Wild Species 2000

The General Status of Species in Canada

Canadian Endangered Species Conservation Council

Limitations of this document

Information considered and summarized in Wild Species 2000: The General Status of Species in Canada comes from diverse sources, including published scientific literature, independent research, and reports from the public domain. Scientists and naturalists from across the country kindly provided valuable expertise and made available their personal datasets under the agreement that certain limitations would apply on release to ensure maintenance of their professional rights and entitlements, including publication rights.

Responsible agencies

The agencies listed below are responsible for the propriety, compilation, and interpretation of the data contained in this report:

Department of the Environment, Government of Alberta
Ministry of Environment, Lands and Parks, Government of British Columbia
Manitoba Conservation, Government of Manitoba
Department of Natural Resources and Energy, Government of New Brunswick
Department of Tourism, Culture & Recreation, Government of Newfoundland/Labrador
Department of Resources, Wildlife & Economic Development, Government of the Northwest Territories
Department of Natural Resources, Government of Nova Scotia
Department of Sustainable Development, Government of the Nunavut Territory
Ministry of Natural Resources, Government of Ontario
Department of Fisheries, Aquaculture and Environment, Government of Prince Edward Island
Faune et Parcs, Québec, Gouvernement du Québec
Ministère de l'Environnement, Gouvernement du Québec
Department of Environment and Resource Management, Government of Saskatchewan
Department of Renewable Resources, Government of the Yukon Territory
Fisheries Research Branch, Fisheries and Oceans Canada, Government of Canada
Canadian Wildlife Service, Environment Canada, Government of Canada
Parks Canada Agency, Heritage Canada, Government of Canada

Additional supporting information on the status of species, subspecies, and populations occurring within the individual provincial and territorial boundaries may in some cases be accessed by contacting these agencies (contact persons listed in Appendix 1).

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What's on the CD

The CD found in the pocket of the inside back cover of this document contains a copy of the report in electronic (.pdf) format, as well as general status ranks for species included in this report. Data are available in both Microsoft Excel 2000 (.xls) and text (.txt) formats. Datasets and a "search tool" for customizing them are also available at the website (http://www.wildspecies.ca).

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Cover Photo
Grey Treefrog on a snag
Photo: M. Runtz

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Executive Summary

Wild Species 2000: The General Status of Species in Canada reflects a commitment made under the *Accord for the Protection of Species at Risk,* an agreement established in 1996 by provincial, territorial, and federal Ministers responsible for wildlife. The *Accord* commits the parties to "monitor, assess and report regularly on the status of all wild species" with the objective of identifying those species that may be in trouble, those for which more information is needed, or those for which a formal status assessment or additional management attention is necessary. The first of these Canada-wide reports is *Wild Species 2000* - A collaborative overview of the condition of our wild flora and fauna. What we have, where they occur, and how they're doing.

In this first report are the general status assessments for a broad cross-section of over 1 600 Canadian species, from all provinces, territories, and ocean regions. Species from eight major groups were evaluated, accounting for most of Canada's vertebrate species (freshwater fishes, amphibians, reptiles, birds, mammals), a representative invertebrate group (butterflies), and two very different plant groups (ferns, orchids). Assessments were done by integrating the best possible information on population sizes, trends, distribution, and threats, to generate an expert evaluation of the general status of the species. All species were classified as either *Extirpated/Extinct, At Risk, May Be At Risk, Sensitive, Secure, Undetermined, Not Assessed, Exotic,* or *Accidental.* As a result, species can be prioritized in terms of the effort and attention needed to prevent their loss: some species are apparently secure, others show early signs of trouble and should be watched, still others need attention now. Likewise, the general status process also identifies what we don't know but need to find out: for some species there is not enough information to assess whether they are secure or already in trouble. Finally, general status assessments will be repeated periodically so that we can develop a picture of trends in species status: for some the situation over time will improve, for some it will worsen, for still others it will remain the same.

In terms of overall species richness - Canada contains more than 70 000 described species within the terrestrial and marine realms, yet only a small fraction (2%) of this variety is captured in the report. Birds comprise the largest species group studied (639 species), followed by butterflies (302 species) and freshwater fishes (237 species). Summary results indicate that the majority (about 65%) of Canada's wild species are *Secure* at all geographic scales. However, across species groups, the proportion of *Secure* species is highly variable - ranging from a low of 40% for marine and terrestrial reptiles to a high of 67% for marine and terrestrial mammals. Considerable differences also occur among taxa in the number of *Accidental* and *Not Assessed* or *Undetermined* species. For example, 27% of birds on our list are considered *Accidental* species, and 45% of butterflies were either *Not Assessed* or *Undetermined.* The report also paints a more grave picture for other wild species in Canada - 5% are known to be *At Risk* and another *5% May Be At Risk.* With our vast landscape and large number of wild species it is not surprizing that for some species we simply have too little information to evaluate their status. As such, five provinces and territories were unable to assess the status of their butterflies, making this the least well known taxon considered. In contrast, the status of our ferns, orchids, and amphibians appears to be relatively well known – at the national level no species in these groups were *Undetermined* or *Not Assessed.* As predators, parasites, and competitors of native species *Exotics* are considered one of the greatest emerging challenges for biodiversity conservation. Importantly, freshwater fish make up the majority of *Exotics* species recorded in this report – 21 species in total – many of which have the potential to cause ecological disturbance in aquatic communities.

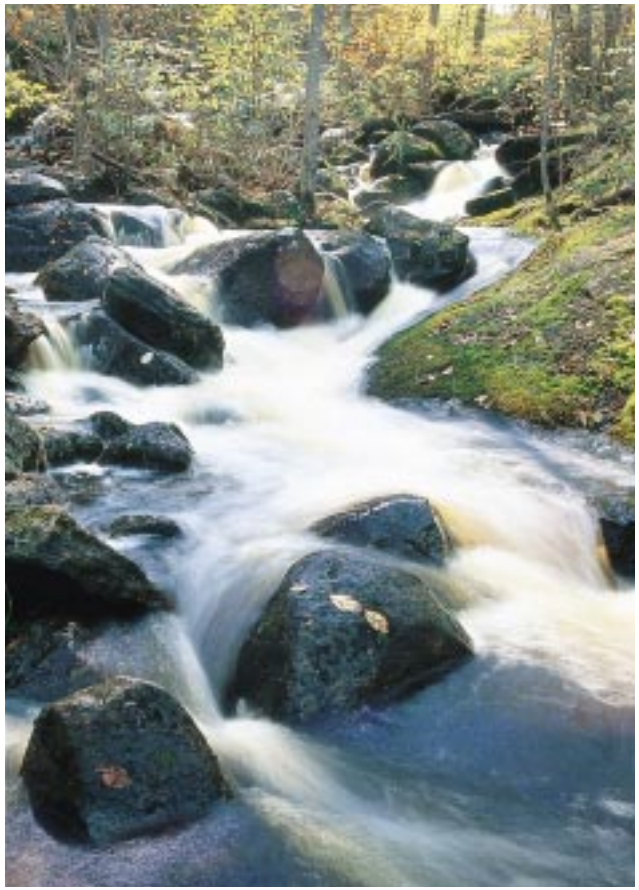
The next *Wild Species* report requires new data to either expand, improve, or update the database of information on Canada's wild species. *Wild Species 2000* is built on the contribution of data and knowledge from individuals, institutions, and agencies across Canada. We hope that many of these same sources will be able to provide new information toward *Wild Species 2005.* We also hope that more people will be encouraged by the release of this first report to contribute data on their own or become involved with general status assessments in their home province or territory.

