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Canadian Science Advisory Secretariat
Science Advisory Report 2022/036

SCIENCE ADVICE TO SUPPORT THE COMPONENTS OF A JEOPARDY ASSESSMENT FRAMEWORK FOR PERMITTING UNDER THE *SPECIES AT RISK ACT*

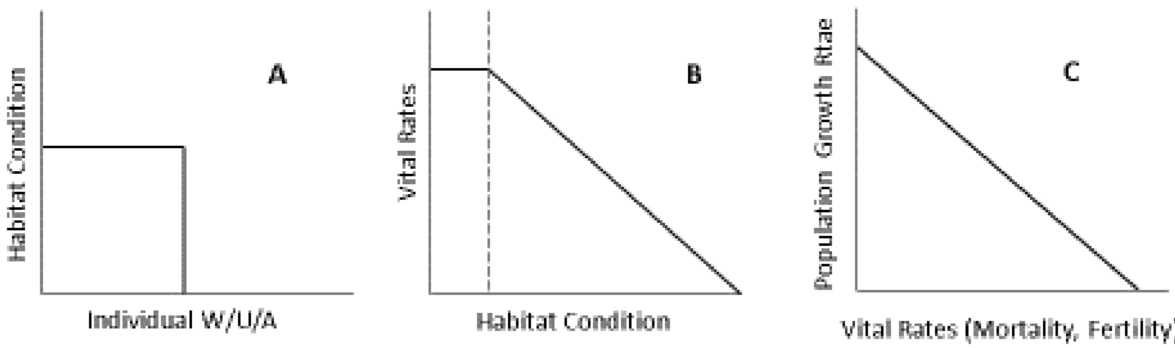

Figure 1. Diagram showing the primary components of a jeopardy assessment framework when habitat is affected by an individual work, undertaking, or activity (W/U/A).

Context:

Under section 73 of the Species at Risk Act *(SARA), the Minister of Fisheries and Oceans may issue a permit authorizing a person to affect a listed aquatic species, any part of its critical habitat, or the residence of its individuals only if the Minister is of the opinion that, among satisfying other conditions, the activity will not jeopardize the survival or recovery of the species. In order to fulfill this specific condition, DFO has to evaluate the scope for allowable harm, i.e. human-induced harm that will not jeopardize the survival or recovery of an aquatic species. An assessment of allowable harm is conducted as part of the DFO Science Recovery Potential Assessment process for species at risk to explore how increases in human-induced mortality or habitat destruction alter survival or recovery probabilities and recovery timelines.*

The issuance of SARA section 73 permits for listed aquatic species is the responsibility of the DFO Species at Risk Program. With the increasing number of species at risk and of human activities in or near aquatic ecosystems in Canada, a habitat-related, science-based framework to evaluate works/undertakings/activities (w/u/a) that may affect a SARA-listed aquatic species, their critical habitat or residence would help the program ensure that permitting or offsetting decisions around section 73(3) are made in a rigorous, transparent and nationally consistent manner. This document summarizes the components of a jeopardy assessment framework when habitat is affected, which includes describing the effect of a w/u/a on habitat condition, the relationship between habitat condition and species vital rates, and the relationship between vital rate changes and population growth rate. Additional information is provided on the potential role of offsetting. Offsetting is a relatively new and evolving technique of habitat compensation that was introduced within DFO following the amendments to the Fisheries Act *in 2012. Offsetting may potentially be used to counterbalance residual effects from human activities (w/u/a) on SARA-listed species.*

This Science Advisory Report provides a proposed framework that builds upon and complements the Department's existing approaches to assess allowable harm in order to assist the Department in making decisions about the impacts of an activity to a listed aquatic species.

This Science Advisory Report is from the November 6-8, 2018 National Science Advisory Process on Science Advice to Support the Jeopardy Assessment Framework for Permitting under the Species at Risk Act. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada (DFO) Science Advisory Schedule] as they become available.

