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Terms and Concepts Used in the *Species at Risk* Program

Termes et concepts utilisés dans le programme sur les *espèces en péril*

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Abstract

Clarification of the interpretation of a number of terms associated with the *Species at Risk Act* is required to improve the national consistency of the application of these terms. The facilitate the discussion of these terms, working papers were prepared on the following topics: Damage / Destroy / Destruction; Residence; On the Identification of Prey as Critical Habitat; The Acoustic Environment as a Dimension of Critical Habitat under SARA: A Marine Mammal Perspective; Feasibility of Recovery in the SARA Context; and Threats to Species at Risk and Their Habitat.

Résumé

Il est nécessaire de préciser l'interprétation d'un certain nombre de termes liés à la *Loi sur les espèces en péril* (LEP) afin d'améliorer l'uniformité à l'échelle nationale de l'utilisation de ces termes. Pour faciliter la discussion sur ces termes, des documents de travail ont été rédigés sur les sujets suivants : Dommage/Détruire/Destruction; résidence; la détermination de l'habitat essentiel des proies; l'environnement acoustique à titre de dimension de l'habitat essentiel en vertu de la LEP : sous l'angle des mammifères marins; la faisabilité du rétablissement dans le contexte de la LEP; les menaces qui pèsent sur les espèces en péril et sur leur habitat.

Introduction

A workshop was held in August 2007 to develop new guidelines for Recovery Potential Assessments (Science Advisory Report 2007/039) and to provide advice on identifying and quantifying critical habitat (Science Advisory Report 2007/038). During discussions at the workshop, many participants identified the need for clearer guidance on how to interpret and describe a number of terms and concepts that are discussed and identified in Recovery Potential Assessments (RPAs), recovery strategies, action plans and other SARA related documents. Additional guidance is needed for the Department (and Science Sector) to interpret these terms in a consistent way from Region to Region and from stock to stock. For many of these terms there are Policy, Habitat and Science aspects to their interpretation and these boundaries need to be clarified further. To address these concerns, a workshop was held in 2008 to provide guidance in interpreting a number of terms used within the SARA.

For the terms under discussion, SARA experts were invited to prepare working papers that provided background information on the issue, the problem interpreting this term in the SARA context, factors to be considered in interpreting the term and possible solutions on how to interpret the term. These papers were provided to the meeting participants in advance of the workshop and were finalized after taking into account the discussions heard during the workshop.

The proceedings of the workshop are posted on the Canadian Science Advisory Secretariat (CSAS) website (Proceedings Series 2009/043) and guidance on the interpretation of the SARA terms is posted in the CSAS Science Advisory Report Series (2009/065).

Section 1: Damage / Destroy / Destruction by Tola Coopper

Background: Interpretation under SARA

The terms damage and destroy are included in the prohibitions of SARA regarding residence and critical habitat that state;

- 33. No person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada.
- 58. (1) No person shall destroy any part of the critical habitat of any listed endangered species or of any listed threatened species, or of any listed extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada.

Under section 73 of SARA an agreement or permit may be issued authorizing an activity affecting a listed species residence or any part of its critical habitat;

- 73. (1) The competent minister may enter into an agreement with a person, or issue a permit to a person, authorizing the person to engage in an activity affecting a listed wildlife species, any part of its critical habitat or the residences of its individuals.

Section 73 makes it possible, so long as the pre-conditions of SARA section 73.3 are met, to authorize the damage or destruction of the residence of a species at risk and the destruction of any part of a listed species critical habitat. The term ‘destruction of any part of the critical habitat of a listed species’ is implied by section 73 of SARA and is actually used in section 77 of SARA that discusses permitting under other Acts of Parliament.

Both residence and critical habitat reflect habitat requirements for a species at risk so guidance is required on how the terms affect the respective habitat type. The definitions for habitat, critical habitat and residence under SARA are as follows;

- Habitat for Aquatic Species: spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced
- Critical Habitat: habitat that is necessary for the survival or recovery of a listed species and that is identified as the species critical habitat in the recovery strategy or action plan for the species
- Residence: a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating.

The residence concept refers to one or more individuals of a listed species and may not apply to all aquatic species whereas critical habitat will be identified for all listed species, to the extent possible, and refers to the species as a whole. Due to some of the unknowns around residence and its application to aquatic species less work has been done on residence and the term damage then critical habitat and the term destruction; damage does not apply to critical habitat.

In order to be able to implement, monitor and enforce SARA in a consistent manner it is important that we have clear guidance and understand what is meant by damage and destruction as it relates to habitat, whether it is a species residence or its critical habitat. Definitions or information on the terms should provide guidance on what constitutes damage to habitat and what constitutes destruction of habitat.

Discussion: Review of the factors to be considered in interpreting the term

Applicable 'Plain Word' Definitions

Applicable definitions for damage, destroy, destruction and habitat destruction are as follows;

Damage
- injury or harm to a person or thing, resulting in a loss in soundness or value

Destroy
- to put an end to; do away with
- to kill
- to neutralize the effect of
- to make useless

Destruction
- the act or process of destroying; demolition or slaughter
- the fact or state of being destroyed
- the cause or means of destroying

The online resource Wikipedia outlines habitat destruction as the process in which natural habitat is rendered functionally unable to support the species originally present or, a human-induced habitat change that results in a reduction, or loss of, of natural habitat

SARA

There have been attempts to define the destruction of critical habitat within SARA policy. The Environment Canada Species at Risk Recovery Program Federal Policy Discussion Paper: Critical Habitat, February 2004, defined it as;
- Destroy any part of: Any alteration to the topography, geology, soil conditions, vegetation, chemical composition of air/water, surface or groundwater hydrology, micro-climate, or sound environment of such a magnitude, intensity, or duration which significantly reduces the capacity of the critical habitat to contribute to the survival or recovery of the species at risk, based upon the biology of that species and as expressed in the approved Recovery Strategy / Action Plan.

And the Draft Policy on Recovery Planning from the SARA 5 Policy Suite defines it as;
- An activity should be considered to result in destruction when it results in a permanent loss of functions that are supplied by the critical habitat and that are necessary to the survival or recovery of the species, or a restorable loss of functions that have a significant negative effect on achieving the recovery goal of the species.

However, legal comments on the Draft Policy Guidelines on the Identification and Protection of Critical Habitat under SARA, version 3 dated April 2007, clearly state that SARA does not protect against anything less than destruction of critical habitat so these definitions as they stand would be too broad to meet the legal context of SARA.

With respect to residence the Environment Canada Species at Risk Recovery Program Federal Policy Discussion Paper: Residence, April 2004, and the Species at Risk Act Implementation Guidance, Draft Technical Guidelines on the Application and Description of Residence, April 2005 defined damage or destroy a residence as;

- Any alteration to the topography, geology, soil conditions, vegetation, chemical composition of air/water, surface or groundwater hydrology, micro-climate, or sound environment which either temporarily or permanently impairs the function(s) of the residence of one of more individuals.