Section 1: Background

Introduction

Canada is home to well over 70 000 wild species, including, but by no means limited to, birds, mammals, fish, frogs, and snakes; trees, flowers, and mushrooms; and bees, butterflies, and worms. These species, and other aspects of nature, are much valued by Canadians. We recognize that wild species provide a host of resources, such as foods, medicines, and materials, as well as services that we often take for granted: cleaning the air and water, regulating the climate, generating and conserving soils, pollinating crops, and controlling pests, to name only a few. In addition, Canadians take pride in, and profit internationally from, a reputation for pristine landscapes with abundant wildlife. But perhaps above all else, Canadians value the aesthetic splendour and spiritual nourishment still afforded by the incredible range of wild species inhabiting our land. For all these reasons, we acknowledge a responsibility to future Canadians and the rest of the world to conserve this nation's natural heritage by preventing the loss of species due to human actions.

McGillivray Falls, Whiteshell Provincial Park, MB.



M. Grandmaison

The first — and essential — step in addressing any problem is detecting the problem and understanding its scope. Accordingly, to prevent the loss of species, we must know which species we have, where they occur, and what their status is. The general status assessment process aims to provide this overview. Species can then be prioritized in terms of the effort and attention needed to prevent their loss: some species will appear to be secure, others will show early signs of trouble and should be watched, while still others will need immediate attention. The general status assessment process also tells us what we don't know but need to find out: for some species, there will not be enough information to assess whether they are secure or already in trouble. Finally, general status assessments will be repeated periodically so that we can develop a picture of trends in the status of species: for some, the situation will improve over time; for others, it will worsen; for still others, it will remain the same.

General status assessments are made by integrating information on population sizes, distributions, trends, and any known threats to a species across its Canadian range. Because these assessments are undertaken for many species and for many areas, patterns of decline or threat across suites of species can emerge. Such patterns not only give a better indication of the nature and magnitude of a problem, but also may point the way to the best planning and intervention strategies. It is this approach, the ability to compare a large number of species of different kinds (e.g., birds, butterflies, fish, and ferns) from different parts of Canada, that is both the defining characteristic and the most powerful product of the general status assessment process.

Assessing this mix of many species across many areas presents a considerable challenge — the number of species is large and the area great. While there are more than 70 000 species known to live in Canada, there are probably about as many again as yet undescribed by science. These species are distributed across the length and breadth of the nation: 9.2 million square kilometres of land and fresh

Why a report on the general status of wild species in Canada?

water, 4.7 million square kilometres of ocean, and the longest coastline in the world, at 244 000 kilometres. To add to the challenge, Canada's species are not distributed evenly across this massive area. Instead, their distribution is influenced by the staggering array of habitats found within our borders: everything from badlands and boreal forest to tundra, taiga, and temperate rainforests, to grasslands, marshlands, and alpine meadows, to the Atlantic coastline and the Arctic Ocean, to name only a few.

The challenge of assessing the general status of Canadian species may be daunting, but the process is essential. Our resource-based economy and high standard of living have an impact on the natural world: vegetation is cleared, cities expand, resources are extracted, waste is produced, alien species are introduced. In altering nature for our benefit, our goal must be to ensure that our activities do not imperil the very species that we both celebrate and depend upon. *Wild Species 2000: The General Status of Species in Canada* is the most comprehensive look at the state of Canada's species and a first step towards that goal of development without species imperilment. This report contains the general status assessments for a broad cross-section of over 1 600 Canadian species, from all provinces, territories, and ocean regions. It establishes for the first time a comprehensive, common platform for examining the general status of Canada's species across their Canadian range and a solid baseline against which future changes in the distribution and abundance of species can be compared. It is a report card to all Canadians, a guide indicating where more information is needed, an effective tool for improved conservation, and a testament to the cooperative will of Canadians to protect wild species.

Wild Species 2000: The General Status of Species in Canada reflects a commitment made under the *Accord for the Protection of Species at Risk*, an agreement in principle established in 1996 by provincial, territorial, and federal ministers responsible for wildlife. The goal of the *Accord* is to prevent species in Canada from becoming extinct or extirpated because of human impact. As part of this goal, the Accord commits the parties to "monitor, assess and report regularly on the status of all wild species," with the objective of identifying those species that may be in trouble, those for which more information is needed, and those for which a formal status assessment or additional management attention is necessary. Each province, territory, and federal agency represented in the Accord undertakes to assess the species for which it has lead responsibility. Assessment of species involves integrating the best possible information on population sizes, trends, distribution, and threats into an expert evaluation of the general status of the species. In addition, because the general status of species can change over time, for better or worse, the Accord commits the provinces, territories, and federal agencies to gathering information about species on an ongoing basis.

In anticipation of this new information and changing general status for some species, parties to the Accord agreed to work together to produce a national "snapshot" of this ongoing process at least once every five years: how species are faring at that time across regions, across types of animal and plant, and across the nation. The first of these Canada-wide reports is *Wild Species 2000: The General Status of Species in Canada.*

M. Grandmaison

Kicking Horse River, Yoho National Park, BC.

Organization of this report

Section I provides information on the background to the *Wild Species 2000* report, which species are covered in the report, how and from where the information was collected, and how species' general status was assessed. **Section II** presents the results of general status assessments, including an overview of the general status of each group of species (e.g., fish, mammals, orchids) and background information on the group. General status ranks for particular species, groups of species, or species in particular regions can be found on the CD-ROM at the back of the report or on the website (http://www.wildspecies.ca), where a search tool to customize datasets is also available. An overview of all species groups combined is provided in **Section III**. Along with this overview are some analyses of trends in the data that give an indication of the richness of the information summarized by the report. Finally, **Section IV** outlines possible directions for the 2005 report of the *Wild Species* project. The **Appendices**, following Section IV, provide the names of and contact information for members of the Wild Species Working Group, a glossary of terms and their usage in this report, and a list of additional sources of information on species and programs referred to in the report.

Cape Split, Kings County, NS

M. Elderkin

What this report does

This report summarizes the general status assessments of a large number and variety of wild Canadian species. Over 1 600 species from 8 major groups were covered, accounting for most of Canada's vertebrate species, a representative invertebrate group, and two very different plant groups. The focus is upon the general status of *all* species within each of these groups, rather than on the general status of only rare or endangered species. This allows for the consideration of a species in its larger context: comparison with other species whether in the same group or region or not. So, for example, one can ask questions like: Are salamanders better off than frogs in British Columbia? Is this pattern the same in Manitoba, or even Canada as a whole? How does the general status of salamanders and frogs compare with that of other very different species that are associated with water, like freshwater fish? These and many other questions can be answered because the report draws together information from different types of species, all provinces and territories, freshwater rivers and lakes, and three bordering oceans, and presents both general status ranks for species in each region and overall Canada-wide ranks. Emphasis was placed in this first report upon establishing what information and expertise exist and using these to make general status assessments of as many species as possible. Focusing on existing information allows the fixing of a benchmark rather than continually delaying a report until complete scientific information is available. Further, taking stock of existing information identifies the type and scope of data already available and helps to prioritize future efforts devoted to collecting new information on species.

This report both provides an overall impression of, and allows comparison among the general statuses of a large number and variety of species. This exceptional breadth of coverage also means that the report focuses on distilling often detailed information into necessarily broad general status categories. Accordingly, while in some cases the report draws upon the information available from initiatives devoted to particular species groups, regions, or functions, it is not a replacement for these efforts, which are more specific. In particular, general status assessments do not replace evaluations by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or provincial and territorial equivalents, which provide in-depth, targeted study of individual species that may be at risk. Similarly, general status assessments are not a replacement for bird conservation

plans (e.g., *Partners in Flight*, landbirds; *Canadian Shorebird Conservation Plan*, shorebirds; and *Wings Over Water,* seabirds and colonial waterbirds), which have developed their own priority-setting systems suited to guide conservation efforts that are focused specifically on these groups. Further information on particular programs and groups of species can be found by consulting **Appendix 3** of this report.