SUMMARY

- A proposed science-based framework that builds on past science advice was reviewed concerning the concept of allowable harm to assess whether works/undertakings/activities (w/u/a) will result in direct or indirect harm to jeopardize the survival or recovery of a SARA-listed species for the purposes of satisfying requirements of SARA subsection 73(3)(c).
- The proposed conceptual framework has three main components to evaluate how a project may affect survival and recovery of the species: a) the relationship between the w/u/a (including offsets, if pursued) and changes in habitat condition; b) the relationship between habitat change and species vital rates (mortality, fertility, growth); and, c) the relationship between changes in vital rates and a population's response.
- Two example analyses were presented that fit into the three main components of the framework: 1) a modelling exercise to determine impacts of changes to vital rates for populations of aquatic species at risk with five different population growth trajectories; and, 2) a meta-analysis of vital rate responses to changes in habitat for freshwater mussels and freshwater fishes.
- The purpose of the modelling exercise was to predict how population growth or decline may respond to life-stage specific impacts. Several limitations may have influenced the results of this analysis, including lack of data for species-specific life-history characteristics and underlying assumptions.
- This modelling exercise is not intended to replace more robust population models or frameworks such as those for marine mammals, but is meant to provide a potential standardized approach for data-limited species.
- Results of the meta-analysis of vital rate responses to changes in habitat for freshwater mussels and freshwater fishes indicate that non-linear responses appear to be more common than linear. Additional work is needed on how to integrate multiple stressors for both linear and non-linear responses.
- The DFO Pathways of Effects models are a way of linking effects of w/u/a to changes in habitat condition, which can be used to understand the impact on species' vital rates.
- Although habitat offsetting is a commonly used tool, the literature review found few examples where policies specifically addressed additional requirements needed to implement habitat offsetting for species at risk. Where the policies were specific, the magnitude of habitat offsetting was required to be much higher than the level of the habitat impact.
- Defensible criteria for evaluating population responses to habitat offsetting were not found. There is uncertainty around understanding how vital rates respond to offsetting measures in the species at risk context.
- There are uncertainties in the components of the framework. As the framework is further developed, strategies for managing risk associated with uncertainties, knowledge gaps, and assumptions need to be built in to account for these uncertainties.

- The framework as presented is largely conceptual; approaches and next steps to operationalize the framework were discussed and presented.

BACKGROUND

Fisheries and Oceans Canada (DFO) has the responsibility to administer the *Species at Risk Act* (SARA) for aquatic species, which includes fish, shellfish, crustacean, marine mammals and marine reptiles. SARA prohibits activities that may kill, harm, or harass an individual of a wildlife species that is listed as an extirpated species, an endangered species, or a threatened species, and prohibits activities that may damage or destroy the residence of these species. The competent minister can, however, allow an exemption under the *Species at Risk Act* and issue permits for projects that may affect aquatic listed species but only if, among satisfying other conditions, it has been determined that the activity will not jeopardize the survival or recovery of the species.

As the number of projects occurring in or near aquatic ecosystems and the number of aquatic species at risk are both increasing, the DFO Species at Risk Program has to respond to a growing number of SARA permit applications and make an assessment of section 73 of the Act, which involves determining if the proposed activity will jeopardize the survival or recovery of the species.

To evaluate section 73 within permit applications, the Species at Risk Program relies on allowable harm assessments conducted by DFO Science. Allowable harm assessments describe the harm to a SARA-listed species that would not jeopardize its survival or recovery, and are most often conducted as part of the Recovery Potential Assessment process. There are, however, several differences among the methods used by DFO Science to assess allowable harm owing to, among other things, data availability and the suitability of analytical approaches for each species. Given these differences and the need to incorporate habitat-related impacts (which are not typically considered within allowable harm assessments), the SARA section 73 permit applications are typically considered on a case-by-case basis by the DFO Species at Risk Program. To assist in this decision-making process, DFO Science developed proposed components of a framework that, once operationalized into a decision-making toolkit, would provide a nationally consistent basis for a transparent determination of Subsection 73(3)(c).

The concept of allowable harm was initially defined and developed into a scientific framework in 2004, hereafter referred to as allowable harm assessment (AHA), during the Framework for Evaluation of Scope for Harm under Section 73 of the *Species at Risk Act* (DFO 2004) Canadian Science Advisory Secretariat (CSAS) meeting. Additional information regarding the four criteria on which the initial scientific framework was built were provided in another document, the “Moncton Protocol”, published later that year. The Moncton Protocol was reviewed and refined in 2006 through the National Science – Habitat Management Workshop on Allowable Harm Assessment for Aquatic Species with Habitat Related Threats (DFO 2006), to account for linkages with habitat-related threats, e.g., area-based or water quality-based habitat changes and resulting impacts to vital rates - the latter being a key factor of AHA.

