

# COSEWIC's Assessment Process and Criteria

November 2004

## Overview of the COSEWIC Process

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) exists to provide Canadians and their governments with advice regarding the status of wild species that are at risk of extinction or extirpation from Canada.

The COSEWIC process is divided into three sequential steps, each of which has a tangible outcome. These are detailed below.

- selection and prioritization of species requiring assessment – COSEWIC Candidate List and the Priority List;
- compilation of available data, knowledge and information – the COSEWIC status report; and
- assessment of a species' risk of extinction or extirpation and subsequent designation –the record of COSEWIC assessment results.

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## The Candidate List and the Priority List

### Identifying Candidate Species

Canada supports a great diversity of wild species. The first step in COSEWIC's task is to choose, from among the thousands of species, which ones may be most at risk of extinction or extirpation nationally, and are therefore candidates for more detailed assessment through the preparation of a COSEWIC status report.

Species to be considered for inclusion in the Candidate List are identified by Species Specialist Subcommittee (SSC) Co-chairs of COSEWIC in consultation with SSC members, and appropriate ATK-SC members. Species are selected using: the "May Be at Risk" list in the Monitoring the General Status of Wild Species in Canada Program, as well as information drawn from other multi-jurisdictional monitoring, jurisdictional and international assessment processes (e.g., IUCN and ABI), published ranking systems in the scientific literature, and the expert knowledge of SSC and COSEWIC members. SSC Co-chairs also will accept and evaluate public requests to consider species for the Candidate lists.

### Eligibility of Candidate Species

Each candidate species is evaluated for eligibility for COSEWIC assessment. To be eligible, species must meet certain criteria regarding taxonomic validity, native origin, regularity of occurrence and dependence on Canadian habitat ([Table 1](#)). In cases where separate designation below the species level is desirable, justification must be provided.

The initial assessment of eligibility for the COSEWIC Candidate List is completed by the SSC Co-chairs, in consultation with their SSC members and the Co-chairs Subcommittee. Eligibility is ultimately reviewed and confirmed by COSEWIC as the first step in status determination.

### Assessing the Relative Priority of Candidate Species

COSEWIC attempts to give priority attention to species at greatest risk of extinction or extirpation across their ranges in Canada. Eligible candidate species are prioritized and placed on the SSC's [Prioritized Candidate species list](#) using a "coarse filter" system. This system blends levels of apparent risk with considerations of taxonomic distinctness, global distribution and proportion of range within Canada to group species into categories of similar priority. Each SSC will assign their candidate species into one of three priority groups. Group 1 species have highest priority for COSEWIC assessment. Species suspected to be extirpated from Canada would also be included in this group. Group 2 and 3 species have medium and lower priority for COSEWIC assessment respectively. Information from an [Application for Species Assessment](#) may be used in assigning relative priority on the Candidate List. Species not in need of assessment are excluded. These priority lists are dynamic documents which will be revised and updated on an ongoing basis by the SSC.

Specifics of how species are assigned to the three priority groups (i.e., which criteria have the strongest influence) will vary with individual SSCs, reflecting the differences in life histories and information available. Each SSC will provide a written explanation of the rationale used to determine candidate species and priorities within their taxa.

## COSEWIC Status Report

### Commissioning New Status Reports and Updates

By establishing the Prioritized Candidate list, COSEWIC has identified species for which status reports are desirable. In addition, COSEWIC tracks the status of species previously designated as Extirpated, Endangered, Threatened and Special Concern by preparing updated status reports.

COSEWIC species status reports summarize the information that is the basis for status determinations. Each report is an up-to-date compilation and analysis of all relevant, available, and credible biological information

concerning a species and its status in Canada. For effective assessment, this information must include distribution, extent of occurrence, area of occupancy, abundance (including population estimates or number of occurrences, where available), population and habitat trends, and factors or threats limiting the species. For more details about the contents and structure of a status report, see [Instructions for the Preparation of COSEWIC Status Reports](#).

Contracts for new status reports and update status reports are opened for a competitive bid on the COSEWIC web site. Applicants (bidders) will be expected to submit a work plan and budget, a statement of qualifications, and a statement indicating willingness to cede intellectual property and moral rights to the Crown on behalf of COSEWIC. The call for bids will be posted for at least three weeks. After the deadline for bid submissions has passed, the applicants are evaluated by the relevant SSC Co-chair according to a specified protocol, and a winning bid is chosen. The SSC Co-chairs commence to negotiate with the successful applicant, resolving further details of the work plan, costs, possible travel plans, and timelines in consultation with the Secretariat.