The following is a summary of just some of the achievements of this ambitious project. Many of these achievements are firsts for Canada. This project:

- **Integrates** information on a large number (over 1 600) and variety of Canada's wild species. These general status assessments help to prioritize which species are in most urgent need of attention: many species are secure; some are at risk, may be at risk, or are sensitive; others are poorly known and require study.

- **Alerts** Canadians to species that may require attention to prevent their extinction, before the species are in "critical condition." Early warning of a species in trouble increases the success and cost-effectiveness of conservation programs.

- **Summarizes** the identity and distribution of non-native wild species (*Exotics*) across Canada. Few Canadians are aware of the proportion of our fauna and flora that are introduced and of their potential impacts on native species.

- **Identifies** the gaps in our knowledge about wild species in Canada. Directing attention and expertise towards filling these gaps is essential for a more accurate and comprehensive picture of the general status of Canadian wild species.

- **Establishes** local networks of people with information to share about Canada's wild species. People identified during this process form part of a coordinated knowledge base critical to this, and future, general status reports.

- **Builds** a common platform across Canada for comparing the general status of wild species: everything from the same species in different regions of the country to different species in the same province, territory, or ocean region.

- **Shares** information with Canadians about the diversity and general status of wild species across the country. Consolidating information about wild species in Canada lets everyone from schoolchildren to resource managers, farmers, and developers know what species there are and how they are doing.

M. Grandmaison

Red spring wheat with isolated woodlots in the distance.

Species diversity in context

Life is variable at almost every conceivable scale. From the DNA that makes up an organism's genes to the composition and behaviour of entire ecosystems, a seemingly endless and complex array of living things surrounds us. The most familiar currency of this diversity is the species that inhabit a place, and this report focuses on that perspective of biodiversity. While the number of species is the most common perspective, it would be a mistake to believe it to be the only valuable viewpoint. By extension, a place with more species is not necessarily more important or more interesting than a place with fewer species. For example, Canada's Arctic has relatively few species, but many of the species occurring there have special adaptations to extremes of climate that

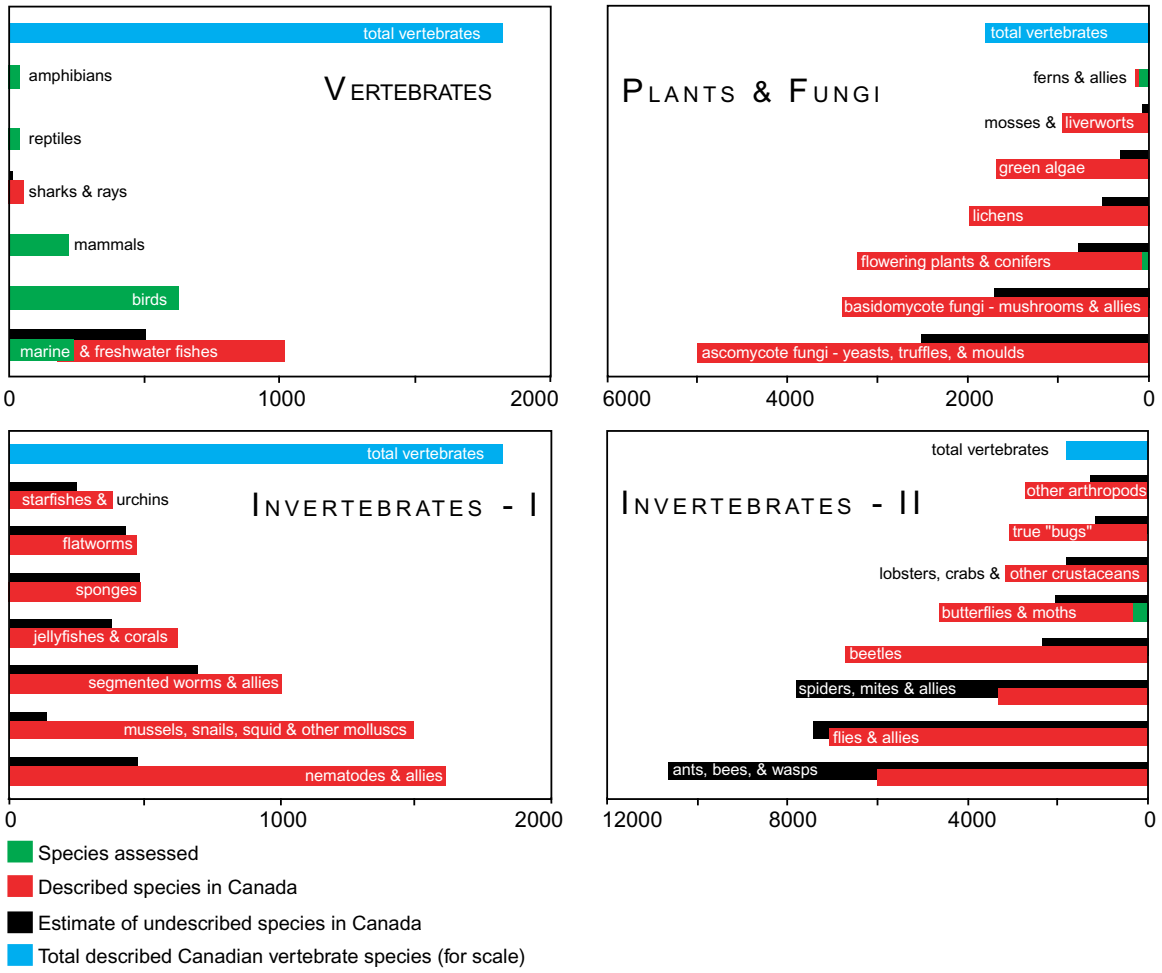


FIGURE I-i. Diversity and number of species assessed in Wild Species 2000. About 85% of Canada's wild species fall into one of the four popular, though not necessarily evolutionarily correct, groupings (vertebrates, plants & fungi, invertebrates I, invertebrates II) of Figure I-i. For each major group, the names of some common or recognizable members are provided, along with the number of described species (red bars), the estimated number of as yet undescribed species (black bars), and the proportion of the group ranked in this report (green bars). Most of the species considered in this first report are vertebrates, the most familiar and conspicuous of species. The total number of described vertebrates in Canada (approx. 1 800) is included in each panel of the figure (blue bars) to allow comparison across the very different scales. For example, the "ants, bees, wasps" bar is more than three times longer than the vertebrates bar of that panel, indicating that this one insect group alone numbers over 6 000 described species. Interestingly, insects and fungi alone make up almost 60% of the described species in Canada. Although this report covers a large number of species, the figure makes clear that there is still much to do in order to get a more complete picture of the state of Canada's species. This report is an essential first step in clarifying the state of what is known and the dimensions of the challenge that will inform future efforts.

Note: Numbers of species in each group are drawn principally from Mosquin, T. and P.G. Whiting, 1992. Canada Country Study of Biodiversity: Taxonomic and Ecological Census, Economic Benefits, Conservation Costs, and Unmet Needs. Draft report for delegations to the International Convention on Biological Diversity, Brazil, 1992. Ottawa: Canadian Museum of Nature.


M. Grandmaison

Post-fire Jack Pine stand, a favourite haunt of Black-backed Woodpeckers.

allow them to persist there and nowhere else. Likewise, while the most common life-form on land is insects, with more than a million described species worldwide, in ocean environments insects are virtually absent. Instead, the oceans support a far greater variety of species groups (e.g., sponges, corals, jellyfish, starfish) that is not paralleled on land. Variety in types of organisms is at least as important as their numbers, because different types of organisms have important, often irreplaceable, functions in nature. For example, the most notable, if inconspicuous, contribution of fungi is some species' association with plant roots, providing minerals without which most vascular plants could not grow.