Combining the definitions of damage and destroy may not accurately reflect the specific meaning of each term resulting in confusion, and a lack of consistency, around its application. For instance not all alterations of habitat will result in the destruction of a species residence (or critical habitat) and impairment is damage not destruction.

ESA

The Endangered Species Act in the US protects against not only the destruction of critical habitat, but also the adverse modification of critical habitat so the definition is not entirely applicable for destruction of critical habitat under SARA. It does provide some guidance to how the term was addressed in the US though, and we can look at adverse modification as it may reflect on damage.

Policy for the ESA defines the destruction or adverse modification of critical habitat as;

- A direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

It should be noted though that the US Courts have found this definition to be invalid, as critical habitat is aimed at recovery of the species it should be survival or recovery of the species (not survival and recovery), otherwise conservation is erased from the equation.

The Fisheries Act

The habitat protection provisions of the *Fisheries Act*, similar to the prohibition and permitting sections of SARA, outline what is prohibited and what can be authorized with respect to fish habitat.

- 35. (1) No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.
- 35. (2) No person contravenes subsection (1) by causing the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister or under regulations made by the Governor in Council under this Act.

The Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff, version 1.0 defines destruction as;

Destruction

- Any permanent change of fish habitat that renders it completely unsuitable for future production of fish, regardless of the means employed in causing the change (e.g. by removal, infilling, blockage etc.)

The definitions of harmful alteration and disruption, also within the Risk Management Framework Guide, are relevant descriptions of damage to habitat and hence can be used as guidance for damage to the residence of a species at risk.

Harmful Alteration

- Any change to fish habitat that reduces its long term capacity to support one or more life processes of fish, but does not permanently eliminate the habitat

Disruption

- Any change to fish habitat occurring for a limited period that reduces its capacity to support one or more life processes of fish.

Guidance and Recommendations

Damage: Residence

Under SARA the term damage refers to the residence, defined as a dwelling-place, of a species at risk so the term must be applicable to habitat that would be consistent with the residence concept under SARA. Residence is likely to include host species, breeding habitat where nests are guarded or provide dwellings for juveniles and certain rearing, staging, wintering, feeding or hibernating areas where the concept of a dwelling place can be applied.

Some of the language that is applicable to the definition of damage under SARA includes:

- harmful alteration, disruption, loss of soundness or value
- temporary or permanent reduction in function of the habitat as a residence
- negative change in chemical, physical, biological attributes of habitat that alters the ability of fish to use the habitat

Examples of damage:

- substrate disruption
- water temperature change
- change in flow
- injury or harm to host species
- aquatic vegetation alteration

Proposed SARA Definition - Damage to the Residence of a Species at Risk:

- *Any change to the species residence, temporarily or long term, that reduces its capacity to be occupied, or habitually occupied, by one or more individuals during all or part of their life cycles.*

Destroy / Destruction: Residence and Critical Habitat

Under SARA the term destroy, and hence destruction, applies to the residence of a species at risk and the critical habitat of a species at risk. To destroy a species residence the dwelling place, or access to it, will have to be eliminated or no longer exist. To destroy any part of the critical habitat of a species at risk may be more complicated to determine when a permanent loss of habitat or function has occurred and it will be important to provide guidance around the term, though it must be applied case by case as species requirements will vary. The biological needs for each species are essential to know when critical habitat is being destroyed.

Some of the language that is applicable to the definition of destruction under SARA includes:

- habitat no longer exists
- ex. spawning habitat no longer suitable for successful breeding, food supply habitat no longer produces sources of food etc.
- a permanent change to the habitat that renders it unsuitable; habitat is rendered functionally unable to support the species originally present
- a permanent loss of functions supplied by the habitat; habitat components have been neutralized to the point they no longer function

Examples of Destruction:

- lack of water
- fill
- alteration or elimination of suitable spawning substrates
- significant changes in water temperature
- substrate removal
- channel diversions or obstructions
- habitat conversion

Proposed SARA Definition - Destruction of Critical Habitat:

- *A permanent change that renders the habitat unsuitable for survival or recovery of the species; a permanent loss of the physical, biological or chemical functions of the habitat that eliminates its utility for survival or recovery of the species at risk.*

Proposed SARA Definition - Destruction of the Residence of a Species at Risk:

- *A permanent change to the habitat, or dwelling place, that eliminates the residence, or the use of the residence, of a species at risk.*

Outstanding Issues

- For critical habitat how do we deal with the cumulative impacts of activities, both direct and indirect, that are not destroying the critical habitat individually, but where multiple projects of the same risk level might over time lead to destruction. There may also be works that may not destroy critical habitat initially, but if left unchecked could in time.
- We have to be very careful about how the concept of habitat function is used, what is meant by it and how it is addressed using SARA and the *Fisheries Act*. Is the function of habitat to provide a specific requirement, or habitat type, or is the type of

habitat a function of the physical, chemical and biological attributes of the environment or both?

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Section 2: Residence by Andrea Doherty

Background

SARA defines residence as:

> "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating" [s.2(1)].

SARA prohibits damaging or destroying a listed threatened, endangered, or extirpated species' residence;

> "no person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada" [s.33].

This prohibition comes into effect immediately upon listing for all threatened, endangered and extirpated species on federal lands, and for species under federal jurisdiction on all lands [s.34(1)].

SARA also contains a "safety net" provision to prohibit the damage or destruction of residences of non-federal species on provincial, territorial and private lands if the Minister of the Environment considers it necessary to do so, by way of an Order by the Governor in Council (GIC), [s.34(2),35(1)].

Environment Canada drafted a Federal Policy Discussion Paper in April, 2004 and posted it for consultation on the SARA registry. Environment Canada also developed templates for developing residence descriptions and for developing rationale for when the concept of residence does not apply. DFO participated in the development of the paper via a workshop in January 2004, however consensus could not be reached to move forward on an overall "federal" position for the development of guidelines. DFO reviewed Northern and Spotted wolffish, Mudpuppy Mussel, Morrison Creek lamprey, Inner Bay of Fundy Atlantic salmon, Lake Utopia smelt and Enos Lake, Paxton Lake and Vananda Creek stickleback.

A DFO Residence Working Group which was tasked in early 2006 to develop a policy on how the residence concept could be applied to aquatic species and develop departmental specific guidelines for developing, reviewing and approving residence descriptions. The activity of the Working Group ceased in late 2007.

The overall purpose of SARA, and hence the objective of residence identification, is to maximize the chances that a species at risk will recover and minimize the risk of species loss. The original intent of SARA was to give immediate protection to crucial nest or den-like structures because of the time-lag before critical habitat is identified in a recovery strategy. Critical Habitat is a population-based concept, while residence is applicable at the level of the individual. The intent of the residence prohibition is to protect specific sites for an individual of a species to successfully carry out specific, crucial functions of their life-cycle.