### **Status Report Review and Approval Process**

Once a Draft status report is received from a report writer and approved by the SSC Co-chair(s), it is distributed by the Secretariat to all the SSC members, and any external experts recommended by the SSC for peer review. It is also distributed to the chair(s) of the recovery team (if the species is already assessed by COSEWIC and has a recovery team in place), to the range jurisdiction(s), to any relevant WMBs, and to the ATK SC. Comments and suggestions are sent to the SSC Co-chair and forwarded to the writer with instructions from the Co-chair for those changes that must be incorporated into the report.

The result is the Provisional Status Report. The involvement of commissioned report writers nominally ends here. If however, the SSC feels that additional changes are required, it may perform any modifications needed to produce the Interim Report. Ideally, the Provisional and Interim Reports are identical.

The Interim status report is forwarded by the SSC Co-chair to the Secretariat which distributes it to the range jurisdiction(s), the relevant WMBs, the ATK SC and if requested, to the SSC members for final review at least six months before a Species Assessment Meeting. Any final changes to the status report must be made at least two months before the Species Assessment Meeting. All COSEWIC members will receive Interim status reports at least two months prior to the COSEWIC Species Assessment Meeting at which they will be discussed.

At this stage, reports contain recommendations of status from the SSC. Once placed on the COSEWIC agenda, reports can only be withdrawn, deferred or modified with the approval of COSEWIC. New information that is significant to the designation of the species, should be presented to the Species Assessment Meeting in written form and COSEWIC may then defer consideration of the species until a subsequent meeting, or proceed with the assessment (and the member will ensure that the SSC Co-chair is given the information to incorporate into the report).

The SSC Co-chair ensures that the final status designation and any revisions suggested and approved by COSEWIC at the Species Assessment Meeting are incorporated into the Interim Status Report. The SSC Co-chair provides the Secretariat with a high quality, clean final copy of the report for publication. The Secretariat translates the report, adding a summary of the COSEWIC assessment, and arranges it for publication. The resulting COSEWIC Assessment and Status Report is then posted on the [SARA public registry](#) as a downloadable (PDF and html) document soon after the Species Assessment Meeting.

## **COSEWIC Status Assessment and Designation**

For each species considered at a Species Assessment Meeting, COSEWIC considers each of four items in order to determine a Canadian status designation:

1. Is the species eligible for assessment?
2. Is the status report adequate and acceptable for assessment purposes?
3. What status is suggested by application of approved COSEWIC quantitative assessment criteria and guidelines (i.e., rescue effect)?
4. Does the suggested status conform to the COSEWIC definition for the proposed status category?

Each of these steps is outlined below.

#### *1. Eligibility for Assessment*

The SSC Co-chair introduces the species, highlighting features such as taxonomy and biology, and establishes eligibility for COSEWIC assessment ([Table 1](#)). If the proposed designation is for a designatable unit(s) below the species level, a justification for this is presented following the [COSEWIC Designatable Units Guidelines](#). After discussion, the Committee may: choose to accept the SSC's recommendation for eligibility of the species; alter the parameters of the species to be considered (e.g. combine or divide designatable units); or return the report to the SSC as ineligible for assessment.

#### *2. Acceptance of the Status Report*

The appropriate SSC Co-chair then briefly reviews the status report, summarizes the discussion of the SSC, presents the results of the straw ballots, and then presents the rationale for the status assessment recommended by the SSC. After discussion, Committee members may choose to let the report stand for status assessment or move that it be withdrawn for further work. In general, assessment of a species is deferred if the Committee believes that the report has not included significant relevant, currently available knowledge, information or data; or does not present an adequate, clear, or objective analysis of the available information.

#### *3. Application of Quantitative Criteria and Guidelines*

Once the species is determined to be eligible, and the status report has been accepted, COSEWIC proceeds to discuss the appropriate status designation. As a first step in this deliberation, information in the status report is used to assess the species according to the quantitative COSEWIC criteria and guidelines ([Tables 2](#) and [3](#)).