Since 2004, different approaches for AHA have been used by DFO Science taking into account important differences regarding data availability, the nature of recovery targets, and allowable harm interpretations among Recovery Potential Assessments (RPAs). Although considerable effort has been put into AHA by DFO Science, there is currently no existing nationally consistent framework to assess Section 73, specifically in regards to incorporating habitat-related threats, that builds upon and complements the department’s existing approaches to AHA. As mentioned in the conclusions of the 2006 workshop, developing a framework for assessing allowable harm among species at risk that includes habitat-related threats would assist DFO in making scientifically-defensible decisions for permitting and was flagged as a key step in the achievement of a nationally consistent implementation of SARA. In addition, the Species at Risk Program is responsible for assessing an increasing number of permit applications; therefore, a habitat-related, science-based framework to evaluate w/u/a that may affect a SARA-listed aquatic species, their critical habitat, or residence would help the program ensure that permitting or offsetting decisions around Section 73 are made in a rigorous, transparent, and nationally consistent manner.

This advice provides an evaluation of components for a scientifically defensible framework, hereafter referred to as the “proposed jeopardy assessment framework”, that builds on past science advice related to AHA to determine if a permitting decision will satisfy the precondition set out in Subsection 73(3)(c) of SARA. Overall the proposed jeopardy assessment framework needs to consider: 1) harm to individuals; 2) harm to habitat; and, 3) how harm is connected to vital rates (mortality, fecundity, growth, migration), and thus how harm influences population growth.

ASSESSMENT

Projects that occur in or near aquatic habitat can have direct and indirect impacts on aquatic wildlife species. Direct impacts can include mortality or other direct harm to a species from the w/u/a (e.g., strikes to animals from construction equipment). Indirect impacts represent changes in habitat condition (e.g., sedimentation, loss of effective habitat area) that lead to vital rate changes and in-turn influence population growth. The proposed conceptual jeopardy assessment framework has three main components that take into account both direct and indirect impacts of human activities on the survival and recovery of SARA-listed species (Drake et al. 2022): a) a relationship between the individual w/u/a and changes in habitat condition (including habitat offsetting, if pursued); b) a relationship between habitat and vital rate changes; and, c) a relationship between changes in vital rates and a population’s response. In the case of direct impacts, the effect of the w/u/a can be directly related to non-habitat related changes in vital rates, and thus, population responses.

While these three components of the framework do not provide a stand-alone assessment framework for an individual w/u/a, they provide a method that allows for habitat and population changes as a result of a w/u/a to be estimated. The population model component of the proposed jeopardy assessment framework (Section C) is intended to provide a potential, standardized approach for data-limited species and is not meant to replace more robust population models or frameworks. Overall, the proposed framework is designed to be flexible enough to allow for the incorporation of additional information from existing population models of SARA-listed species that estimate the baseline condition of the population (e.g., current trajectory) and habitat (e.g., habitat conditions in the vicinity of the w/u/a, as well as total habitat available to the species).

Section A: Effects of Works/Undertakings/Activities (w/u/a) on Aquatic Habitat

The first component of the proposed framework outlines methods to translate impacts from human activities (w/u/a) into changes to aquatic habitat that are then linked with vital rate changes. The DFO’s Pathways of Effects (PoE) models are considered a useful tool to relate the habitat stress resulting from the residual effects of an individual w/u/a to species’ vital rates.

To allow the w/u/a to be linked back to vital rates (and the degree of chronic or temporary harm), the PoE framework should be used to determine the types of habitat stressors that are relevant, which can then be associated with the state of habitat features in the area prior to the development, the degree of change from baseline due to the w/u/a, and the duration of change. This provides a characterization of the different species-specific habitat impacts expected for an individual w/u/a.

Section B: Relationships between Aquatic Habitat Change and Vital Rates

The second component of the proposed framework aims to connect aquatic habitat alterations with vital rates, and provides an intermediate link between a given project and expected population responses. In some cases, such as a one-time impact on mortality or fecundity, or recurring direct impacts (e.g., vessel strikes, bycatch), the estimate of vital rate changes and the population models in Section C may form the basis by which to evaluate permitting conditions under Section 73 of SARA. However, most w/u/a that occur near or in aquatic habitat will involve a certain degree of habitat alteration (complete or temporary loss, degradation of function) that could present a combination of one-time or continuous impacts, and would require further information.

A meta-analysis of the relationship between habitat condition and survival showed that considerable research has been conducted on the habitat features that support aquatic species. However, deriving meaningful links is difficult and requires an understanding of which habitat features maximize the productivity of a species. Ideally this would be broken down into the contribution of each habitat feature (e.g., food supply) on each life stage (e.g., juveniles) and life-history process (e.g., survival). Although this type of data is difficult to obtain for most SARA-listed species, some generalities can be drawn. Recent assessments of the relationship between habitat condition and survival in freshwater fishes and mussels (Braoudakis et al. unpublished data, summarized in Drake et al. 2022) show that non-linear responses were most common. Despite the complexity of most relationships between habitat condition and vital rates, there are dominant relationships that can be generalized across the different classes of habitat stressors and particular vital rates.