This report is the responsibility of a national working group composed of representatives from all provinces and territories and two federal government agencies — Environment Canada (Canadian Wildlife Service) and Fisheries and Oceans Canada. The national working group established which groups of species would be ranked in this first report and the general guidelines for the criteria that would be used to derive general status ranks. Provincial and territorial representatives held the primary responsibility for establishing lists of species that occur in their province or territory. These representatives were also responsible for the sourcing, compilation, and interpretation of the information that would both inform their province's or territory's ranks for given species and serve as a resource tailored to the particular needs of that province or territory. Once provincial and territorial general status ranks were established, the national working group was the body responsible for assigning a Canada-wide rank: a national general status rank that interprets the overall state of the species in Canada based on the information about populations in each province or territory. A list of national working group members appears at the end of this report (see **Appendix 1**).

The remainder of this section provides more detail on the methods and sources of information used in *Wild Species 2000: The General Status of Species in Canada.* Included are definitions of general status categories (**Box 1**) and underlying criteria (**Box 2**), as well as a description of the process used to derive ranks and some generalized examples of general status assessments.


M. Grandmaison

Sugar Maple forest in Gatineau Park, QC.

Box 1 – General status categories

Each species assessed in the report received a numerical rank that summarizes its general status. Each assessment was based upon a series of criteria (see Box 2) that capture information, where available, on population size and distribution as well as any trends (increasing or decreasing) in these attributes and on any known threats to populations or their habitat. Species received a general status rank in each province, territory, or ocean region in which they are known to be present, as well as an overall Canada-wide general status rank. General status categories are necessarily somewhat broad, both because the large number of species covered precludes the detailed and intensive species assessments that would inform a finer-scaled system and because of variation in the amount of information available for different species. For instance, where data are more extensive (particularly for birds), the Secure ranking could be broken down further to identify species that are not immediately threatened but for which there is reason for some concern, such as a common species becoming less common. The reader should also note that all general status categories refer only to a species' status in Canada. Where the species also occurs outside of Canada (as most of our species do), the situation for those populations of the species may be different. For example, a species that is abundant elsewhere (e.g., USA, Europe) may exist in Canada in very low numbers. In this case, it could be ranked as At Risk, reflecting the Canadian general status and level of concern for its future here, while being of lesser conservation concern in other parts of its range.

The general status categories used in this report are as follows:

0 - Extirpated/Extinct — species that are no longer thought to be present in the province or territory or in Canada (for the case of a national general status rank) or that are believed to be extinct. Extirpated species have been eliminated from a given geographic area but may occur in other areas. Extinct species are extirpated worldwide (i.e., they no longer exist anywhere). Species listed by COSEWIC as extinct or nationally extirpated automatically receive an *Extirpated/Extinct* general status rank. This rank applies at the national level and in whichever province or territory the species formerly existed. Nationally *Extirpated/Extinct* species are not considered part of Canada's species richness. Likewise, species *Extirpated* from a particular province or territory are not considered part of that regions' species richness.

1 - At Risk — species for which a formal detailed risk assessment (COSEWIC assessment or provincial or territorial equivalent) has been completed and that have been determined to be at risk of extirpation or extinction (i.e., endangered or threatened). A COSEWIC designation of *Endangered* or *Threatened* automatically results in a general status rank of *At Risk* nationally. Where a provincial or territorial formal risk assessment finds a species to be "endangered" or "threatened" in that particular region, then, under the general status system, the species automatically receives a provincial or territorial general status rank of *At Risk*. In this case, if the species is restricted to that province or territory, it would also automatically receive a national general status rank of *At Risk*. Note that this rank does not necessarily reflect the global status of the species.

2 - May Be At Risk — species that may be at risk of extirpation or extinction and are therefore candidates for a detailed risk assessment by COSEWIC or provincial or territorial equivalents. Note that this rank does not necessarily reflect the global status of the species.

3 - Sensitive — species that are not believed to be at risk of immediate extirpation or extinction but may require special attention or protection to prevent them from becoming at risk. Note that this rank does not necessarily reflect the global status of the species.

4 - Secure — species that are not believed to belong in the categories *At Risk, May Be At Risk,* or *Sensitive*. This category includes some species that show a trend of decline in numbers in Canada but remain relatively widespread or abundant. Note that this rank does not necessarily reflect the global status of the species.

5 - Undetermined — species for which insufficient data, information, or knowledge is available with which to reliably evaluate their status.

6 - Not Assessed — species that are known or believed to be present regularly in the geographic area in Canada to which the rank applies but have not yet been assessed.

7 - Exotic — species that have been moved beyond their natural range as a result of human activity. In this report, *Exotic* species have been purposefully excluded from all other categories.

8 - Accidental — species occurring infrequently and unpredictably, outside their usual range. Because they so rarely occur in Canada, *Accidental* species are not considered a part of Canada's species richness.

Box 2 – Criteria underlying general status assessments

The general status of a given species was derived by considering available information relating to a set of seven criteria that collectively reflect the status of a (species') population within specific geographic areas — that is, provinces, territories, ocean regions, and Canada as a whole. These criteria were based on definitions used in the *Red List Categories* of the *World Conservation Union*, the *Criteria for Amendment of Appendices I and II* (Res. Conf. 9.24) of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES), and the *Natural Heritage Program and Conservation Data Centres of the Association for Biodiversity Information – Canada*. Criteria were used as a guide to help determine the appropriate general status category for a species. Where possible, representatives from each province, territory, and federal agency followed the following definitions of the seven criteria:

• **Population size** is defined as the current estimate of the total number of mature individuals capable of reproduction. Where populations are characterized by natural fluctuations, the minimum number should be used. Likewise, if the population is characterized by biased breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals that will take this into account. For many species, a figure of less than 1 000 individuals has been found to be an appropriate guideline of what constitutes a small population. It is likely that different definitions of what constitutes a "small" population will need to be developed for different taxonomic groups.

• **Number of occurrences** is defined as the estimated number of sites where the species currently persists. A site occurrence is described ecologically as a location representing a habitat that sustains or otherwise contributes to the survival of a population. A site occurrence will be defined differently for different species, depending on its natural history. When a species' distribution is extremely limited and there are very few site occurrences, the species is very susceptible to any number of disturbances, both predictable and unpredictable. This criterion is therefore the single most important factor influencing overall rank when the number of occurrences is few.

• **Geographic distribution** is defined as the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred, or projected sites of occurrence, excluding cases of accidental species. The area within the imaginary boundary should, however, exclude significant areas where the species does not occur. For migratory species, the geographic distribution is the smallest area essential at any stage for the survival of the species.

• **Trend in population** is defined as an estimate of the change (if any) in the number of mature individuals over time. Where declines are indicated, *rapidly declining* is defined as a decrease of 50% in the last 10 years or three generations, whichever is longer. *Declining* is defined as a decrease of 20% in the last 10 years or three generations, whichever is longer. Natural fluctuations will not normally count as part of a decline, but an observed decline should not be considered part of a natural fluctuation unless there is evidence for this interpretation.

• **Trend in distribution** is defined as the change (if any) in the geographic distribution of the species over time. Where declines in distribution are indicated, rapidly declining is defined as a decrease of 50% in the last 20 years or six generations, whichever is longer. Declining is defined as a decrease of 20% in the last 20 years or six generations, whichever is longer.

• **Threats to population** are defined as observed, inferred, or projected direct exploitation, harassment, or ecological interactions with predators, competitors, pathogens, or parasites that may result in population declines. Extreme threats are significant, could affect more than half the population, and are unmitigated. Moderate threats are also serious but affect less than half the population or are mitigated by some level of human protection. Limited threats are less significant to population viability or are being mitigated through protective measures.

• **Threats to habitat** are defined as observed, inferred, or projected habitat alterations (loss, conversion, degradation, or fragmentation) that may result in population declines. Extreme threats are significant, affect more than half the population, and are unmitigated. Moderate threats are also serious but affect less than half the population or are mitigated by some level of human protection. Limitedthreats are less significant to population viability or are being mitigated through protective measures.

