have been developed to assess, categorize and prioritize threats (e.g. International Union for Conservation of Nature threat calculator, BC Freshwater Fish Threats Assessment Tool). These tools contain different lists of threats, and although no preference is highlighted here, threat assessors must make sure that each threat meets the accepted definition of threat above. Other factors (e.g. climate change) or limiting factors can be treated in the narrative, but should not be classified by the following approach.

The following approach outlines a step-by-step process to characterize and prioritize threats to the survival and/or recovery of a species. The two-step approach first characterizes threats at the population level and then at the wildlife species level. Since threats vary across a species range and populations, assessing threats at the population level informs management of activities at a local scale. Assessing threats at a wildlife species level aids in determining a national perspective and enables a better allocation of resources.

General Overview

Step 1 – Evaluate threats at the population level. This includes evaluating:

- Likelihood of Occurrence;
- Level of Impact;
- Causal Certainty;
- Population Threat Risk (product of Likelihood of Occurrence and Level of Impact);
- Population-Level Threat Occurrence;
- Population-Level Threat Frequency; and
- Population-Level Threat Extent.

Step 2 – Evaluate threats at the species level. This includes evaluating:

- Species Threat Risk (Roll-up of Population Threat Risk);
- Species-Level Threat Occurrence;
- Species-Level Threat Frequency; and
- Species-Level Threat Extent (Roll-up of Population-Level Threat Extent).

Step 1 - Evaluating Threats at the Population Level

Evaluate threats at the population level. This includes evaluating Likelihood of Occurrence (Table 1), Level of Impact (Table 2) and Causal Certainty (Table 3) of the threat.

Table 1: Categories of Likelihood of Occurrence. Likelihood of Occurrence refers here to the probability of a specific threat occurring for a given population over 10 years or 3 generations, whichever is shorter.

Likelihood of Occurrence	Definition
Known or very likely to occur	This threat has been recorded to occur 91-100%
Likely to occur	There is 51-90% chance that this threat is or will be occurring.
Unlikely	There is 11-50% chance that this threat is or will be occurring
Remote	There is 1-10% or less chance that this threat is or will be occurring.
Unknown	There are no data or prior knowledge of this threat occurring now or in the future.

Table 2: Categories of Level of Impact linked to a threat. Level of Impact refers to the magnitude of the impact caused by a given threat, and the level to which it affects the survival or recovery of the population.

Level of Impact	Definition
Extreme	Severe population decline (e.g. 71-100%) with the potential for extirpation.
High	Substantial loss of population (31-70%) or Threat would jeopardize the survival or recovery of the population.
Medium	Moderate loss of population (11-30%) or Threat is likely to jeopardize the survival or recovery of the population.
Low	Little change in population (1-10%) or Threat is unlikely to jeopardize the survival or recovery of the population.
Unknown	No prior knowledge, literature or data to guide the assessment of threat severity on population.

Table 3: Categories of Causal Certainty linked to a threat. Causal Certainty reflects the strength of evidence linking the threat to the survival and recovery of the population. Evidence can be scientific, traditional ecological knowledge or local knowledge.

Causal Certainty	Definition	Rank
Very high	Very strong evidence that threat is occurring and the magnitude of the impact to the population can be quantified.	1
High	Substantial evidence of a causal link between threat and population decline or jeopardy to survival or recovery	2
Medium	There is some evidence linking the threat to population decline or jeopardy to survival or recovery	3
Low	There is a theoretical link with limited evidence that threat is leading to a population decline or jeopardy to survival or recovery	4
Very low	There is a plausible link with no evidence that the threat is leading to a population decline or jeopardy to survival or recovery	5

Threat Risk Matrix

Determine population threat risks using rankings for Level of Impact and Likelihood of Occurrence and plotting them in the Threat Risk Matrix below (Figure 2). Incorporate Causal Certainty by placing level of certainty in brackets after the classification. This gives the Population-Level Threat Risk (Table 4).