Problems with Interpretation of Residence

- The concept of residence may or may not apply for aquatic species.
- It is possible for a species to have more than one type of residence (e.g., a shelter for overwintering and a site for spawning), however the components should be described separately for each type of residence.
- Although not mandated specifically under SARA, enforcement of the prohibition would be aided with the development of publicly available guidelines that would help identify residences for listed aquatic species or of a publicly available residence description.
- **What are the parameters used to describe residences?**
- **Can a living host species be a residence?**
- What constitutes damage or destruction of a residence? This is not discussed in this paper as it is covered in another section of this workshop.

It may be the case that the concept of residence does not apply to every aquatic species. When the concept does apply, species-specific residence descriptions based on the best available evidence are required as a matter of policy. Documentation of the rationale behind whether the concept applies to each species is important. Residence descriptions should provide general information on what may constitute damage or destruction of the residence.

Does the residence concept apply?

To promote national consistency in determining if the concept applies, it is recommended to evaluate the ecology of the species against the three basic criteria for having a residence:

1) Do individuals of the species use a specific, discrete dwelling place that is similar to a den or nest?
2) Are these places occupied or habitually occupied by the individual(s)?
3) Are these places crucially linked to the performance of a specific function, so if that location is not available, or has been impaired, the function will not be carried out successfully at that time?

If all of these conditions are met, then the residence concept applies to the species. It is worthy of re-emphasizing two important policy concepts in the above:

1) that the specific location must relate to a crucial function in the life cycle of an individual, and
2) that the specific location is essential to the carrying out of that function by the individual at that time.

These two concepts become extremely important in the spatial and functional delimitation of where a residence is or is not on the landscape. If these conditions are met, then the residence concept applies to the species.

Description/Interpretation

The minimum standard for preparing residence descriptions should be a narrative that generally describes the residence and its ecological context and function – it is not necessary to include specific locations of residences within residence descriptions.

Ideally, the description of a "residence" should include:

1) A physical site or location including, where applicable, a delimited spatial area;
2) A temporal period, up to and including permanent;
3) A suite of described biological and physical attributes outlining the conditions required to carry out the crucial functions.

These attributes can be pre-existing or the result of intentional modification by the species.

Examples of how a residence may be similar to a den or nest include characteristics such as; strong site fidelity, the use of a structure (either pre-existing or modified by the species), provision of shelter and security, or a link between a specific location and an essential life function. There is also a notion of 'investment' involved in a residence. If it is damaged or destroyed, the individual cannot fulfill that function at that time. It is not merely a place where an individual spends a lot of time. The definition of residence in SARA makes it quite clear that a residence is a specific, discrete dwelling place used by an individual(s) of the species for a very specific function, rather than a more general type of habitat (which is dealt with by the Critical Habitat provisions in SARA).

A residence must be occupied or habitually occupied, which means that the dwelling-place must be occupied by at least one individual of the species or there should be a reasonable expectation that the individual(s) will return. This has several implications, such as; an extirpated species cannot have a residence until it has been reintroduced into Canada, a residence can be protected even if the individual is absent and, there is a temporal aspect to the length of time the prohibition remains in effect. There are many possible temporal patterns in the use of a residence (e.g., occupied for a period of time once a year and never used again; occupied for a period of time once a year but reused every year, etc.). The time frame under which the prohibition remains in effect should relate to the pattern of occupancy by the individual.

These crucial functions are:

- Breeding
- Rearing of young through stages that can only be accomplished at that type of site under specific conditions
- Staging for migration
- Wintering, or sheltering from harmful, routine climatic conditions
- Hibernation or estivation

Living Host as residence

While it is unlikely that living hosts as residence was envisioned when this section of SARA was written, the wording of the definition could be interpreted that the host is a dwelling place that is habitually occupied by the species at risk, such as the glochidia of freshwater mussels.

For example, during the glochidial (parasitic, pre-juvenile) stage, Wavyrayed Lampmussel (*Lampsilis fasciola*) residence can simply be described as the gill tissue of the Smallmouth Bass (*Micropterus dolomieu*) as this is its only requirement for survival and successful transformation to the juvenile stage.

In the adult form, freshwater mussels are basically sessile; movement is limited to a few metres of the lake or river bottom. The only time that significant dispersal can take place is during the parasitic phase. Infected host fishes can transport the larval unionids into new habitats, and can replenish depleted populations with new individuals. Dispersal is particularly important for genetic exchange between populations.

Living hosts will not have one discrete location, however, it is possible to identify a boundary or territory for a host species. Within this boundary, the host species could be identified as residence and the prohibitions apply. However, is there any added value in identifying the living hosts as residence? If the host species can be protected using other legislation, then rationale can be provided that a living host is not a residence but an important component of their life cycle. Additionally, individuals of the SAR species (glochidia) are protected under section 32. As long as there is sufficient population of host species, there is no evidence that individual mussels rely on an individual fish, and in many cases there are more than one host fish species (one known exception is the snuffbox and log perch interaction).

Legal services is supportive of the position not to include the living host as residence if through the recovery strategy and its implementation, we include management measures to ensure that enough individuals of the host species are available to the listed species in order to achieve recovery objectives. We would have to include this requirement in recovery planning guidelines.

Additional questions will need to be clarified around protection of residence if a living host is considered a residence. Is the specific host protected all year or only during the time of year when larvae are present? Is the entire host species protected or just a portion of the population? There are jurisdictional implications and impacts with managing a host species that is not at risk (provincially regulated recreational fisheries, recovery strategies, threats to the host species which may be very different from threats to the SAR species)

Recommendation on how this fits into the Act/SARA program

The federal *Fisheries Act* may represent the most important legislation protecting mussel habitat in Canada. Freshwater mussels are considered to be shellfish and, as such, are included in the definition of “fish” under this Act. Given the broad definition of “fish habitat” under the *Fisheries Act* and the protection provided by the habitat provisions of the *Fisheries Act*, any aquatic SAR residence would necessarily be captured within that *Fisheries Act* protective mechanism. Therefore, in sum total, those residences have been effectively protected even prior to SARA and no other measures or consultations should be necessary.

Residence is a subset of habitat and there has been extensive discussion that residence should be based on geo-physical attributes and limited to geo-spatial areas. However, as with critical habitat, is there the ability within SARA to protect features of residence that are not physical or chemical properties of the environment?

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Development of Residence Descriptions for Species at Risk in British Columbia

Section 3: On the Identification of Prey as Critical Habitat
by Marten A. Koops and Todd J. Morris

> "The purposes of this Act are to prevent wildlife species from being extirpated or becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened."
>
> - *Species at Risk Act*, section 6

A recent Memorandum for the Deputy Minister on Northern and Southern Resident Killer Whales Designation of Prey as Critical Habitat in *Species at Risk Act* Recovery Strategy (file number: 2007-025-00053), raised concern over the possibility of identifying prey species (in this case Chinook and Chum salmon) as critical habitat. While the proposed Recovery Strategy and a peer review of possible critical habitat did not identify prey as critical habitat (Ford 2006, DFO 2006), concern has been raised that identifying prey as critical habitat would have the effect of *de facto* classifying the prey species as protected species. As outlined in the Memorandum (file number: 2007-025-00053), DFO's current position appears to be that critical habitat should be identified based on geo-physical attributes and is limited to geo-spatial areas. However, the need for guidelines on "...how to treat habitat features that are not physical or chemical properties of the environment (such as food supply, sound, etc.)" has also been identified (DFO 2007).