Sub-lethal effects

Although it is possible to link habitat changes with vital rates, in many cases a w/u/a will produce habitat conditions that will lead to behavioural or other sub-lethal effects on aquatic species. For these effects to impact the population growth rate, there must be some underlying linkage with one or more vital rates, otherwise, population growth rate would remain unchanged. Several approaches were reviewed that allow behavioural or sub-lethal effects to be incorporated into the proposed assessment framework.

Multiple stressors

When assessing the change in vital rates, all relevant habitat features should be taken into account. Although additional work is needed on how to integrate multiple stressors for both linear and non-linear responses, four main situations were identified when considering the effect of multiple stressors on an aquatic population. They include simple additive effects (Figure 2A), situations in which one stressor is overwhelmingly important (“dominant driver”, Figure 2B), or interactions in which two stressors produce a greater (Figure 2C) or lesser (Figure 2D) effect on vital rates than if the effects were additive. For simplicity, these relationships were denoted as linear with similar origin points, but as with single stressors, multiple forms can exist (e.g., non-linearities and different origin points).

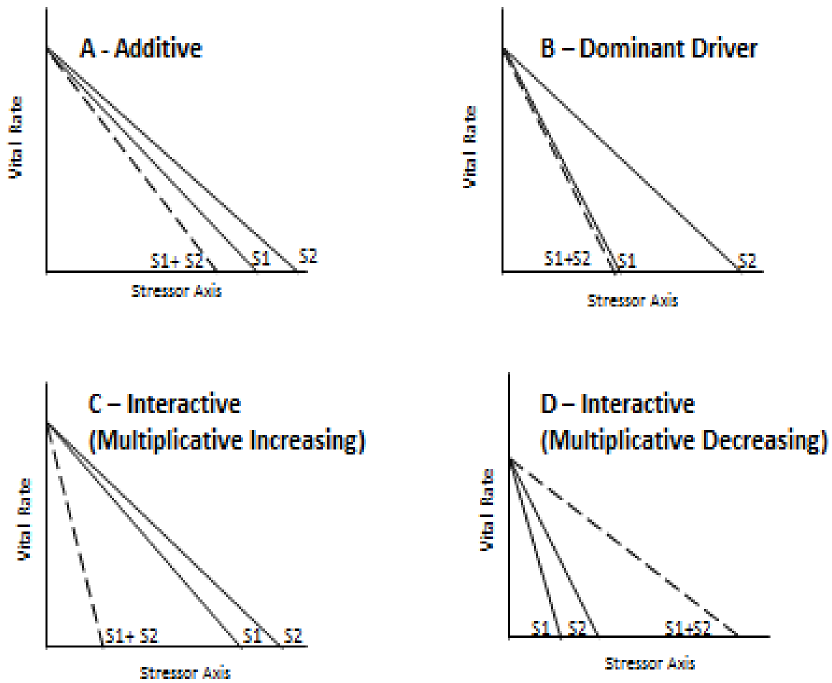

Figure 2. Four types of scenarios for the effect of multiple stressors. The stressor axis describes an increase in habitat stress (i.e., decrease in habitat suitability or condition). The labels S1 and S2 denote the effect of individual stressors, and the dashed line denotes the aggregate effect of both stressors under each scenario (A – Additive, B – Dominant Driver, C – Multiplicative Increasing, D – Multiplicative Decreasing).

Overall, for a single w/u/a, the following information should be considered to assess the relationship between aquatic habitat condition and vital rates: 1) the types of habitat changes relevant for a species, life stage, and vital rate (including sub-lethal or behavioural effects), and 2) their shape(s), and 3) the nature of interactions, if any. Information on the duration, periodicity, and spatial extent of these changes relative to pre-w/u/a conditions is also needed.

Section C: Relationship Between Changes in Vital Rates and a Population Response

The third component of the proposed framework for assessing the impact of w/u/a on species at risk is the response of population growth rate to shifts in vital rates (mortality, fertility, growth). One method of quantifying the effect of harm on species at risk is through elasticity analysis. Elasticities measure the impact of a change in a vital rate on population growth rate.

Elasticity analysis was used to build the final component of the proposed framework using five different population trajectories (booming, growing, stable, declining and crashing). The purpose of this modelling exercise was to predict which life stages are most sensitive to harm, a recovery action, or an offset, for a given taxonomic group (freshwater fishes, marine fishes, sharks and skates, marine mammals, freshwater mussels, marine turtles). Stage-specific population models were used to estimate the impact of a change in a vital rate on population growth rate (i.e., elasticity) for groups of at-risk aquatic taxa. The life history factors that best identify elasticity patterns were then determined.