Reporting units

In this first report on the general status of Canada's species, the biological reporting unit is the species, commonly considered to mean populations of organisms that do not usually interbreed with other populations, even where they overlap in space and time. Species are the most common and recognizable units of biological classification used in conservation, but they are not the only one. For instance, where populations of the same species are separated from one another, they may become genetically distinct, leading to the formation of subspecies, which may look and behave differently and so warrant separate consideration. Similarly, harvested species are sometimes divided into "stocks": separate populations that may require different management approaches because they experience different ecological pressures. While these divisions below the species level may have merit, there tends to be more disagreement over the precise limits and biological significance of differences observed at this finer scale. Moreover, relatively few species have been examined closely enough to distinguish candidate subspecies or stocks. Accordingly, in general, only species were assigned general status ranks, rather than subspecies or distinct populations. However, in some cases, the province, territory, or federal agency with lead responsibility for a species has further information on subspecies or on special populations. Where additional information of this sort is available (particularly for birds), it accompanies the general status rank for the species in the data table available on the cd-rom at the back of the printed report or on the web site at www.wildspecies.ca. For further information about the general status of species for a particular province or territory or about the general status of a particular species group (e.g., birds, marine mammals, fish), see the list of contacts at the end of this report (see **Appendix 1**).

While biological reporting units focused at a single scale (species), geographical reporting units were employed at two scales. All provinces and territories assigned general status ranks to species, and in most cases species were also assessed for their national general status. There are two important exceptions. First, the Province of Newfoundland and Labrador assigned separate general status ranks for species that occur on the island of Newfoundland and those that occur in mainland Labrador. These two regions are significantly different from one another in terms of climate and soils and, therefore, in terms of habitat and wildlife species and their distributions. Furthermore, there is little movement of species between the two areas.

These differences require that the province consider and manage the island and mainland wildlife resources separately. The second exception is for marine species (in this report, marine mammals and marine turtles). These species are reported by ocean region, reflecting the fact that, in many cases, these species (e.g., whales) are more difficult to associate with a given province or territory. A map of all regions with which general status ranks are associated is presented in **Figure I-ii**.

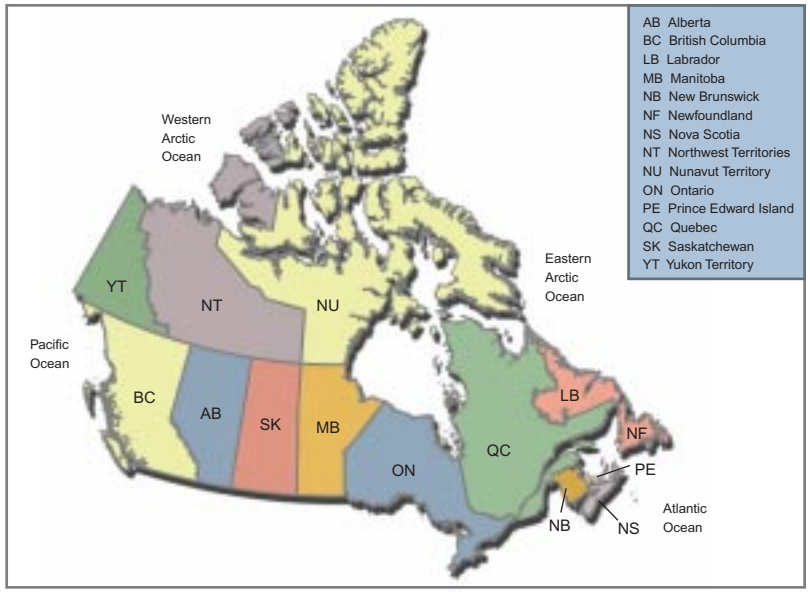


FIGURE I-ii. Map of Canada and geographical context of reporting units.
Note that the island of Newfoundland and mainland Labrador serve as distinct geographic reporting units for the purposes of this report.

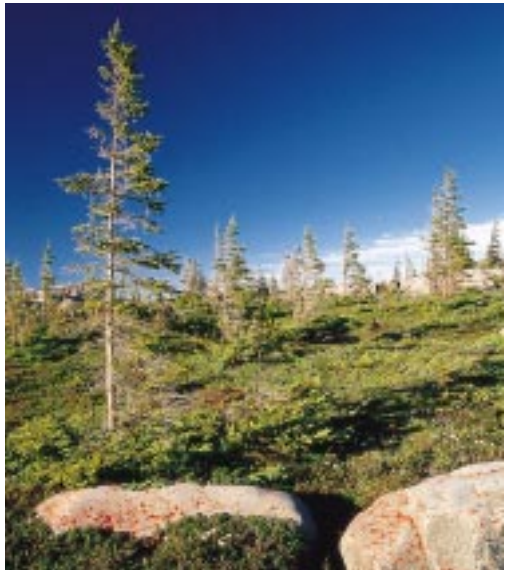
Sources of information

Getting the most accurate overall impression of a species meant compiling local information to generate provincial/territorial/ocean regional, and then national, pictures of a species' general status. This made assessing the general status of Canada's species a complicated and challenging task for two main reasons: there are many species, and they are distributed across a vast area. Fortunately, there is also a vast array of sources of information about many of Canada's species, some in published documents, but much in the accumulated knowledge and expertise of people. For example, amateur naturalists, museum specialists, government biologists, and holders of traditional ecological knowledge were often key to determining which species occur within a region, the abundance and geographic distribution of a given species, whether a species' populations are growing, declining, or stable, and the level and types of threats a species may face directly or through modification of its habitat. In many provinces, some of this local knowledge was already held within Conservation Data Centres (data nodes of the Americas-wide Natural Heritage Program network). Still, even in provinces and territories with a Conservation Data Centre, previously unrecognized sources of knowledge were identified.

Involving a great variety of people with knowledge to share about species ensures that the best and most comprehensive picture of a species' general status is gained. An added benefit is that the extensive consultation required to collect data for species' general status ranks fosters a network of expertise that is an enduring resource for wildlife management and conservation within each province or territory. Further, gaps identified in this network point to where investment may be necessary to develop expertise in particular species groups and highlight the need to capture the knowledge inherent to today's experts. The fruits of these knowledge networks were agreed-upon lists for species in a given region and, in most cases, sufficient information for the province or territory to establish a general status rank for each species (see below). Provincially- and territorially-generated general status ranks were compiled nationally to produce Canada-wide general status ranks for each species. Assessments for Canada-wide general status ranks for each species were undertaken by a national working group composed of representatives from every province and territory. Also part of the national working group were representatives from two federal agencies: Environment Canada (the Canadian Wildlife Service) and Fisheries and Oceans Canada.

Assessments

A wide range of information sources was used to guide the establishment of general status scores for each species. Although the details of the process varied somewhat depending on the province or territory, the process was relatively standardized. In general, the most common process was for informal or formal committees to distill the available information into scores for the set of seven criteria (see **Box 2**) that underlie general status ranks. For example, in a given province, a species might receive a score of *extreme* or *moderate* or *limited* on the criterion of *threats to population* (see **Box 3** for examples). Criteria were weighted according to the strength of information (e.g., empirically versus anecdotally based) that was used to generate the respective scores on each. General status ranks were the result of a further weighting of all criteria for which information had been available. Among the important rules of thumb in generating these general status ranks was that in most cases, at a minimum, the criteria of threat factors (*threats to population, threats to habitat*) must be known or reasonably inferred and defined. In cases where the committee considered that insufficient information, knowledge, or data were available with which to reliably evaluate the general status of a species, the species was assigned a general status of *Undetermined*.



M. Grandmaison

Tundra landscape near Churchill, MB.

Box 3 – Profile of regional general status ranks

The following three examples give an idea of criterion scores that could inform a general status rank for a given species in a province, territory, or ocean region. Each score is supported by information that may be contributed from a variety of sources. The amount and type of information (e.g., empirically versus anecdotally based) were used as factors in weighting the contribution of each score to the final overall rank. Thus, each general status rank is not a simple average of component criteria scores but depends on the particular character of the information underlying each criterion. Most commonly, it was formal or informal committees in each province and territory that distilled information into criterion scores and then weighted these to derive the general status rank.