		Level of Impact				Unknown
		Low	Medium	High	Extreme	
Likelihood of Occurrence	Known	Low	Medium	High	High	Unknown
	Likely	Low	Medium	High	High	Unknown
	Unlikely	Low	Medium	Medium	Medium	Unknown
	Remote	Low	Low	Low	Low	Unknown
	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

Figure 2: Threat Risk Matrix.

Table 4: Population-Level Threat Risk.

	Population 1			
	Likelihood of Occurrence	Level of Impact	Causal Certainty	Population-Level Threat Risk
Threat 1	Likely	Extreme	4	High (4)
Threat 2	Known	Medium	1	Medium (1)
...				

Then evaluate the Population-Level Threat Occurrence (Table 6), Population-Level Threat Frequency (Table 7) and Population-Level Threat Extent (Table 8) for each threat. Complete the population-level input table (Table 5).

Table 5: Population-Level threat assessment.

	Population 1						
	Likelihood of Occurrence	Level of Impact	Causal Certainty	Population-Level Threat Risk	Population-Level Threat Occurrence	Population-Level Threat Frequency	Population-Level Threat Extent
Threat 1							
Threat 2							
...							

Table 6: Categories of Population-Level Threat Occurrence. Population-Level Threat Occurrence refers to the timing of the occurrence of the threat and describes whether a threat is historical, current and/or anticipatory for a given population. Any combination of PTO categories is possible².

Population-Level Threat Occurrence	Definition
Historical	A threat that is known to have occurred in the past and negatively impacted the population.
Current	A threat that is ongoing, and is currently negatively impacting the population.
Anticipatory	A threat that is anticipated to occur in the future, and will negatively impact the population.

Table 7: Categories of Population-Level Threat Frequency. Population-Level Threat Frequency refers to the temporal extent of a given threat over the next 10 years or 3 generations, whichever is shorter. Select only one of the 3 possible categories.

Population-Level Threat Frequency	Definition
Single	The threat occurs once.
Recurrent	The threat occurs periodically, or repeatedly.
Continuous	The threat occurs without interruption.

Table 8: Categories of Population-Level Threat Extent. Population-Level Threat Extent refers to the proportion of the population affected by a given threat.

Population-Level Threat Extent	Definition
Extensive	71-100% of the population is affected by the threat.
Broad	31-70% of the population is affected by the threat.
Narrow	11-30% of the population is affected by the threat.
Restricted	1-10% of the population is affected by the threat.

Step 2 – Roll-Up Population-Level Threat Risk to Species-Level Threat Risk (Table 9)

Population-Level Threat Risk to Species-Level Threat Risk

The highest level of risk for a given population must be retained when rolling-up at the species level (Precautionary Approach). Describe population-level differences in threat risk when applicable. Incorporate causal certainty by carrying the associated level of certainty forward.

Population-Level Threat Occurrence to Species-Level Threat Occurrence

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

Population-Level Threat Frequency to Species-Level Threat Frequency

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

Population-Level Threat Extent to Species-Level Threat Extent

Provide context to the extent of the threat to the species by considering the proportion of each population and the proportion of the overall population affected by the threat. For the latter, options are to use the mode (value that appears most often), median (mid value), mean or proportion of area of occupancy.

Table 9: Species-Level threat assessment.

	Species			
	Species-Level Threat Risk	Species-Level Threat Occurrence	Species-Level Threat Frequency	Species-Level Threat Extent
Threat 1				
Threat 2				
...				

BACKGROUND – ASSESSING ECOLOGICAL RISK IN SUPPORT OF SPECIES AT RISK LISTING RECOMMENDATIONS

The purpose of the Risk-Based Assessment Tool is to establish a standard, coherent and transparent approach to developing listing recommendations throughout the department for species assessed by COSEWIC as Endangered, Threatened or Special Concern. This tool aims to minimize the variability in the way listing recommendations are developed across Regions to ensure all species are assessed in a similar and equitable manner. The tool graphically displays the considered risks for List and Do Not List scenarios, thus summarizing the risks and making them easier to analyze and prioritize. This will communicate the risks of listing and not listing a species to decision makers in a standard and transparent format.

While the components of the tool are largely subjective and the tool does not produce a final recommendation, it assists in the considerations of various biological, socio-economic and departmental risk elements. There is no weighing of the different criteria.