Species displayed different responses in terms of how perturbations to mortality and fertility lead to changes in population growth rate. Overall the analysis showed that species at risk can be categorized into four distinct elasticity groups that describe how population growth rate varies with disturbances to different vital rates: 1) species that were predominantly sensitive to reproduction/young of the year (YOY) survival; 2) species that were predominantly sensitive to adult survival; 3) species that were sensitive to juvenile and adult survival; and, 4) species that were predominantly sensitive to early life stages (Figure 3). These patterns can differ depending on whether populations are in a state of growth or decline, but in general, it is possible to describe the sensitivity of species to changes in stage-specific mortality or fertility based on elasticity pattern groupings.

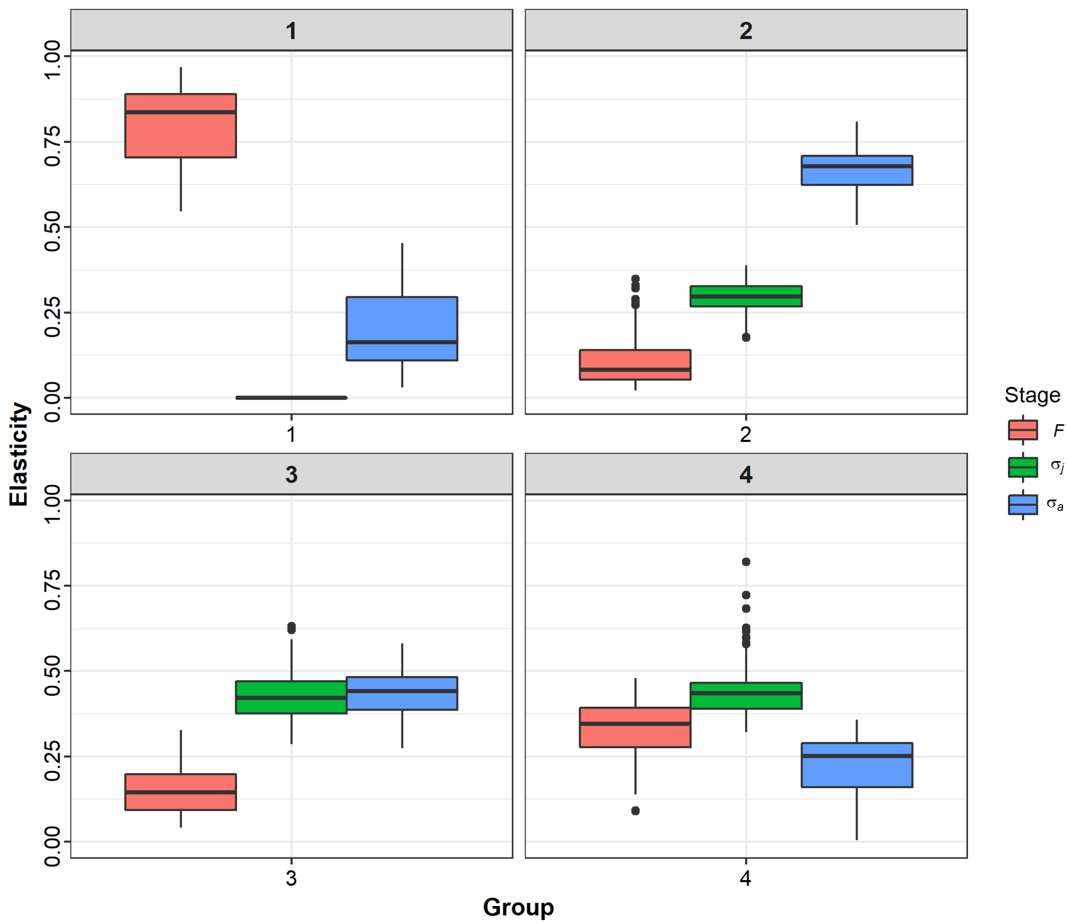

Figure 3. Elasticity patterns of identified groups (1-4) for aquatic species-at-risk across taxa. F represents fertility, σ_j represents juvenile survival rate, and σ_a represents adult survival rate. Group 1 represents species that were predominantly sensitive to reproduction/young of the year (YOY) survival; Group 2 represents species that were predominantly sensitive to adult survival; Group 3 represents species that were sensitive to juvenile and adult survival; and Group 4 represents species that were predominantly sensitive to early life stages.