Lake Whitefish *(Coregonus clupeaformis)*

CRITERION	SCORES
I. Abundance and distribution	
Population size in prov./terr.	large
• more than 10 000	
Number of occurrences in prov./terr.	large
• more than 100; throughout the mainland	
Geographic distribution (% of prov./terr.)	widespread
• 88%	
II. Trend scores	
Trend in population	stable
• stable	
Trend in distribution	stable
• stable	
III. Threat scores	
Threats to population	limited
• commercial fishing; limited threat in prov./terr.	
Threats to habitat	limited
• limited in prov./terr.	
GENERAL STATUS RANK (prov./terr.)	*secure*

Bowhead Whale *(Balaena mysticetus)*

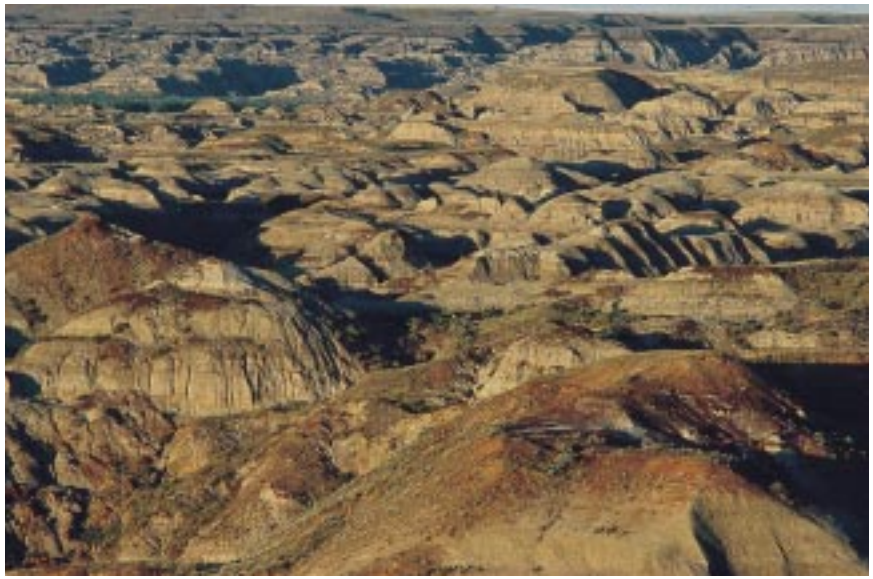
CRITERION	SCORES
I. Abundance and distribution	
Population size in ocean region	medium
• ~8 700 (number poorly known)	
Number of occurrences in ocean region	small
• 3 stocks, several summering areas; bowheads aggregate	
Geographic distribution (% of ocean region)	widespread
• 65%	
II. Trend scores	
Trend in population	increasing
• increasing; about 1% per year	
Trend in distribution	stable
•migratory	
III. Threat scores	
Threats to population	limited
• potential overhunting, environmental conditions; oil development a threat in NT, not NU	
Threats to habitat	limited
• oil development; threat more pronounced in some prov./terr. associated with ocean region	
GENERAL STATUS RANK (ocean region)	*sensitive*

Garter Snake *(Thamnophis sirtalis)*

CRITERION	SCORES
I. Abundance and distribution	
Population size in prov./terr.	small-medium
• not large	
Number of occurrences in prov./terr.	very small
• 2	
Geographic distribution (% of prov./terr.)	very restricted
• 1%	
II. Trend scores	
Trend in population	stable
• unknown	
Trend in distribution	stable
• unknown	
III. Threat scores	
Threats to population	limited
• road mortality, disturbance at denning sites	
Threats to habitat	limited
• disturbance or destruction of denning sites	
GENERAL STATUS RANK (prov./terr.)	*may be at risk*

From regional to national general status assessments

A Canada-wide general status rank was developed for most species in order to provide a coarse-scale picture of its national status. Canada-wide ranks were assessed by the national working group through a compilation of criterion scores and associated ranks from provinces, territories, or ocean regions. Canada-wide ranks for a given species were not simple arithmetic averages of the ranks from provinces, territories, and ocean regions. Rather, the individual regional ranks were weighed in light of the picture formed by a consideration of each in the context of the whole. Thus, a particularly important consideration at this level was the geographic distribution of the species being ranked. In general, the relative proportion of a species' range that fell within a province, territory, or ocean region reflected the relative importance of that region's general status score in contributing to the overall Canada-wide score. For example, a province harbouring the majority of a species' distribution carried more influence in determining the Canada-wide score than did a province in which the species was only marginally represented.



M. Grandmaison

The badlands of Dinosaur Provincial Park, AB.

In **Section II** of this report, a brief overview is provided for each of the eight groups of species (i.e., ferns, orchids, butterflies, freshwater fishes, amphibians, reptiles, birds, mammals). Each overview gives some background information on important characteristics of that group of species, their role in the environment, the number of species distributed globally and in Canada, and, most importantly, some key statistics gleaned from the general status ranks for that group. Summaries of general status ranks by region are also presented for each group in graphical form. General status ranks for individual species at the national level or for a particular province, territory, or ocean region can be found by consulting the data tables available on the CD accompanying the hard copy of this report or at the website (http://www.wild-species.ca). The data presented represent the best estimate of the general status of these species at the time of writing. However, the situation for species is dynamic: some populations will fare better or worse in the time between this report and the next, due in 2005.

The reader is cautioned against overinterpreting differences in general status ranks. General status ranks are best interpreted as a rough guide that allows comparison among species and regions. Differences in these values derive from two main sources. Most importantly, apart from natural population fluctuations, different species are impacted more or less directly, and more or less heavily, by human actions. Such variation in human impacts will be reflected in a species' numbers, distribution, and risk of extinction, and therefore in its general status rank. However, it is also true that general status ranks reflect only a best estimate of a species' status. Some estimates will be closer to the true status of a species because there is more information available in that province, territory, or ocean region for that species than there is for other species and regions. Variation in general status ranks does not diminish their value as guides to a species' status, but it does recommend a conservative approach to their interpretation.

In addition, readers are reminded that species richness values for each province, territory or Canada as a whole are calculated as the sum of all extant species in the region of interest. Therefore, species richness values exclude *Extirpated/Extinct* and *Accidental* species since those species are either no longer, or not regularly, found in Canada. Consequently, the number of species studied within each taxonomic group may be greater than the total species richness for that group. Throughout this document we used the term "resident species" to refer to regularly occurring (not *Accidental*), extant species.

Ferns

fern: *any of a large class (Filicopsida) of flowerless spore-producing vascular plants; especially : any of an order (Filicales) of homosporous plants possessing roots, stems, and leaflike fronds.*

Quick facts:

- There are about 11 000 species of ferns globally.
- Canada is home to 122 resident species of ferns.
- Ontario, British Columbia, and Quebec have the most species of ferns (78, 78, and 75 species, respectively).
- About two-thirds (65%, 79 species) of fern species in Canada are considered *Secure.*
- Three species (3%) of ferns in Canada are considered *At Risk.*
- Threats to ferns include habitat loss, toxins, and physical disturbance.
- Ferns are among the oldest living vascular plants.

B.T. Aniskowicz

Cinnamon Fern fiddlehead.

Ferns are among the most readily identifiable of plants. With most species having leaves (fronds) that are subdivided into many smaller leaflets, they are a familiar sight in houses and gardens, offices, and restaurants. The popularity of ferns in these urban settings may be due in part to a strong image of ferns in nature: a thick and lush green understorey in cool, shady forests. Still, not all ferns in nature conform to this typical view. Ferns' habitats range from wetlands to dry rocky talus; some species, such as the Polypody ferns, are epiphytes on tree trunks; and ferns can be found in habitats ranging from the coastal rainforest of British Columbia to the province's dry Okanagan Valley to the understorey of the boreal forest in northern Ontario.