Risk assessment organizes and analyzes data, assumptions, and uncertainties to evaluate the likelihood of adverse effects. Risk refers to the effect of uncertainty on objectives. It is the expression of the likelihood of occurrence and level of impact of an event with the potential to affect the achievement of an organization's objectives. For the ecological risk criteria, the objectives relate to the purposes of the SARA to: prevent species extinction, achieve their recovery and prevent status degradation for species of special concern.

ANALYSIS - ASSESSING ECOLOGICAL RISK IN SUPPORT OF SPECIES AT RISK LISTING RECOMMENDATIONS

The Risk-Based Assessment Tool

The Risk-Based Assessment tool Appendix 7² was developed by DFO Species at Risk Policy. There are three risk categories: Socio-Economic Risk, Departmental Risk and Ecological Risk. Science is involved in providing advice to populate the Ecological Risk Categories (see Appendix 1). The four Ecological Risk Categories are:

- Population and Extinction Risk;
- Habitat and Distribution;
- Ecosystem and Biodiversity; and
- Threats.

The Risk-Based Assessment tool Appendix 7 guidance document should be used in tandem with the Ecological Risk Categories (see Appendix 1).

Using the Tool

Sources of Information

Practitioners should use the following sources of information when using the tool:

- the COSEWIC Status Report;
- the RPA;
- Science Advisory Reports and related Proceedings;
- any peer-reviewed information about the species life history, including ecosystem function; and
- any peer-reviewed information on the impacts of threats on the species, or similar species, and its habitats.

Level of Impact

In using the tool, impacts should be assessed in terms of negative outcomes. The level of impact is measured in terms of the magnitude of the negative consequences to the species. For example, if not listing a species would result in the imminent extinction of a species, the level of impact would be assessed as very high with regards to the objectives of SARA). The level of impact may be categorized as very high, high, medium, low or negligible – See Appendix 1 at the end of this document for guidance.

Likelihood of occurrence refers to the risk that an event “may” occur. The likelihood of an impact occurring can range anywhere from Not Likely to Certain (Table 10).

² Risk-Based Assessment tool Appendix 7. DFO 2012. DFO Species at Risk Listing Policy and Guidelines Draft Document. 18 pp. This is an internal DFO document.

Table 10: Categories of likelihood for ecological risk.

Ranges for the Likelihood of Ecological Impact Occurring			% Confidence of Impact Occurring
1	Not Likely	Impact will be rare or never happen, it may occur in exceptional circumstances	0 – 5%
2	Somewhat Likely	Impact very unlikely and may occur at some point	5 – 35%
3	Likely	Impact will occur in some but not all circumstances. There is some evidence to suggest the impact is possible	35 – 65%
4	Very Likely	Impact will occur in most circumstances	65 – 95%
5	Certain	Impact will occur	95 – 100%

Range of Risk

Using the risk matrix, determine the likelihood of occurrence and level of impact to determine the evaluated risk from the risk matrix (Figure 3 and 4).

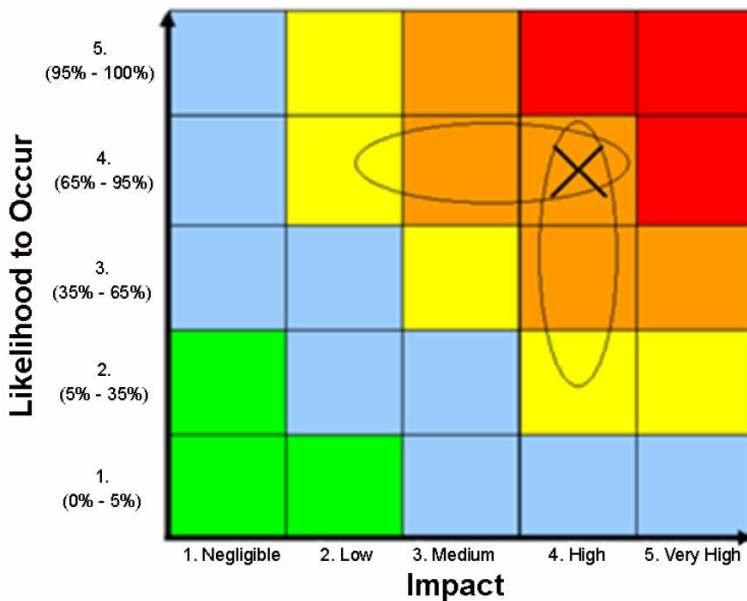


Figure 3: Risk Matrix – Likelihood of Occurrence vs Level of Impact for ecological risk criteria.