Taxa-specific analyses were unable to discern different elasticity patterns or identify the life-history characteristics (other than population growth rate, λ) that influence them. Extending this analysis to species that are not at-risk may allow for increased diversity of life-history characteristics and elasticity patterns that could then be modelled with greater success.

It is important to note that this third component of the proposed framework is not intended to replace pre-existing model scenarios, but rather provides a methodology to categorize species into groups that have a similar capacity to respond to harm or recovery actions. This may be a useful approach when robust population models or frameworks are not yet available.

Offsetting for SARA-Listed Species

Biodiversity offsetting is a relatively new and evolving technique used to counterbalance unavoidable residual environmental effects of development projects. When pursued, offsetting is the third phase of a three-tiered mitigation hierarchy that begins with:

1. avoiding project impacts;
2. the application of mitigation measures; and,
3. offsetting losses when avoidance and mitigation result in residual ecological impacts (Gardner et al. 2013).

A review of the basic theory behind offsetting and international policy frameworks was conducted in order to understand what information might be needed to support permitting decisions around offsetting. Although offsetting has been applied successfully for species at risk in the past, there are only a few examples where policies specifically addressed additional requirements needed to implement habitat offsetting for species at risk. Where the policies were specific, the magnitude of habitat offsetting was required to be much higher than the level of the habitat impact.

There is still considerable scientific debate about the effectiveness of offsetting with the most frequent criticism surrounding a) the lack of empirical evidence for effectiveness; b) concerns that the eventual opportunity to offset residual impacts relaxes the rigour of other stages of the mitigation hierarchy; and c) the idea that offsetting involves allowing habitat or species losses in exchange for uncertain future improvements in habitat or a species' population trajectory. Moreover, following the literature review, defensible criteria for evaluating population responses to habitat offsetting were not found. There is still uncertainty around understanding how vital rates respond to offsetting measures in the species at risk context.

Following the literature review, scenarios were developed in the proposed framework for whether and how offsets could balance residual impacts to population growth, including their associated uncertainties. To determine the level of offset required, an integrative metric is needed to assess the population response to both the impact and offset with relevance to survival and recovery outcomes. Following the development of the scenarios, it was determined that a change in population growth rate is a logical metric to evaluate the equivalency of a given offset as it can be linked to both jeopardy and recovery. However, determining the suitability of offset implementation requires evaluating the probability of achieving gain in population growth rate due to the offset, relative to the loss in population growth rate due to the residual impact. Significant monitoring data related to the long-term function and outcomes of offsetting in aquatic environments would be required for such a detailed evaluation, and were not available at the time of the review and would also not likely be available for most species at risk. However, implementing offsets in advance of the w/u/a would allow effectiveness to be assessed on a case-by-case basis and prior to the application of residual impacts, which in-turn would reduce some uncertainty around offset function.

Integration of the Proposed Jeopardy Assessment Framework Components in Support of Section 73

The proposed components of this framework are relevant for making a determination of harm to SARA-listed species under Section 73. The integration of the following framework components is recommended (Figure 4):

1. A description of the pre-impact state of SARA-listed species and their habitat including:
    a. A description of the population state (growth rate, λ). Population state can be evaluated directly, or by inferring one of the five states (booming, growing, stable, declining, crashing). This step should also determine whether a population model exists for the species.
    b. A description of the habitat state. Understanding the baseline state of habitat requires identifying the habitat features that are important to the population.
2. An estimate of the change in habitat condition and species' vital rates imposed by the individual w/u/a
    a. A description of the changes to the state of habitat, informed based on an evaluation of the habitat variables likely to be affected by the w/u/a, using DFO's PoE.
    b. An estimate of the changes to vital rates that considers: i) the number of likely habitat variables influenced by the project, ii) which vital rates they influence (e.g., a single rate may be influenced by multiple habitat variables), and iii) the nature of interactions between habitat stressors and vital rate responses. In some cases, the project itself will impose changes to vital rates as a consequence of direct effects (e.g., death of individuals due to construction activities).
    c. An estimate of changes in population growth rate.
    d. An estimate of the change in population growth rate associated with an offset (if pursued).
3. An estimate of the change in population productivity imposed by all other w/u/a and non-w/u/a factors over the permitting period. To ensure that survival or recovery of the wildlife species is not jeopardized, an individual w/u/a cannot be assessed in isolation. Thus, an assessment must be made of the change in population productivity of all other w/u/a over the permitting period. Additionally, the change in expected population growth rate imposed by non-w/u/a factors must also be considered (e.g., expectations for population growth due to recovery measures or population decline due to threats or stressors).
4. Combine information in steps 1 through 3 and make decision about individual w/u/a.