Despite this wide range of habitats, all ferns share an unusual form of reproduction, referred to as the alternation of phases in a generation. The completion of each generation involves the interdependence of two very different plants. Specifically, the conspicuous vegetative fern with which we are familiar (the sporophyte) does not reproduce directly by shedding seeds, as do other vascular plants. Rather, it produces many tiny spores, each of which can give rise to small and inconspicuous (often 5 millimetres or less) independent plants (gametophytes). As suggested by their name, gametophytes produce male and female gametes that can unite to reform a sporophyte, thus completing one generation of the fern. This cryptic form of reproduction and the absence of obvious seeds may have contributed to the belief for much of history that fern "seeds" were invisible and that by collecting them a person could also become invisible. Shakespeare's play *Henry IV*, for example, features the lines "We have the receipt of Fern seed – we walk invisible."

Water-loving Cinnamon Fern- the brown spike is the fertile spore-bearing frond.

M. Runtz

Of course, the history of ferns vastly predates Shakespeare. Ferns are among the oldest living land plants, arising about 400 million years ago as some of the first plants to possess a vascular system: dedicated elements of the plant's structure used for the transport of water and nutrients. The distinction of being among the first vascular plants is reflected in ferns often being classed as "lower" vascular plants, situated above the non-vascular mosses, liverworts, and hornworts and below the higher vascular plants — the seed plants (conifers and flowering plants). However, the fern's designation as a lower vascular plant bears no relation to its importance in ecosystems of which it is a part. Like all plants, ferns produce oxygen and sequester carbon, modify the climate, and provide food and shelter for other organisms. In addition, ferns are thought to be important in the production of soils and reduction of soil erosion, allowing other less tenacious plant species to thrive.

Some ferns are able to reproduce in other ways, as well as by spore. Oakferns, some Maidenhair ferns, and Bracken grow rhizomes, which allow the plant to form sizeable colonies. Anderson's Swordfern grows bulbils along the stem of its fronds, which fall off and can establish new plants.

Canadian fern species are used by humans in a variety of ways. Some species are harvested as food. For example, Ostrich Fern "fiddleheads," the tightly coiled new shoots, are sold commercially and are considered a delicacy. Some of the First Nations of the west coast use Swordfern fronds as liners in cooking pits, and others harvest the rhizomes of Bracken both for their long fibres and as food. In addition to uses as cough syrup, shampoo, and skin medication, recent research has shown that some Maidenhair Ferns contain potent anti-bacterial and anti-yeast agents. Most Canadian species are available in the horticultural trade, and the wide use of ferns in gardening is resurging, although it has not returned to the heyday of Victorian England, when thousands of species and varieties were available through specialty nurseries.

Like most plants, ferns are found in their highest species diversity in the tropical regions of the world. Still, of the more than 11 000 fern species found globally, 122 are found in Canada. A large number of predominantly woodland fern species are found in southern Ontario and Quebec, but these provinces are also home to ferns typical of rocky habitats, like the Purple Cliff-brake, Polypody, and Swordfern. Ontario, British Columbia, and Quebec have the highest species richness, with 78, 78, and 75 species, respectively. All but one of the provinces and territories have at least 26 or more fern species; the exception is Nunavut, which has five species. British Columbia contains far more species that occur nowhere else in Canada than any other province or territory, with 23 species. Some of these species, such as *Polystichum kwakiutlii*, are of global significance, as they are found nowhere else in the world.

The majority of ferns (65%, 79 species) are ranked nationally as *Secure* (**Figure II-i**). However, a small proportion (3%, three species) are *At Risk*, and many species are classified as *May Be At Risk* within individual provinces or territories. Threats to ferns come from a number of sources, and different species may have different sensitivities. For instance, some species are known to occupy areas that are impacted most by recreational activities, others by pollutants, still others by erosion. Added to this list are more dramatic factors to which all species are sensitive, such as habitat loss through land conversion or habitat fragmentation. A final significant threat to ferns involves not the modification of their habitat but their wholesale removal from it by collectors.

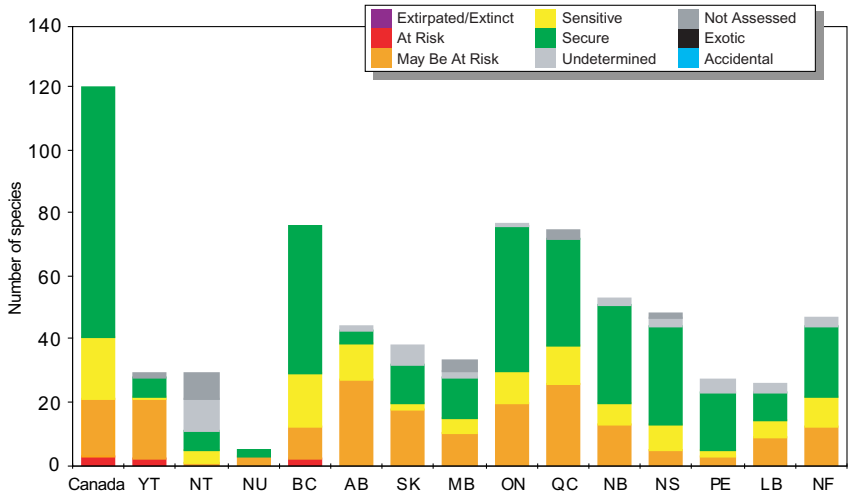


FIGURE II-i. Summary of the general status of ferns in Canada. Of the 122 fern species in Canada, 79 are considered nationally *Secure*. However, many species are classified as *May Be At Risk* within individual provinces and territories.

Orchids

or·/chid: *any of a large family (Orchidaceae, the orchid family) of perennial, epiphytic, saprophytic, or terrestrial monocotyledonous plants that usually have showy, three-petaled flowers with the middle petal enlarged into a lip and differing from the others in shape (and sometimes colour).*

Quick facts:

- There are more than 30 000 orchid species globally.
- Canada is home to 77 resident species of orchids.
- Ontario and Quebec have the most orchid species (61 and 50, respectively).
- The majority of Canada's orchid species (65%, 50 species) are considered *Secure*.
- Seven (9%) of Canada's orchid species are considered *At Risk*.
- Many orchids grow slowly (e.g., Showy Lady's-slipper — up to 16 years from seed to flower).
- Showy orchids are most severely impacted by collection from the wild.

Among the most diverse (about 30 000 species worldwide), specialized, and flamboyant families of flowering plants, orchids are widely distributed and are found in all parts of the world, except in the major deserts. While their attractiveness has prompted much horticultural interest, relatively few botanists have conducted serious research on the family. Thus, much remains to be discovered about these mysterious organisms that constitute one of the most striking and successful streams of plant evolution.

Three basic types of orchid are recognized: epiphytic, terrestrial, and saprophytic. Epiphytic orchids encompass most of the tropical and subtropical species — these are the "aerial" plants that attach to, and suspend themselves from, tree trunks, branches, and rock faces. Terrestrial species are typically anchored to the ground via underground roots with which they obtain nutrients. Saprophytic orchids also have underground roots, but they lack chlorophyll, their leaves being generally small and yellowish, and have lost the power to photosynthesize. Saprophytic

species, like the widely-distributed Spotted Coral-root, secure nourishment directly from decaying organic matter in the soil.

Regardless of type, most orchids are notable for their ability to produce prodigious numbers of seed; a single capsule can contain up to ten million. Interestingly, after dispersal, the seeds of many orchids cannot germinate without infestation of a suitable mycorrhizal fungus. Once germinated, the path to a flowering orchid is barely begun; many species may take up to 10 years or more to mature. A long trajectory to reproductive maturity means that many species are found only in habitats that are at least moderately stable. Long maturation time and the fact that soil conditions must be "just right" for fungal infection and seed germination suggest that many orchids can serve as valuable indicators of environmental change.