Contextual considerations are then reviewed, and if thought to be significant, may be used to modify the initial quantitative assessment. Such considerations include rescue potential from outside of Canada, and other life-history characteristics that may not have been adequately assayed by the quantitative assessment ([Tables 3](#) and [4](#)). This discussion is concluded by the SSC Co-chair by reviewing the assessment criteria scores, and suggesting a status category.

#### *4. Conformity with COSEWIC Status Category Definitions*

As a final step in the assessment process, COSEWIC considers all the information, analysis, and discussion presented at the meeting, and evaluates if the status category suggested by the application of the criteria and guidelines is consistent with the definition of the status category used by COSEWIC ([Table 5](#)). If there is inconsistency, the status representing the most appropriate definition will take precedence, and any variance will be explained.

**Table 1. Determining eligibility of species for status assessment.**

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**A) Taxonomic validity**

COSEWIC would normally only consider species and subspecies or varieties that have been established as valid in published taxonomic works or in peer reviewed communications from taxonomic specialists. COSEWIC would not normally consider other designatable units unless they can be shown to be genetically distinct, separated by a major range jurisdiction, or biogeographically distinct (refer to Guidelines for [Recognizing Designatable Units Below the Species Level](#)). Justification for considering designatable units below the species level must be provided.

**B) Native species**

COSEWIC would normally only consider native species. A native species is a wild species that occurs in Canada naturally, or that has expanded its range into Canada without human intervention from a region where it naturally occurred, has produced viable populations, and has persisted in Canada for at least 50 years.

**C) Regularity of occurrence**

COSEWIC would normally only consider species that occur or formerly have occurred regularly in Canada, excluding vagrants.

**D) Requires habitat in Canada**

COSEWIC considers species that are year-round residents in Canada. COSEWIC also considers species which, although not full-time residents in Canada, meet the other eligibility criteria and require habitat in Canada for a key life history stage.

**E) Special cases**

Notwithstanding the above guidelines, a taxon may be considered eligible if there are clear conservation reasons for consideration (for example high risk of extinction). In particular, a species which does not meet the eligibility criteria but which is at risk in its primary range outside of Canada could be considered for designation.

Reasons for considering a special case must be presented and supporting information must be provided; this should normally be reviewed and agreed to by COSEWIC before a status report is prepared.

**Table 2. COSEWIC quantitative criteria and guidelines for the status assessment of species.**

COSEWIC's revised criteria to guide the status assessment of species. These were in use by COSEWIC by November 2001, and are based on the revised IUCN Red List categories (IUCN 2001<sup>1</sup>). An earlier version of the quantitative criteria was used by COSEWIC from October 1999 to May 2001 (these original criteria and the associated definitions can be viewed [here](#)). Definitions of terms are provided in [Table 6](#).

	Endangered	Threatened
<b>A. Declining Total Population</b>		
Reduction in population size based on any of the following 4 options and specifying a-e as appropriate:		
	≥ 70 %	≥ 50 %
	(1) population size reduction that is observed, estimated, inferred, or suspected in the past 10 years or 3 generations, whichever is longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) one or more of a-e below.	
	≥ 50 %	≥ 30 %
	(2) population size reduction that is observed, estimated, inferred or suspected over the last 10 years or 3 generations, whichever is longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) one or more of a-e below.	
	(3) population size reduction that is projected or suspected to be met within in the next 10 years or 3 generations, whichever is longer (up to a maximum of 100 years), based on (and specifying) one or more of b-e below.	
	(4) population size reduction that is observed, estimated, inferred, projected or suspected over any 10 year or 3 generation period, whichever is longer (up to a maximum of 100 years), where the time period includes both the past and the future, AND where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) one or more of a-e below.	
	<ul style="list-style-type: none"> <li>a) direct observation</li> <li>b) an index of abundance appropriate for the taxon</li> <li>c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</li> <li>d) actual or potential levels of exploitation</li> <li>e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites</li> </ul>	
	Endangered	Threatened

**B. Small Distribution, and Decline or Fluctuation**

1. Extent of occurrence	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
Or		
2. Area of occupancy	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>

For either of the above, specify at least two of a-c:

(a) either severely fragmented or known to exist at # locations  $\leq 5$   $\leq 10$

(b) continuing decline observed, inferred or projected in one or more of the following:

- i) extent of occurrence
- ii) area of occupancy
- iii) area, extent and/or quality of habitat
- iv) number of locations or populations
- v) number of mature individuals