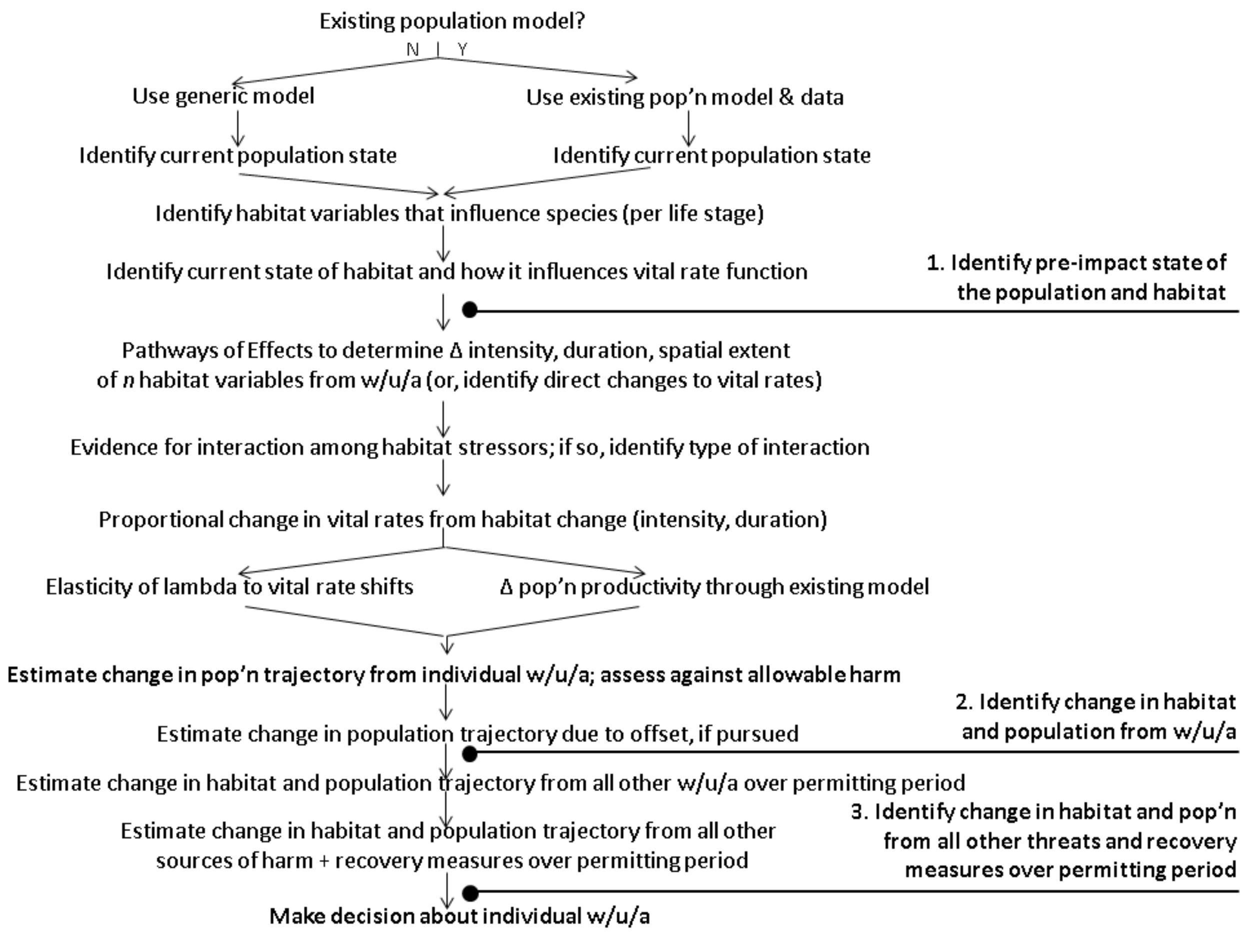

Figure 4. Conceptual framework to evaluate the harm of an individual w/u/a to a SARA species in relation to all other sources of harm and recovery measures over the permitting period. Steps 1 and 2 follow the three-component framework for evaluating an individual w/u/a shown in Figure 1.

Sources of Uncertainty

There are uncertainties in the components of the framework. As the framework is further developed and implemented as a decision-making tool, strategies for managing risk associated with model assumptions and other knowledge gaps need to be incorporated.