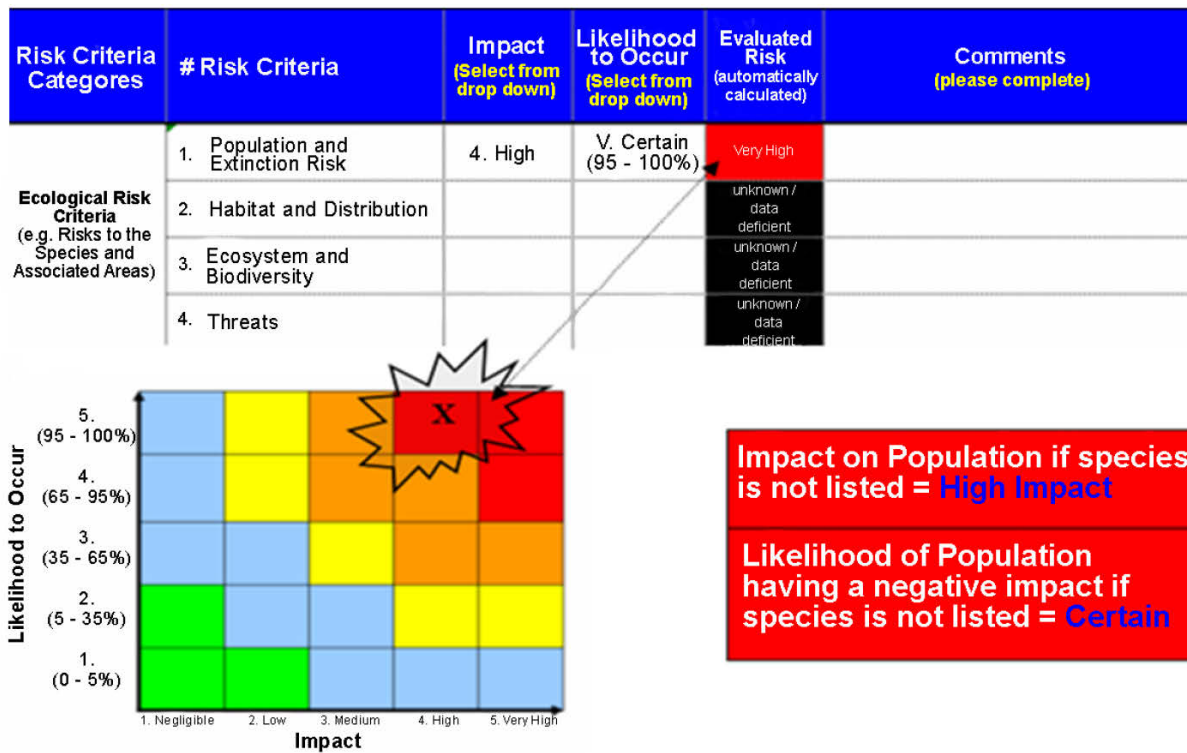


Figure 4: Tabular and graphical representation of ecological risk assessment.

Time Period

Assessment of impacts may differ depending on the length of time considered (e.g., 5 years versus 25 years). The time period should be provided in the “Comment” field of the spreadsheet.

Precautionary Principle

There will be a level of uncertainty associated with predicting the level of impact and likelihood of occurrence in the ecological category. If uncertainty is high, practitioners should identify a range of plausible levels of impact/likelihood of occurrence (represented by ellipses in Figure 3): e.g. medium to high, low to high or low to medium, etc. Practitioners should assume the highest likely level of risk when assessing a scenario that involves not listing.