(c) extreme fluctuations in one or more of the following:  $> 1$  order of magnitude  $> 1$  order of magnitude

- i) extent of occurrence
- ii) area of occupancy
- iii) number of locations or populations
- iv) number of mature individuals

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### C. Small Total Population Size and Decline

Number of mature individuals  $< 2,500$   $< 10,000$

and 1 of the following 2:

(1) an estimated continuing decline rate of at least: 20% in 5 years or 2 generations (up to a maximum of 100 years in the future) 10% in 10 years or 3 generations (up to a maximum of 100 years in the future)

(2) continuing decline, observed, projected, or inferred, in numbers of mature individuals and at least one of the following (a-b):

(a) fragmentation-- population structure in the form of one of the following:

- (i) no population estimated to contain  $>250$  mature individuals
- (ii) at least 95 % of mature individuals in one population
- (i) no population estimated to contain  $>1,000$  mature individuals
- (ii) all mature individuals are in one population

(b) extreme fluctuations in the number of mature individuals

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### D. Very Small Population or Restricted Distribution

(1) Number of mature individuals  $< 250$   $< 1,000$

Or

(2) Applies only to threatened: Population with a very restricted area of occupancy (area of occupancy typically  $< 20 \text{ km}^2$ ) or number of locations (typically 5 or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and thus is capable of becoming highly endangered or even extinct in a very short time period.

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## E. Quantitative Analysis

Indicating the probability of extinction in the wild to be at least:      20% in 20 years or 5 generations, whichever is longer (up to a maximum of 100 years)      10% in 100 years

### Special Concern:

those species that are particularly sensitive to human activities or natural events but are not endangered or threatened species.

Species may be classified as being of Special Concern if:

- a. the species has declined to a level of abundance at which its persistence is increasingly threatened by genetic, demographic or environmental stochasticity, but the decline is not sufficient to qualify the species as Threatened; or
- b. the species is likely to become Threatened if factors suspected of negatively influencing the persistence of the species are neither reversed nor managed with demonstrable effectiveness; or
- c. the species is near to qualifying, under any criterion, for Threatened status; or
- d. the species qualifies for Threatened status but there is clear indication of rescue effect from extra-limital populations.

### Examples of reasons why a species may qualify for "Special Concern":

- A species that is particularly susceptible to a catastrophic event (e.g., a seabird population near an oil tanker route)
- A species with very restricted habitat or food requirements for which a potential threat to that habitat or food supply has been identified (e.g., a bird that forages primarily in old-growth forest, a plant that grows primarily on undisturbed sand dunes, a fish that spawns primarily in estuaries, a snake that feeds primarily on a crayfish whose habitat is threatened by siltation)
- A recovering species no longer considered to be Threatened or Endangered but not yet clearly secure

### Examples of reasons why a species may not qualify for "Special Concern":

- A species existing at low density in the absence of recognized threat (e.g., a large predatory animal defending a large home range or territory)
- A species existing at low density that does not qualify for Threatened status for which there is a clear indication of rescue effect

### Guidelines for use of Extirpated

A species may be assessed as extinct or extirpated from Canada if:

- there exists no remaining habitat for the species and there have been no records of the species despite recent surveys, or
- 50 years have passed since the last credible record of the species, despite surveys in the interim, or
- there is sufficient information to document that no individuals of the species remain alive.

### Guidelines for use of Data Deficient

Data Deficient should be used for cases where the status report has fully investigated all best available information yet that information is insufficient to: a) satisfy any criteria or assign any status, or b) resolve the species' eligibility for assessment.

#### Examples:

- Records of occurrence are too infrequent or too widespread to make any conclusions about extent of occurrence, population size, threats, or trends.
- Surveys to verify occurrences, when undertaken, have not been sufficiently intensive or extensive or have not been conducted at the appropriate time of the year or under suitable conditions to ensure the reliability of the conclusions drawn from the data gathered.
- The species' occurrence in Canada cannot be confirmed or denied with assurance.

Data Deficient should **not** be used if: a) the choice between two status designations is difficult to resolve by COSEWIC, or b) the status report is inadequate and has not fully investigated all best available information (in which case the report should be rejected), or c) the information available is minimally sufficient to assign status but inadequate for recovery planning or other such use.