In most cases, knowledge on species at risk is limited, which may limit quantitative assessments of allowable harm. As many of the species included in the analysis are rare and not well known, there were significant gaps in data availability for many species. Values found in the literature or estimated from relationships were used to fill in the gaps, however, the incorporation of estimated values in the analysis may lead to an under-representation of the diversity in life-history characteristics. The population model in Section C provides general patterns among species, recognizing several inherent uncertainties. Extending the elasticity analysis beyond at-risk species may allow for increased diversity of life-history characteristics and elasticity patterns that could then be modelled with greater certainty.

There is also uncertainty around the elasticity patterns produced by alternative (non-stable) population growth rates. Alternative population growth rates were obtained by simulating habitat impacts on stable populations. While it was attempted to apply harm to certain life stages in a manner that reflected taxa-specific threats, their application across all species within a taxa may not be appropriate. As a result, the elasticity patterns produced by alternative population growth rates represent hypotheses of threats and may differ from population-specific results when threats differ. Further work into how threats affect different life stages is required to clarify the impact on elasticity patterns.

There is currently insufficient knowledge to fully understand the relationships between habitat condition and vital rates for species at risk. Deriving meaningful links with population models requires understanding which habitat features maximize the productivity of a species, ideally broken down into the contribution of each habitat feature on each life stage and life-history process. This information is difficult to obtain for most species at risk and thus generalities drawn from studies of freshwater mussels and fishes were used to identify the main effects of habitat stressors on a population. Given the uncertainties regarding how habitat relates to productivity, additional work is needed on how to integrate multiple habitat stressors and sub-lethal effects for both linear and non-linear responses.

Although habitat offsetting is a commonly used tool, the literature review found few examples where policies specifically addressed additional requirements needed to implement habitat offsetting for species at risk. Where the policies were specific, the magnitude of habitat offsetting was required to be much higher than the level of the habitat impact. Based on the current state of knowledge, it was determined that there was a lack of defensible criteria for evaluating population responses to offsetting and uncertainty around how vital rates respond to habitat offsets for species at risk. Detailed, long-term monitoring datasets that include control sites would be needed to parameterize models to evaluate the likelihood that an offset could achieve a given change in population growth produced in the three-stage framework. In the absence of such data, implementing offsets in advance of the w/u/a on a case-by-case basis would allow species responses to offsets to be monitored and confirmed prior to a project's residual impacts.

The proposed jeopardy assessment framework does not consider or assume density-dependent effects, and thus assumes no relief from population compensation as a result of development impacts. This approach represents a precautionary viewpoint.

CONCLUSIONS AND ADVICE

The proposed framework components are designed to determine the probability that an individual project will lead to a given change in the population growth rate of a SARA-listed species. The jeopardy assessment framework should include three main components: 1) the relationship between an individual w/u/a and changes in habitat condition, including proposed offsets (if pursued), 2) the relationship between changes in habitat condition and vital rates; and, 3) the relationship between changes in vital rates and a population's response.

The impacts of a w/u/a on species' survival and recovery can include direct effects, such as animal strikes during construction, and indirect effects, such as sub lethal effects or habitat changes that lead to impaired growth, fertility, and survival, as in the loss of critical habitat extent. Direct and indirect effects can occur together and may interact. The sensitivity of a species to these impacts depends on the identity and magnitude of the imposed vital rate changes, as well as the elasticity of the impacted vital rates and the nature of the interaction (if any). Additional work is needed on how to integrate the effects of multiple habitat stressors on vital rates for both linear and non-linear responses. DFO Pathways of Effects models are suggested as a way of linking the effects of w/u/a to changes in habitat condition.

There is uncertainty around how species at risk respond to offsetting measures. Offsetting should thus be used only in exceptional circumstances after first considering avoidance and then mitigation of the threats. If offsetting is pursued, implementing the offset in advance of the w/u/a on a case-by-case basis would allow the function of the offset to be assessed prior to residual impacts.

This proposed jeopardy assessment framework is relevant for making a determination of harm to SARA-listed species under Section 73. It is not intended to replace more robust population models or frameworks, but is meant to provide a potential, standardized approach for data-limited species. The framework as presented is still conceptual; approaches and next steps to operationalize the framework could be assessed in a future meeting. If operationalized into a decision-making toolkit, the framework will help to provide a scientific, nationally consistent basis for the transparent determination of Subsection 73(3)(c) of SARA.

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SOURCES OF INFORMATION

This Science Advisory Report is from the November 6-8, 2018 National Science Advisory Process on Science Advice to Support the Jeopardy Assessment Framework for Permitting under the *Species at Risk Act*. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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