Stating Assumptions

As the determination of the levels of impact and likelihood of occurrence are done prior to recovery planning, this exercise will be surrounded by a certain amount of uncertainty as recovery measures and their likely impacts would have to be anticipated. Practitioners will have to use their best judgment and state their assumptions in the comment field.

General Guidance

- Risk-Based Assessment tool Appendix 7 guidance document should be used in tandem with the Ecological Risk Categories (see Appendix 1).
- The assumptions used to populate the risk criteria must be clearly articulated in the completed spreadsheet.

- State uncertainty and assumptions and carry them out through the end of the listing process.
- In the absence of evidence to the contrary, one must assume that the species status will improve if the species is listed.
- Inferences and using information derived from surrogate species is acceptable.
- In the absence of evidence to the contrary, one must assume that the species status will not improve under *Status Quo*.
- Clarify guidance as new issues arise, clearly state assumptions, provide proper training and coaching to those assessing ecological risks to ensure repeatability of assessment process.
- Clarify mitigation measures associated with a given scenario before the RPA process to allow modelling and provide a sound basis for the risk assessment.
- Provide the timeframe used for assessment of likelihood.
- It is acceptable to end up with the same ecological risk for the “list” and “do not list” scenarios.
- The ecological risks table must be filled in although a conclusion may have been reached to the effect that recovery may not be feasible, and therefore that all options would yield a very high risk impact for the “Population and Extinction risk”.

Roles and Responsibilities

The ecological risk criteria table³ 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’ 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.

BACKGROUND – MONITORING ECOLOGICAL IMPACTS OF ACTION PLANS

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.

Under the SARA (s.55), DFO 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.

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

³ Species at Risk Program Guidance Materials and Templates, Ecosystem and Fisheries Management, Species at Risk Program Management Intranet site, June 16, 2014.

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.

The Tri-departmental Template for Action Plans contains a section that is intended to be useful in meeting the 5-year reporting requirements of the SARA s. 55. 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 the 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.

ANALYSIS - MONITORING ECOLOGICAL IMPACTS OF ACTION PLANS

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, documenting the ecological impacts through selected indicators, and describing the strength of the relationship between the result, if any, and the action and/or group of actions undertaken.

As a way to connect requirements of the species at risk process, it may be useful to address aspects of the 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 the SARA s. 55.

General Guidance

- 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.
- The 5-year action plan monitoring reports have to be designed with full understanding of the limitations and gaps of existing monitoring programs.
- Development of a RPA needs to take into consideration the requirement of an Action Plan to report on progress after 5-years.
- Information necessary to plan for the monitoring of ecological impacts shall be provided where possible at the RPA through:
 - Identification and prediction of potential ecological impacts of a threat and/or threat abatement;
 - Identification of knowledge gaps of potential ecological impacts;
 - Identification of existing monitoring efforts for both the target species and its ecosystem; and
 - Evaluation of the potential of these data to respond to the SARA s. 55 requirement.
- Planning for the monitoring of ecological impacts shall take place at the recovery planning stages through:
 - Identification and prediction of potential ecological impacts of a recovery action;
 - Prioritization of recovery measures based on how likely they are to help achieve recovery objectives

- For each priority recovery measure, understanding the pathways of effects
- Identification of elements most vulnerable to ecological impacts
- Screening out actions of low potential ecological impact
- For actions of higher potential ecological impact, identification of those with existing monitoring data (data should be robust enough to infer trends) specifying how this information will be accessed and reported on.
- Identification of knowledge gaps associated with potential ecological impacts;
- If necessary, identification of new monitoring efforts to address knowledge gaps; and
- Evaluation of the potential strength of the relationship between the specific recovery action undertaken and a given ecological impact (this may be qualitative or quantitative).
- Planning for the monitoring of ecological impacts during the RPA and recovery planning stages shall not require data analysis or modeling. Data analysis will occur during the implementation of the Action Plan.
- If potential measures to address threats or recovery of the species will have a potential negative impact on non-target species, communities, or ecological processes, the department should consider these in development of recovery strategies and action plans.