What is Critical Habitat?

> "Critical Habitat means the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' Critical Habitat in the Recovery Strategy or in an Action Plan for the species"
>
> - *Species at Risk Act*, section 2(1)

This definition, while telling us that critical habitat is the amount of habitat needed for the survival or recovery of the species, is not prescriptive about what constitutes critical habitat. Presumably, any habitat features that affect the survival or recovery of species at risk should be taken into consideration.

What is Habitat?

The *Compact Oxford English Dictionary* defines habitat as "the natural home or environment of an organism" which is consistent with Krebs' (1994) ecological definition of habitat as "...any part of the biosphere where a particular species can live, either temporarily or permanently". Dennis et al. (2003), Mitchell (2005), and Kearney (2006) provide a selection of definitions that demonstrate how the ecological literature on habitat has shifted from purely physical to resource-based definitions of habitat (see Table 1 for a selection of these definitions). However, it is the definition of habitat in Canadian legislation that is important for the identification of critical habitat. The *Species at Risk Act* (SARA) defines habitat for aquatic species as

> "...spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order

> to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be re-introduced"
>
> - *Species at Risk Act*, section 2(1)

which is consistent with the *Fisheries Act* where

> "Fish Habitat means spawning grounds and nursery, rearing, food supply and migration areas on which aquatic species depend directly or indirectly in order to carry out their life processes"
>
> - *Fisheries Act*, section 34(1)

The proposed text for the new Fisheries Act, while re-worded is consistent

> "Fish Habitat means any areas on which fish depend directly or indirectly in order to carry out their life processes, including spawning grounds, nursery areas, rearing areas, food supply areas and migration areas"
>
> - proposed text of new *Fisheries Act*, section 3

All of these legislative definitions of habitat are consistent with the interpretation that habitat, *per se*, is a geo-spatial area. However, these definitions also articulate the need to describe and identify habitat based on attributes pertinent to the life processes of aquatic organisms (fish). This would be consistent with a wider resource-based definition of habitat (e.g., Dennis et al. 2003).

What is Prey?

Prey does not need to be entirely consumed, and a typical ecological definition of the predator-prey interaction is where one species obtains a benefit at the expense of another species (i.e. it is a +/- interaction). The cost to the prey may range from a mild energetic cost up to either direct or indirect mortality. This then encompasses what is typically considered to be predation where one organism (the predator) consumes some or all of another organism (the prey) resulting in mortality of the prey. It also includes herbivory where the "prey" is a plant and host-parasite interactions where the "prey" provides more than just energetic support to the "predator". Krebs (1994) defines a host as an "organism that furnishes food, shelter, or other benefits to another organism of a different species". Therefore, we shall consider prey under two categories: organisms that serve as food and organisms that serve as hosts. In either case, prey is a resource (limiting or non-limiting) that affects fitness (Abrams 1992) and can be expected to affect habitat selection and the population dynamics that influence survival and recovery (Goss-Custard and Sutherland 1997). But, should prey (food or hosts) be considered critical habitat?

Food as Critical Habitat

Animals, including fish, select habitats based on multiple attributes (Wootton 1990, Goss-Custard and Sutherland 1997). Some of these attributes include substrate, complexity, refuges, food, predators, oxygen, temperature, and the presence of conspecifics. For example, the ideal free distribution (IFD; Fretwell and Lucas 1970) predicts that organisms will distribute themselves across habitats based on the distribution of resources, such as food. There has been considerable basic research on habitat selection that supports the idea that food, as a resource essential for survival, growth and reproduction, will influence habitat selection. Werner and Hall (1974, 1979, 1988) provided the classic studies showing that Bluegill (*Lepomis macrochirus*) select

habitat based on trade-offs between foraging gains and predation risk. Conservation biology has discovered that re-introduced animals may ignore what scientists consider to be perfectly suitable habitat, settling for poor habitat, based on the presence of conspecifics in the sub-standard habitat and the absence of conspecifics in the suitable habitat (e.g. Morell 2008). These examples, and the ecological theory underlying this research, suggest that biotic attributes of habitat are as, or more, important than geo-physical attributes when fish select habitat.

Hosts as Critical Habitat

Animals with obligate parasitic life stages, such as freshwater mussels of the Family Unionidae (McMahon 1991), represent an interesting challenge when describing habitat requirements. During the encysted parasitic stage the host itself represents the primary habitat while other physical, chemical and biological components of the environment that maintain the host indirectly function as supporting habitat for the parasite. For example, during the glochidial (parasitic, pre-juvenile) stage, Wavyrayed Lampmussel (*Lampsilis fasciola*) habitat can simply be described as the gill tissue of the Smallmouth Bass (*Micropterus dolomieu*) as this is its only requirement for survival and successful transformation to the juvenile stage. Implied in that description is the need for indirect habitat to maintain and support the host during the period of encystment and to ensure that a suitable host supply is available at the time when the parasite requires it. It is these indirect components, the geo-physical conditions supporting the host, which are more typically perceived as habitat rather than the host itself. However the importance of host availability can not be overlooked as most other geo-physical elements become irrelevant if the host is absent.

It is important to note that the habitat conditions which support the host and thereby function as indirect habitat for the parasite may be radically different from those conditions which would be considered as direct habitat for other life stages of the parasite. In the case of unionid mussels, adults are typically small, benthic, sessile filter feeders while the hosts can be large, vagile predators. In keeping with the ecological and legislative definitions of habitat, any attempt to define critical habitat for an obligate parasite must consider the availability and functionality of the host as well as its habitat requirements.

Conclusions about Prey as Critical Habitat

The biotic attributes of a habitat can easily be affected by human activities. If aquatic organisms occupy (select) a habitat for the presence of food or hosts, then both the abundance and distribution of a species can be affected when its prey is affected by human activities such as exploitation of the prey species or development that affects water quality (e.g., even if the species at risk is tolerant to turbidity, if its prey is not then human activities that affect turbidity may indirectly affect the distribution and abundance of the species at risk). The food an organism consumes (its diet) can change based on the abundance of prey, its physiological state and the behaviour of competitors (Stephens and Krebs 1986, Giraldeau and Caraco 2000). Parasite distributions can be limited by host distributions (Lyons et al. 2007). Life history traits (growth, reproduction, longevity) can be affected by food supply (Roff 2002) and the availability of hosts, thereby affecting population dynamics and the survival and recovery of a species at risk. The purpose of the *Species at Risk Act*, and hence the objective of critical habitat identification, is to maximize the chances that a species at risk will recover and minimize

the risk of species loss. If the attributes of habitat protected for the survival and recovery of a species change to the point that the species at risk partially or entirely selects other habitat, then the function of critical habitat is compromised or negated.