**Table 3. Guidelines for modifying status assessment based on rescue effect.**

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COSEWIC's approach to assigning status is, first, to examine the Canadian status of a species or other Designatable Unit in isolation and then, if deemed appropriate, to consider the potential for "rescue" from extra-regional populations (e.g., from across an international boundary or from another designatable unit within Canada). The rescue effect is the immigration of gametes or individuals that have a high probability of reproducing successfully, such that extirpation or decline of a population or other Designatable Unit, can be mitigated. If the potential for rescue is high, the risk of extirpation may be reduced, and the status may be downgraded. COSEWIC addresses this by applying the following guidelines developed by IUCN for this purpose (Gardenfors et al. 1999<sup>2</sup>).

#### **Likelihood of propagule migration**

Are there any extra-regional populations within a distance from which propagules could reach the region? Are there any effective barriers preventing dispersal to and from extra-regional populations? Is the species capable of long-distance dispersal? Is it known to do so?

If there are no extra-regional populations or propagules are not able to disperse to the region, the regional population behaves as an endemic and the status category should be left unchanged.

#### **Evidence for the existence of local adaptations**

Are there any known differences in local adaptation between regional and extra-regional populations, i.e. is it probable that individuals from extra-regional populations are adapted to survive within the region?

If it is unlikely that individuals from extra-regional populations would be able to survive within the region, the status category should be left unchanged.

#### **Availability of suitable habitat**

Are current conditions of habitats and/or other environmental (including climatological) requirements of the taxon in the region such that immigrating propagules are able to successfully establish themselves (i.e. are there inhabitable patches), or has the taxon disappeared from the region because conditions were not favourable?

If there is not enough suitable habitat and current conservation measures are not leading to an improvement of the habitat within a foreseeable future, immigration from outside the region will not decrease extinction risk and the status category should be left unchanged.

#### **Status of extra-regional populations**

How abundant is the taxon in neighbouring regions? Are the populations there stable, increasing or decreasing? Are there any important threats to those populations? Is it probable that they produce an appreciable number of emigrants, and will continue to do so for the foreseeable future?

If the taxon is more or less common outside the region and there are no signs of population decline, and the taxon is capable of dispersing to the region and there is (or soon will be) available habitat, downgrading the category is appropriate. If the population size of extra-regional populations is declining, the 'rescue effect' is less likely to occur, hence downgrading the status category may not be appropriate.

#### **Degree of dependence on extra-regional sources**

Are extant regional populations self-sustaining (i.e. have they shown a positive reproductive rate over the years) or are they dependent on immigration for long-term survival (i.e. are the regional populations sinks)?

If there is evidence that a substantial number of propagules regularly reaches the region and the population still has a poor survival, the regional population may be a sink. If so, and there are indications that the immigration will soon cease,

upgrading the status category may be appropriate.

**Table 4. Policy for modifying status assessment based on quantitative criteria.**

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COSEWIC, IUCN and other groups recognize the need for other assessment tools. Specifically, there is a need to consider life-history variation amongst species and other taxa. COSEWIC has developed the following guideline:

**In addition to the quantitative guidelines, COSEWIC will base its assessment on the degree to which various life-history characteristics (e.g., age & size at maturity, dispersal strategy, longevity) affect extinction probability and the likelihood that the species is vulnerable to the Allee effects of density dependence.**

All else being equal:

- species with delayed age at maturity tend to be at greater risk of extinction than species with early age at maturity;
- for indeterminately growing organisms (species that continue to grow after attaining maturity), larger species tend to be at greater risk of extinction than smaller species;
- species with low dispersal tend to be at greater risk of extinction than species with high dispersal; and
- species with non-overlapping generations tend to be at greater risk of extinction than species with overlapping generations.

**Table 5. COSEWIC wildlife species definition and status categories.**

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**Wildlife Species** - a species, subspecies, variety or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.

**Extinct (X)** - A wildlife species that no longer exists.

**Extirpated (XT)** – A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.

**Endangered (E)** - A wildlife species facing imminent extirpation or extinction.

**Threatened (T)** - A wildlife species likely to become endangered if limiting factors are not reversed.

**Special Concern (SC)** – A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

**Data Deficient (DD)** - A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

**Not At Risk (NAR)** - A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.

**Table 6. COSEWIC definitions associated with quantitative criteria.**

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**Area of Occupancy:** the area within 'extent of occurrence' that is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that the extent of occurrence may contain unsuitable or unoccupied habitats. In some cases (e.g. irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data. To avoid inconsistencies and bias in assessments caused by estimating area of occupancy at different scales, it may be necessary to standardize estimates by applying a scale-correction factor. Different types of taxa have different scale-area relationships. (Source: adapted from IUCN 2001.)