SOURCES OF UNCERTAINTY

There will be sources of uncertainty when assessing threats, ecological risk, and ecological impacts for species at risk. As noted throughout, the two-step standardized approach to threat assessment, the ecological risk-based assessment tool, and the general guidance for monitoring ecological impacts of action plans prompt users to identify sources of uncertainty in their application.

CONCLUSIONS

Threat Assessment:

A two-step process to characterize and prioritize threats to the survival and recovery of a species is proposed. Threats should be evaluated at both the population-level and species-level.

Assessing Ecological Risk in Support of Species at Risk Listing

Recommendations:

DFO Science is involved in providing advice to populate the four ecological risk categories. The evaluated risk is calculated using a risk matrix that considers the likelihood of occurrence and level of impact for each criterion.

Monitoring Ecological Impacts of Action Plans:

Under SARA s.55, DFO has a legal obligation to assess and report on the ecological impacts of an Action Plan five years after the plan is approved. Planning for the monitoring of ecological impacts shall occur at both the Recovery Potential Assessment and recovery planning stages.

SOURCES OF INFORMATION

This Science Advisory Report is from the May 29-31, 2013 National Peer Review on Assessing Threats, Ecological Risk and Ecological Impacts. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

Salafsky, N., D. Salzer, J. Ervin, T. Boucher, and W. Ostlie. 2003. Conventions for defining, naming, measuring, combining, and mapping threats in conservation: an initial proposal for a standard system. Conservation Measures Partnership, Washington, D.C.

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.

APPENDIX 1 - ECOLOGICAL RISK CATEGORIES

Levels of Negative Impact ⁴ Criteria	Negligible OR No Impact	Low	Medium	High	Very High
<p>1. Population and Extinction Risk</p>	<ul style="list-style-type: none"> Minimal change anticipated falling within natural range of variability; or Species will be in the healthy zone of the Precautionary Approach; or Species will be considered “Not at Risk”; or Species is extirpated and reintroduction is deemed not possible 	<ul style="list-style-type: none"> Negative impacts will be minor - may involve changes within natural range of variability, recoverable on the short term (1 year), e.g., seasonal, changes in fish stock or habitat; or Species is in the cautious zone of the Precautionary Approach, and not showing signs of decreasing 	<ul style="list-style-type: none"> Persistence will be increasingly threatened by genetic, demographic or environmental stochasticity; or Species will be under significant pressure but not expected to reach historic lows; or Species will be at the limit reference point but will not increase; or Species will meet definition of COSEWIC Special concern category 	<ul style="list-style-type: none"> Probability of extinction in the wild to be at least 10% within 100 years; or Species will be below the Precautionary Approach limit reference point or rapidly decreasing to the limit reference point and will likely exceed it in the very near future but above the mid-point between the origin and the Precautionary Approach limit reference point; or Species will meet COSEWIC criteria for Threatened or Extirpated (reintroduction deemed possible) 	<ul style="list-style-type: none"> The species will be facing imminent extinction or extirpation; or Probability of extinction in the wild to be at least 20% within 20 years or 5 generations, whichever is longer (up to a maximum of 100 years); or Species will be below the mid-point between the origin and the Precautionary Approach limit reference point; or Species will meet COSEWIC criteria for Endangered
<p>2. Habitat and Distribution</p>	<ul style="list-style-type: none"> No habitat change or minor habitat change anticipated with no impact on the species; or Habitat will not be a limiting factor for the species; or Few threats to habitat will remain and they will be easily mitigated 	<ul style="list-style-type: none"> Minor impact to fish habitat are anticipated with short term recovery (less than 3 years); or Species’ range will expand; or All habitat necessary for recovery will be available and effectively protected from key threats 	<ul style="list-style-type: none"> Moderate impact to fish habitat are anticipated, with longer term (3-5 years) for recovery; or Continuing decline observed, inferred or projected in the area, extent and/or quality of habitat; or Some habitat will be effectively protected, but not all that is required for species recovery; or Mitigation and control of some threats will be difficult or ineffective 	<ul style="list-style-type: none"> Significant damage to fish habitat caused by anthropogenic threats is anticipated; or Habitat will be severely fragmented or known to exist at < 10 locations; or Species will demonstrate a small distribution, and will decline or fluctuate in distribution where the extent of occurrence is < 20,000 km² or area of occupancy is < 2,000 km²; or None of the habitat required for species recovery will be effectively protected; or Threats to habitat will be difficult to mitigate or control (e.g. cumulative effects, non-point pollution) 	<ul style="list-style-type: none"> Remaining habitat will be inadequate to support a self-sustaining population; or There will be permanent, large scale loss of fish habitat; or Species will demonstrate a small distribution, and will decline or fluctuate in distribution where the extent of occurrence is < 5,000 km² or area of occupancy is < 500 km²; or All of the remaining habitat will be under threat from activities that are difficult to mitigate or control