Prey, either as food or hosts, need not be defined as habitat *per se* to be included in the identification of critical habitat for a species at risk. Habitat has many important attributes that extend beyond the geo-physical. Any description of critical habitat should include the attributes that are important to the species at risk. These attributes may include prey presence and abundance. While this would not provide the *de facto* protection to a prey species that defining them as critical habitat would provide, it is consistent with the legislated definitions of habitat and the body of scientific knowledge and theory about the behaviour and ecology of animals. It will, however, require that prey species be managed to maintain the attributes of critical habitat needed for the recovery and survival of species at risk. In the case of the Killer Whale, this would require fisheries management strategies and exploitation levels for Chum and Chinook salmon that do not compromise the quality of identified critical habitat for Killer Whale foraging. Likewise, in the case of parasitic species a clear strategy to ensure the maintenance and supply of the host species would be necessary to ensure adequate protection of the critical habitat of the parasite. Maintaining the function of critical habitat requires the management of habitat and human activities outside of the area identified as critical habitat, recognizing that critical habitat and the species at risk are embedded in a broader landscape that must be managed for the survival and recovery of the species at risk (Rosenfeld and Hatfield 2006). While potentially consistent with advice on the functional description of habitat (guideline 1; DFO 2007), this does require defining “habitat feature” broader than just physical features.

By extension, similar arguments could be made for any other attribute of habitat necessary for the completion of an aquatic organism’s life processes. This implies that an ecosystem approach (e.g. Christie et al. 1986, Likens 1992, Jennings 2004, Koops et al. 2009) must be used for the conservation of species at risk, particularly when defining habitat, identifying critical habitat, and managing those components of the ecosystem that affect habitat attributes. Descriptions of habitat cannot be limited to space and time (area), but need to answer questions about why a species is using the area and what resources in the area affect survival and recovery.

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Table 1. A selection of ecological definitions of habitat (compiled by Dennis et al. 2003) that demonstrate the historic shift from a physical to a resource-based perspective on habitat.

Definition of habitat	Original source
Place, living space, where an organism lives	Odum (1963)
Locality, site and particular type of environment occupied by an organism	Lincoln et al. (1982)
Habitat is a suite of resources and environmental conditions that determine the presence, survival and reproduction of a population	Caughley and Sinclair (1994)
Habitat [as] the resources and conditions present in an area that produce occupancy – including survival and reproduction – by a given organism; ...it is the sum of the specific resources that are needed by organisms	Hall et al. (1997)

Section 4
The Acoustic Environment as a Dimension of Critical Habitat under SARA: A Marine Mammal Perspective by John K.B. Ford

Background

It is widely recognized that anthropogenic sound has the potential to cause behavioural disturbance and, in extreme cases, physiological harm to marine mammals. However, in the context of SARA, it has been unclear whether anthropogenic sound should be considered solely as a source of direct effects on the individual animal, or more broadly to include effects on the acoustic environment of a listed species' Critical Habitat. The following is intended to provide a brief overview of the varied roles of underwater acoustics in the lives of marine mammals. This should clarify that it is important for SARA-listed species to be protected from the impacts of anthropogenic sound both in terms of direct effects on individuals and as mediated through effects on the acoustic environment of their Critical Habitats.

Underwater Sound and Marine Mammals

Water is a far superior medium for the transmission of sound than is air – sound in water travels faster (4-5X) and suffers much less attenuation over distance than does sound above water. Marine mammals use specialized adaptations to take advantage of these attributes of underwater sound in two main ways: 1) the active production of sounds for the purpose of facilitating various life history processes and 2) the passive reception of ambient sounds to gather information about the environment. Acoustics is the primary sensory medium for marine mammals while underwater, as the use of both vision and chemoreception, though important to terrestrial mammals, is typically highly constrained in the aquatic environment.

Purposely produced sounds of marine mammals fall into two functional categories: 1) signals for social communication, and 2) signals for orientation and discrimination of objects in their environment. There can be overlap in these functions, as sounds produced for social purposes may also convey information about the animals' surroundings and orientation, and vice versa.

The functions of underwater social signals have been well studied and even a summary review is beyond the scope of this paper. Common functions, however, include contact and coordination within social groupings (e.g., dolphin whistles, sperm whale clicks, killer whale calls), territorial displays (e.g., bearded seals, Weddell seals), breeding displays (e.g., humpback whale songs), and communication of group identity (e.g., sperm whale codas, killer whale calls). An important function of social signalling in the context of foraging is likely coordination of cooperative prey capture techniques, as seen in killer whales (Van Opzeeland et al. 2005; Ford and Ellis 2006) and humpback whales (Sharpe 2001).

Sounds generated for the purpose of orientation and discrimination are generally confined to echolocation clicks produced by odontocete cetaceans (toothed whales, dolphins and porpoises). Echolocation of small odontocetes has been well studied in the captive setting, and numerous studies have demonstrated the exceptional abilities of these animals to acoustically discriminate objects in their environment. Research on

free-ranging odontocetes suggests that the use of echolocation is important for navigation, orientation, and for detection and capture of prey. Baleen whales appear not to produce sounds for the primary purpose of echolocation, though there is evidence that echoes from their social signals may be used for navigation (e.g., bowheads moving through ice, George et al. 1989). There is no evidence that pinnipeds echolocate.

There is growing recognition in the scientific community that the passive detection of ambient sounds is important to marine mammals. For example, much of the diet of bottlenose dolphins consists of soniferous species of fish that are located at long ranges by passive listening (Gannon et al. 2005). Mammal-hunting killer whales use passive listening in preference to active echolocation to locate prey, possibly to avoid being detected by their acoustically-aware prey (e.g. pinnipeds, small odontocetes) (Guinet 1992; Barrett-Lennard et al. 1996). These predators likely cue on the vocalizations of their prey, or on sounds made incidental to swimming or breathing at the surface. Pinnipeds do not echolocate, but appear to rely extensively on passive listening to locate prey (Schusterman 2000) or to detect and avoid predators (Deecke et al. 2002). Most marine mammal species likely make use of ambient sounds produced by physical features of their environment (e.g., ice cracking, surf, tide rips) or of biological origin (e.g., snapping shrimp in nearshore waters) as aids to orientation and navigation (Norris 1967).

An additional potential use of underwater sounds by marine mammals is the intentional herding and manipulating of prey through vocalization for the purpose of predation. Examples include calls used by bottlenose dolphins while hunting salmon (Janik 2000) and by humpback whales while feeding on herring (Leighton et al. 2007).