**Continuing Decline:** a recent, current or projected future decline (which may be smooth, irregular or sporadic), which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines, but an observed decline should not be considered as a fluctuation unless there is evidence for this. (Source: IUCN 2001)

**Demographic Stochasticity:** Random variation in demographic variables, such as birth rates and death rates, sex ratio and dispersal, for which some individuals in a population are negatively affected but not others. In small populations, these random events increase the risk of extinction.

**Environmental Stochasticity:** Random variation in physical environmental variables, such as temperature, water flow, and rainfall, which affect all individuals in a population to a similar degree. In small populations, these random events increase the risk of extinction.

**Extent of Occurrence:** the area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a species (Source: Adapted from IUCN 2001)

**Extreme Fluctuation:** changes in numbers or in distribution that occur rapidly and frequently, and are typically of more than one order of magnitude. (Source: adapted from IUCN 2001)

**Generation:** Generation length is the average age of parents of a cohort (i.e. newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once. Where generation length varies under threat, the more natural, i.e. pre-disturbance, generation length should be used. (Source: IUCN 2001)

**Location/Site:** a geographically distinct area where a group of individuals of a species is (or has been) found. The total population or a population may comprise a number of sites. Dispersal between sites is impossible or very rare. A single threatening event can rapidly affect all individuals in a site. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat. (Source: adapted from IUCN 2001)

**Mature Individuals (Number of):** The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction. When estimating this quantity, the following points should be borne in mind:

- Mature individuals that will never produce new recruits should not be counted (e.g. densities are too low for fertilization).
- In the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals that take this into account.

- Where the population size fluctuates, use a lower estimate. In most cases this will be much less than the mean.
- Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g. corals).
- In the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.
- Re-introduced individuals must have produced viable offspring before they are counted as mature individuals. (Source: IUCN 2001)

**Population:** A geographically or otherwise distinct group within a species that has little demographic or genetic exchange with other such groups. Theoretically, populations maintain genetic distinction if there is typically less than one successful breeding immigrant individual or gamete per generation. (Equivalent to the term "subpopulation" as employed by the IUCN; adapted from IUCN 2001)

**Quantitative Analysis:** An estimate of the extinction probability of a taxon based on known life history, habitat requirements, threats and any specified management options. Population viability analysis (PVA) is one such technique. Quantitative analyses should make full use of all relevant available data. If there is limited information, available data can be used to provide an estimate of extinction risk (for instance, estimating the impact of stochastic events on habitat). In presenting the quantitative analyses, the assumptions, the data used and the uncertainty in the data or quantitative model must all be documented. (Source: adapted from IUCN 2001).

**Reduction:** A reduction is a decline in the number of mature individuals of at least the amount (%) stated under COSEWIC criterion A over the time period (years) specified, although the decline need not be continuing. A reduction should not be interpreted as part of a fluctuation unless there is reasonable evidence for this. The downward phase of a fluctuation will not normally count as a reduction. (Source: adapted from IUCN 2001)

**Rescue Effect:** Immigration of gametes or individuals that have a high probability of reproducing successfully, such that extirpation or decline of a population, or some other Designatable Unit, can be mitigated. If the potential for rescue is high, the risk of extirpation may be reduced.

**Severely Fragmented:** a situation where most individuals are found in small and relatively isolated populations (in certain circumstances this may be inferred from habitat information). Severe fragmentation results in a reduced probability of recolonization of habitat patches where populations go extinct, which increases extinction risk for the species. (Source: adapted from IUCN 2001)

**Total Population:** the total number of mature individuals of a wildlife species in Canada. (Equivalent to the term "population" as employed by IUCN 2001; Source: adapted from IUCN 2001)

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<sup>1</sup>IUCN 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, U.K. Available at <http://www.redlist.org/>

<sup>2</sup> Gardenfors, U., J.P. Rodriguez, C.P. Hilton-Taylor, C. Hyslop, G. Mace, S. Molur and S. Poss. 1999. Draft guidelines for the application of Red List criteria at national and regional levels. Species 31-32:58-70