⁴ Negative Impact refers to the anticipated consequences associated with a given listing scenario, including protection, recovery and conservation measures or absence thereof.

Levels of Negative Impact ⁴ Criteria	Negligible OR No Impact	Low	Medium	High	Very High
3. Ecosystem and Biodiversity	<ul style="list-style-type: none"> A vagrant from other ecosystems 	<ul style="list-style-type: none"> ⁵The species has been and is expected to remain a very minor component of its trophic level. All ecosystem functions attributed to the species will be maintained or re-established; or The species has limited trophic interactions and will be readily replaced by equivalent species. 	<ul style="list-style-type: none"> The species has been an important component at its trophic level, and either: Trophic level shifts may take place, but main ecosystem functions will be maintained or re-established; or The species historically had numerous connections at different trophic levels and is unlikely that it can be replaced by an equivalent species. 	<ul style="list-style-type: none"> ⁶The species has been the most important component (e.g. main primary producer; main top predator) at its trophic level, and either: The species will not be replaced by an equivalent species; or Trophic interactions will be disrupted, and/or ecosystem function altered. Loss of a wildlife species that is a biological sub-species endemic to Canada, or a wildlife species that has a large proportion of its distribution in Canada 	<ul style="list-style-type: none"> ⁷The species is essential for the persistence of some other components of the ecosystem (e.g., keystone species, obligatory commensalism, sole food source, etc) and either: Such role will be at extreme risk; or Trophic interactions will be disrupted so much that it will lead to large ecosystem changes or shifts. Loss of a Wildlife endemic biological species (not a sub-species or population)
4. Threats⁸	<ul style="list-style-type: none"> All threats will cease and will be controlled Threats will not be an issue for the species (e.g. at risk because of limited range) 	<ul style="list-style-type: none"> Major threats will cease or will be controlled Impacts of threats will not prevent achievement of recovery objectives 	<ul style="list-style-type: none"> Some major and/or minor threats will cease or will be controlled by mitigation measures. Rate of population declines or habitat destruction will be reduced 	<ul style="list-style-type: none"> Major threats will continue to cause significant population declines and/or habitat destruction Some minor threats will be mitigated, but will be insufficient to improve the status of the species 	<ul style="list-style-type: none"> All threats to species' survival and recovery are ongoing and unmitigated

Note: Although a conclusion may have been reached to the effect that recovery may not be feasible, and therefore all options would yield a very high risk impact for the "Population and Extinction risks" criterion, it is still important to fill in the ecological risks table as values for other criteria may differ across different listing scenarios.

⁵ Either the criteria in the first bullet AND one of the two latter can be met, or only the first OR one of the two latter.

⁶ The last bullet is a stand-alone. Either a combination of the criteria in the first three bullets can be met AND the last bullet, or a combination of the first three OR the last bullet.

⁷ The last bullet is a stand-alone. Either a combination of the criteria in the first three bullets can be met AND the last bullet, or a combination of the first three OR the last bullet.

⁸ In the first four Levels of Impact (Negligible OR No Impact) to High, one of the two criteria or both can be met.

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ERRATUM: JUNE 2016

The Threat Risk Matrix in Figure 2 was corrected and the symbols representing the definitions in Table 1, Table 2, Table 4, Table 5, Table 6, Table 7, Table 8, and Table 9 have been removed throughout the document for clarity. The written explanation of the table, originally found above the table, has been moved to the table title for clarity in Table 1, Table 2, Table 3, Table 6, Table 7, and Table 8.