Impacts of Anthropogenic Noise on Marine Mammals

Anthropogenic underwater sounds include those created deliberately (e.g., sonar, seismic testing) and those that are produced unintentionally (e.g., motorized vessels, pile driving). Such sounds can affect marine mammals in three main ways: 1) by causing short- or long-term physiological effects (e.g., temporary or permanent threshold shift of hearing acuity), 2) by triggering disruptive behavioural responses, and 3) by auditory masking of the reception of an animal's own signals (e.g., echoes from echolocation clicks), the signals of conspecifics, or natural ambient environmental sounds (see recent reviews by Hildebrand (2005), Nowacek et al. (2007) and Weilgart (2007)). The potential results of these effects are many, but may include reduced social contact and sensory integration within groups, disruption of normal behaviours, displacement from ensonified areas, reduced foraging efficiency, increased rates of predation, and so on. Several cetacean species, including humpback whales (Miller et al. 2000), belugas (Lesage et al. 1999) and killer whales (Foote et al. 2005) have been shown to change the duration, frequency and rate of vocalizations in response to anthropogenic noise.

Acoustics as a Biophysical or Functional Attribute of Critical Habitat

The underwater acoustic environment is an important biophysical component of marine-mammal habitats. Studies have shown that, as in terrestrial vertebrates, the structure of marine mammal vocalizations is shaped by the natural ambient noise spectrum of particular habitats so as to optimize the efficiency of communication and echolocation (e.g., Morisaka et al. 2005). Ambient noise provides marine mammals with cues that aid in navigation, orientation, prey capture and predator avoidance, thus the acoustical properties of a particular habitat can enhance or constrain its suitability or quality. For

example, particularly quiet habitats with low natural ambient noise may be of benefit to predators that rely on passive listening to detect prey (e.g., mammal-hunting killer whales). On the other hand, a noisy habitat (e.g., shallow waters near surf) may provide the potential prey of killer whales with an acoustic 'cover' that reduces the risks of predation.

Changes in underwater ambient noise in a habitat, whether it be due to natural (e.g., wind, rain) or human (e.g., vessel noise) causes, can affect a marine mammal's ability to function in that habitat. Increased broadband noise reduces the signal-to-noise ratio and thus the auditory detection thresholds of marine mammals, potentially making animals less able to detect and discriminate faint vocalizations of dispersed group mates, returning echoes from objects such as prey in their habitat, or the sounds of prey or predators. Marine mammals are no doubt adapted to natural fluctuations in the ambient noise in their environments, but may not be able to accommodate to loud or chronic anthropogenic sounds.

For almost all SARA-listed marine mammals in Canada, the acoustic environment should be considered to be a key dimension of Critical Habitat. A possible exception is the sea otter, which is not known to make significant use of underwater sound. For SARA-listed cetaceans and pinnipeds, however, degradation of the natural acoustic properties of a Critical Habitat by the introduction of anthropogenic noise has the potential to significantly compromise the species' ability to function acoustically in that habitat.

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Section 5
Feasibility of Recovery in the SARA Context
by R. K. Smedbol and D. S. Clark

Preamble

A substantial portion of this working paper has been derived from draft and (working?) national policy documents concerning interpretation and implementation of sections of the Species at Risk Act (SARA). An excerpt from one key policy document has been attached as an Appendix. This working paper uses these existing documents as a starting point for presentation and evaluation of current views of "feasibility of recovery" and then provides additional information and recommendations for discussion.

Background and Context

Section 40 of the Species At Risk Act states that *"in preparing the recovery strategy, the competent minister must determine whether the recovery of the listed wildlife species is technically and biologically feasible. The determination must be based on the best available information, including information provided by COSEWIC".*

The federal government will consider recovery of an endangered, threatened, or extirpated species to be technically and biologically feasible if all of the following four criteria are met:

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

4. Recovery techniques exist or can be developed to achieve recovery goal.

In assessing feasibility, the competent minister will use the best available biological and technical information, including information provided by COSEWIC, but not social and economic information, consistent with section 40 of SARA. When recovery is not feasible, the competent minister must prepare a recovery strategy consistent with section 41(2) of SARA indicating that recovery is not feasible. The competent minister will reassess the feasibility of recovery when new information warrants. Where there is insufficient information to assess feasibility, the competent minister will take a precautionary approach and will prepare a recovery strategy consistent with section 41(1) of SARA.

Current and developing policy

The draft policy document Policy on the Feasibility of Recovery (Government of Canada 2005) states that recovery feasibility should be based on specific criteria and be defensible. This document phrases the four criteria to be met (listed above) as questions

and states that recovery of a species should not be deemed feasible if the answer to any one of the questions is **no**:

1. Are individuals capable of reproduction currently available to improve the population growth rate or population abundance?

2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration?

3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions?

4. Do the necessary recovery techniques exist and are they demonstrated to be effective?

Further guidance has been provided to recovery practitioners in DFO's Recovery Planning Guidelines (Draft dated 2003). [The pertinent section concerning feasibility of recovery has been provided in Appendix 1, and should be read before continuing.]

Evaluation and critique

The concept of recovery feasibility can be divided into two components: "biological feasibility" and "technical feasibility" (Appendix 1). The definition of biological feasibility of recovery given in Appendix 1. can be extended as: "The intrinsic ability of a population/species to achieve the status of a viable, self-sustaining population that persists in the wild for multiple generations without human intervention". "Technical feasibility" can be considered the ability of management to successfully implement any actions required to achieve species recovery.

A number of intrinsic and extrinsic factors will affect recovery feasibility and the likelihood of success. These factors are implicit in the list of requirements for feasibility provided above. Some of these factors include life history structure and function, vital rates (and associated variance in rates), population resilience, Allee effects (e.g. inbreeding, demographic stochasticity), habitat specificity, habitat availability, and environmental stochasticity. There are others; the issue is complex.

Appendix 1 divides species into the familiar "R" and "K" species groups, and identifies R-selected species as exhibiting greater recovery potential than K species, due to greater resilience. This is not necessarily the case; a species with a relatively high intrinsic rate of natural increase (r) that also exhibits high annual variance in r may be at higher risk of extinction at low abundance than a species with low r but low variance in r. Further, in Appendix 1 it is stated that K-selected species are less likely to respond positively to environmental changes caused by management activities to promote recovery. The rationale for this statement is unclear; there is no reason to assume differing likelihoods of positive response between R and K species. There is, however, a time dimension to response: K species may respond immediately to management actions, but the ***rate*** of this response will be lower (e.g. population increase per unit time) because it will be constrained by their intrinsic life history strategy and dynamics. Relatively more time will be needed to measure the effectiveness of any measures.

Recommendations and further considerations

If a researcher can answer "yes" to questions 1-3 of the Policy on the Feasibility of Recovery (included above), it is likely that recovery is feasible. A "no" answer to question 4 as it is worded may not automatically disprove recovery feasibility, since some methods and techniques currently in use have not been in operation for sufficient duration to allow evaluation of their effectiveness. Examples include the relatively new methodologies available and in use to minimize the negative effects of inbreeding and domestication selection in captive breeding programs (P. O'Rielly, BIO, Halifax, pers. comm.). In another related and more recent (March 31, 2008) working policy document, this forth point is not so prescriptive: "Effective recovery techniques exist or can be developed."

In general, there are three requirements for biological feasibility of recovery: correction or removal of the root cause(s) of decline, sufficient habitat to support a viable population, and sufficient number of breeding individuals to overcome the initial elevated extinction risk. The latter two factors are likely case-dependent; for instance, the number of individuals needed is a function of species life history, ecology, and the degree of environmental variance.

The minimum number of individuals is also a function of the degree of human intervention to augment reproduction and abundance. Thus it may be important to evaluate feasibility of recovery separately for populations where captive breeding and live gene banking is possible (e.g. salmon), and for those where it is not (e.g. whales). Where population augmentation can be undertaken, recovery from very low abundance is possible, perhaps even down to the hypothetical 1 male, 1 female scenario (as long as the reasons for the decline are rectified). In the absence of assisted breeding, feasibility of recovery is determined by the case-specific biological and environmental factors, and the ability of management actions to address the root cause of population decline.

If the decline was due to anthropogenic causes, recovery should be considered to be technically feasible, as it is a matter of will to remove or minimize that threat so that the species can rebound to a viable population status. If the decline cannot be linked to a specific anthropogenic cause, recovery may not be technically feasible. It will need to be judged to what extent recovery planning and implementation to manage these effects will be successful in minimizing the impact on a particular species at risk or its habitat.

Suggested reading

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Appendix 1

DFO Recovery Planning Guidelines – Recovery Feasibility

3.2 Contents of recovery strategies and action plans under SARA

3.2.2 Contents of Recovery Strategies under SARA

3.2.2.1 Recovery Feasibility

In order to resolve the content requirements of recovery strategies, SARA first requires that a determination be made on whether the recovery of the listed species is 'technically and biologically feasible', as per section 40 of the Act. The answer to this question will determine whether section 41(1) contents of recovery strategies if recovery is feasible, or section 41(2) contents of recovery strategies if recovery is not feasible will be invoked.

> **40.** In preparing the recovery strategy, the competent minister must determine whether the recovery of the listed wildlife species is **technically and biologically feasible.** The determination must be based on the best available information, including information provided by COSEWIC.

To better understand the concept of recovery feasibility, these guidelines attempt to deconstruct the individual terms in section 40. Specifically, the terms for 'technically and biologically feasible' are discussed in an attempt to aid recovery planners in making an assessment on the potential for recovery of a listed species at risk, as well as describe what SARA demands of their recovery strategies.

i) Biological feasibility:

Biological feasibility of recovery in simple terms means the intrinsic capability of a listed species (or populations within a species) to be capable of being able to achieve a viable population status. Depending on the specific recovery goal for the species, this could mean an ability of the species to increase in sufficient population size, demographic composition, or to expand across a specified geographic area such that the viability of the population is secured over the long term.

A few factors associated with determining biological feasibility include:

- natural resilience of a species to external pressures/stochastic events;
- life expectancy;
- rate of dispersal, settlement in new communities;
- age of maturity/reproduction;
- investment in nursing/rearing;
- reliance on specific habitat characteristics/availability of preferred habitat
- current distribution vs. historical distribution

Many of the above noted characteristics of species are used to determine whether a species is an 'R-selected species' or a 'K-selected species'. For the purposes of these guidelines, biological feasibility is examined in these terms.

R-selected species typically demonstrate high biotic potential, are relatively short-lived, mature rapidly, are highly fecund and at the population level demonstrate a strong resilience to natural or human-induced pressures. The potential for recovery of these species is therefore comparatively high. K-selected species on the other hand demonstrate low biotic potential, long-lived, low numbers of offspring, and are highly susceptible to outside pressures. Recovery potential for these species, not surprisingly, is therefore relatively low.

The majority of species that are assessed as being at risk can be considered K-selected species and by virtue of their intrinsic characteristics, are generally less inclined to respond positively to changes in their environment that would be achieved via the implementation of recovery actions. Within this classification, some species will respond more readily then others to recovery actions, and DFO recovery planners will need to determine where in the spectrum of recovery potential the species that is the focus of recovery planning can be placed. This determination will need to be grounded in solid rationale, accounting for factors outlined above, and be communicated clearly in the recovery strategy.

For species designated as “Endangered”, arguably the biological feasibility for these species will be lower than those designated as “Threatened”, as an Endangered species is defined by COSEWIC as “a species facing imminent extinction or extirpation”, whereas a Threatened species is defined as “as species likely to become Endangered if limiting factors are not reversed”. For species designated as “Extirpated” from Canada by COSEWIC that no longer exist in the wild in Canada (but exist somewhere else), SARA still requires that a strategy for its recovery be developed. Typically, biological feasibility for recovery for these species will be considerably lower than that for Endangered and Threatened species, and will only be possible if it is determined that efforts to re-introduce and re-establish the species in its former range can be successful.

It bears noting that recovery should be deemed to be biologically feasible if for example (hypothetically) 1 male and 1 female of reproductive age are left in a population, and the recovery goal is to reach a viable population of 3 individuals. Each species will be its own special case when determining whether or not recovery is biologically feasible, and an assessment should be made on this feasibility using the best available information when preparing the recovery strategy.

For many species, it will be difficult to make this assessment when recovery planning is initiated due to lack of information, and in these cases, DFO should err on the side of caution and determine that recovery is biologically feasible until such time that new information suggests that it isn’t. Recovery objectives in a recovery strategy should then target the obtaining of new information to increase the level of confidence in the feasibility determination.

ii) Technical feasibility

Technical Feasibility refers to the ability of organizations and jurisdictions that are responsible for recovery to respond to the needs of a species such that its recovery can be achieved:

Unlike ‘Biological feasibility’, ‘Technical feasibility’ as a concept relates more to the ability of organizations and jurisdictions that are responsible for recovery to respond to the needs of a species such that its recovery can be achieved.

For human induced/anthropogenic threats impacting upon a species that can be mitigated through government or stakeholder actions, recovery should be considered to be technically feasible, as it is a matter of will to remove or minimize that threat so that the species can rebound to a viable population status.

For example, the taking of individuals of a species in commercial fishing gear for another target species can be minimized in any number of ways (e.g., gear modifications, time:area closures, improved disentanglement/release techniques, etc), and if this activity represents a primary limiting factor, then its removal or modification should facilitate attaining the recovery goal for that species.

Natural effects may or may not be mitigated through government or third party recovery actions and it will need to be judged to what extent recovery planning and implementation to manage these effects will be successful in minimizing their impact on a particular species at risk or its habitat.

Species whose population size or range is declining and it is difficult or impossible to attribute to the activities of one single entity may not be fully recoverable to the point where a viable population status can be attained. For example, species affected either indirectly or directly by global warming and climate change may be impacted such that implementing specific actions will not markedly contribute towards its recovery. Under these circumstances, recovery might not be considered to be “technically feasible”. On the other hand, there may be more localized natural effects that can be mitigated, such as enhancing or rehabilitating habitat that has been altered through natural or stochastic events, and that are required to support key life history functions. Here, the carrying out of recovery actions will contribute towards overall recovery, and therefore recovery can be considered technically feasible.

As with biological feasibility above, any determination to be made on technical feasibility must be based on solid rationale, and be included along with a determination for biological feasibility in a justification statement in the recovery strategy.

Section 6
Threats to Species at Risk and Their Habitat by Nicholas E. Mandrak

A threat is any activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur (Environment Canada 2007. *Draft Guidelines on Identifying and Mitigating Threats to Species at Risk*. Species at Risk Act Implementation Guidance).

The Species at Risk Act (SARA) indicates threats that pose serious or irreversible damage to the listed species must be identified and addressed (Appendix 1). Threats must be identified at several points in the SARA listing process: pre-COSEWIC assessment (PCA); COSEWIC assessment (CA; Appendix 2); recovery potential analysis (RPA; regulatory impact assessment statement (RIAS – informed by RPA); and, recovery strategies and action plans (Appendix 1). SARA places the responsibility of identifying threats on COSEWIC, the responsibility of addressing threats on recovery strategies, and the implementing the strategies on action plans.

It is important to make the distinction between threats and limiting factors. Naturally limiting factors, such as aging, disease and predation, that limit the distribution and/or abundance of a species are not normally considered threats unless they are altered by human activity or may pose a threat to a critically small or isolated population (Environment Canada 2007). It is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.

Distinction should be made between general threats (e.g. agriculture) and specific threats (e.g. siltation from tile drains), which are caused by general activities. The causal certainty of each threat must be assessed and explicitly stated as threats identified may be based on hypothesis testing (lab or field), observation, expert opinion or speculation. Threats based on the latter three sources should be treated as hypotheses that require testing (see Environment Canada 2007).

Some issues related to threats:

- Lack of standardized terminology and assessment of magnitude and impact*
- Vague descriptions (e.g. agriculture, urbanization)* and lack of distinction between general and specific threats
- Lack of distinction of threats of serious or irreversible damage to listed species from less serious chronic, background or landscape threats
- Lack of distinction of threats that can and cannot be addressed through SARA or recovery strategies and actions plans
- Cumulative threats
- Linking threats to DFO FHM SOPs

* Environment Canada (2007) has developed a threat classification.

Appendix 1. Addressing Threats in the *Species at Risk Act*.

"… if there are threats of serious or irreversible damage to a wildlife species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty …" Preamble (25)

38. In preparing a recovery strategy, action plan or management plan, the competent Minister must consider the commitment of the Government of Canada to conserving biological diversity and to the principle that, if there are threats of serious or irreversible damage to the listed wildlife species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty.

41. (1) If the competent Minister determines that the recovery of the listed wildlife species is feasible, the recovery strategy must address the threats to the survival of the species identified by COSEWIC, including any loss of habitat, and must include:
(*b*) an identification of the threats to the survival of the species and threats to its habitat that is consistent with information provided by COSEWIC and a description of the broad strategy to be taken to address those threats;

49. (1) An action plan must include, with respect to the area to which the action plan relates,
(*d*) a statement of the measures that are to be taken to implement the recovery strategy, including those that address the threats to the species and those that help to achieve the population and distribution objectives, as well as an indication as to when these measures are to take place;

130. (1) COSEWIC must assess the status of each wildlife species set out in Schedule 2 or 3, and, as part of the assessment, identify existing and potential threats to the species …

Appendix 2. COSEWIC Instruction to Authors for Limiting Factors and Threats.

LIMITING FACTORS AND THREATS

Writers must provide justification for any threats that are mentioned in the report and the imminence and degree of real or potential harm must be indicated and justified. Flexibility and common sense will have to be applied in terms of what constitutes justification and documentation, but more than speculation is needed. Several types of threats and their potential usefulness for status evaluation can be identified:

Threats that are imminent and can result in harm and population-scale impacts are of the highest importance for status evaluation; such threats must be suitably documented with concrete facts. Threats that are clearly imminent but the harm to the populations is uncertain should be reported but with uncertainties explained. For threats whose imminence is uncertain but harm is likely if they occur should not be listed as primary threats but could be included as additional considerations if a species faces other threats. Threats where the imminence and harm are both hypothetical but possible are of little value in documenting risk to a species or population and should not be listed. Similarly, threats with no clear relationship to the species' biology or impact on its habitat should not be included. Natural mortality itself should not be a threat, unless there are particular circumstances that have caused a recent change in, for example, predation rate.

Climatic change should only be used as a threat if there are experimental data that indicate a particular sensitivity to climatic changes that have already been demonstrated for the species in question. Where habitat damage or removal is a threat it is important to specify if applications have been filed for activities that would cause the damage or removal. General statements such as "human population expansion in the near vicinity of sites will result in harm as the recreational use of lands increases", are not suitable as indications of threat; if included, such statements must be supported by evidence of increased housing developments and of documentation of observed harm resulting from such activities as ATV use and damage to sensitive habitat features.

Uncertainty about threats must be presented clearly. Where there is disagreement among experts over the magnitude or likelihood of impacts, the nature of the debate should be presented and a balanced reference list included. The relative degree of the impact must also be presented with suitable explanations.

Identify and evaluate natural limiting factors and real or potential anthropogenic threats to the species and explain what effect they are likely to have. Discuss those characteristics that make it particularly susceptible to disturbance. Discuss biological, environmental or other factors limiting population size and/or distribution of the species or population(s) being designated. Factors to consider include loss, degradation or fragmentation of habitat (due to soil disturbance, water manipulation, water pollution, agricultural runoff, mowing, burning, logging, other forestry practices, nutrient enrichment, herbicide or insecticide use, agricultural tillage, other agricultural practices, road salting, mining, trampling, camping, water or air pollution, land clearing and stress from invasive species, urban or other development, land use practices), or hybridization resulting in genetic swamping, and other factors. Inter- and intra-specific competition, predation, disease are events that normally occur in nature; however, if any of these

events are aggravated or amplified by human activities and result in increased pressures on a population, report them as threats but give details of the anthropogenic involvement. For example, freshwater mussels are preyed upon by raccoons but adoption of conservation tillage practices by farmers has led to significant increases in raccoon populations in some watersheds, and increased predation pressure on mussels as evidenced by increased frequencies and sizes of shell middens. Populations may also be at risk from disturbance or over-utilization through hunting/fishing/collecting for food, trade, trophies, medicinal uses, wildflower or specimen collection, horticultural collection, or pet trade. Discuss the imminence and magnitude of the threats and provide qualifications or references for the threats. Indicate if any of the factors that were responsible for the loss or decline of the species is reversible.