While the majority of the world's orchid species are tropical and subtropical in distribution, 77 species can be found within Canada. At least four of these have 70% or more of their North American range in Canada. In fact, the range of several orchid species, such as Spotted Lady's-slipper, Sparrow's-egg Lady's-slipper, and Northern Twayblade, is largely restricted to cooler regions of Canada (and Alaska). These three species all occur north of the Arctic Circle, and Spotted Lady's-slipper, a true northerner, can be found in North America only in the Northwest Territories, Yukon, and Alaska.

Orchids are associated with many different types of natural communities in Canada, including bogs, meadows, fields, swamps, fens, prairies, and forests. Given the sweeping breadth of Canada's boreal forest region, stretching from Newfoundland in the east to Yukon and British Columbia in the west, it is not surprising that many orchid species associated with boreal spruce forests and peatlands have a widespread distribution in Canada. Similarly, species restricted to only one province are often associated with narrow floral regions. For example, Nodding Pogonia is found only in the very restricted Carolinian region of Ontario. Some orchid species tend to be more liberal in their habitat requirements, occupying different types of habitats in different geographic regions. Blunt-leaf Orchid, for example, is found all the way from the Arctic tundra region in the north down to the northern edge of the Carolinian region in the south.

M. Runtz

Arethusa or Dragon's Mouth, an orchid of fens and bogs.

While approximately 21% of Canada's 4 153 wild vascular plants are thought to be *Exotic* species, only about 5% (four species) of our orchids are reported as being *Exotic* — representing less than 0.1% of all alien vascular plant species in the country. Reasons for the low incidence of *Exotic* orchids in Canada are not well known but may be related to lack of suitable pollinators. Three of the alien orchid species found in Canada currently are restricted to only a few sites. One of these, Common Twayblade, first reported in Canada in 1968, is very common and widespread in Europe and may be expanding its range in Ontario. Another *Exotic* orchid, Broad-leaved Helleborine, is both widespread in Canada and drab in appearance, a combination that results in it being considered a weed.

Showy Orchis is restricted to Ontario, Quebec, and New Brunswick.

B.T. Aniskowicz

Although some introduced species of orchids are successful enough to be considered weeds, many of our native species are not faring so well. Seven species are ranked *At Risk*, and another 10 *May Be At Risk* (**Figure II-ii**). Still, a majority (65%, 50 species) of orchids in Canada are considered *Secure*. At present, the orchid species facing the most acute threats (*At Risk, May Be At Risk*) are those that reach the northern limit of their range in southern Canada, such that much of their Canadian range overlaps with the densest area of human activity. Many of the factors adversely affecting these species also extend to other orchids. Chief among these is the destruction or modification of habitat — for instance, draining of bogs and fens or thinning of forest, which can lead to a drying of the forest floor where some orchids thrive (e.g., Small Round-leaved Orchid). Another threat is the harvesting of showy species like the Yellow and Showy Lady's-slipper by collectors. Ironically, even when orchids are not collected, their attractiveness can still spell their demise. Some keen naturalists and photographers may inadvertently disturb the habitat around an individual orchid and so "love it to death."

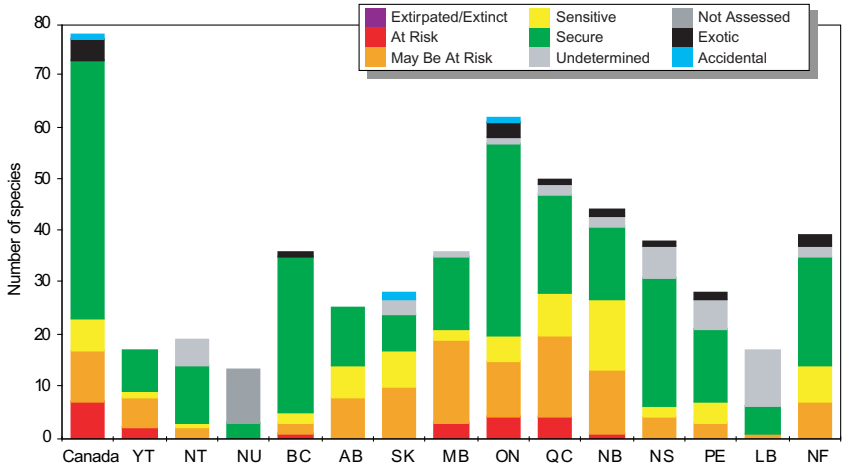


FIGURE II-ii. Summary of the general status of orchids in Canada. Most (65%) of Canada's 77 orchid species are thought to be *Secure* nationally, but several species fall within higher risk categories within individual provinces and territories. Canada has recorded only 1 *Accidental* orchid species.

Butterflies

but·/ter·/fly: *any of numerous slender-bodied (mostly) diurnal insects (order Lepidoptera) with broad often brightly coloured wings.*

Quick facts:

- Globally, there are about 20 000 butterfly species.
- Canada is home to 284 resident species of butterflies, although as many as 18 *Accidental* species have also been found here.
- British Columbia has a higher species richness (182 species) than any other region.
- Most species (45%) are *Secure* at the provincial/territorial level.
- At least three butterfly species are *At Risk*.
- The Cabbage White and European Skipper are Canada's only known *Exotic* butterflies.
- Adult butterflies are key plant pollinators.
- Monarchs migrate thousands of kilometres to avoid the Canadian winter.

With their conspicuous daytime activity, bright colours, and jaunty flight patterns, butterflies tend to invoke the interest and sympathy of the general public. As a result, butterflies have become a "flagship" invertebrate and are the only insects evaluated in this report. That the Niagara Parks Butterfly Conservatory in Ontario attracted 850 000 visitors during its first full year of operation is one indicator of just how popular these insects have become. Perhaps even more telling was the move by Quebec to become the first province to designate an official insect — the White Admiral holds this lauded status.

Although butterflies number only about 10% of the order Lepidoptera — with moths comprising the other 90% — butterflies tend to be more eye-catching than moths, which are generally active during the night and are usually somewhat drab in colour. However, all butterflies begin life in a relatively understated form, as a tiny cryptic egg. A key to the survival of each generation lies in a female butterfly's careful timing and choice of location for laying her eggs. Not only must she set the eggs on the right "host plant," but she must also secure them to the right part of the plant, since not all plant parts will be equally edible to the caterpillar when it hatches from the egg. Upon hatching, the plant-chomping butterfly caterpillar grows by way of periodic moulting or shedding its skin. The last larval moulting results in the formation of a pupal case or chrysalis, rather than a larger caterpillar. This marks the start of a remarkable change, for, after a period of time, the pupal case splits open, and a fully formed adult winged butterfly emerges.

By undergoing total metamorphosis, butterfly larvae and adults are able to live radically different lifestyles in completely different environments — the former as a slow-crawling homebody with an insatiable appetite for vegetation, the latter as a flighty, wide-ranging sipper of nectar. Methodically munching through life, the larva exists in a tiny leafy world that contrasts greatly with that of the adult, which may be several hectares to several hundred square kilometres in extent. Indeed, Monarchs are known to undertake migratory flights of thousands of kilometres — adults tagged in Canada in the autumn have been subsequently recaptured in the winter forests of central Mexico. Most butterflies are relatively short-lived — the

M. Runtz

Common Branded Skipper.

Tiger Swallowtails feeding on bear scat.

M. Runtz

entire cycle from egg to adult may be only a month or two, and adults may live only a week. Many species produce only one generation per year and fly only a few months out of the year.

Throughout most of Canada, where temperatures drop below freezing during part of the winter, at least one stage in a butterfly species' life cycle must enter a dormant state termed "diapause" in order to resist freezing. Most species that spend the winter months in Canada do so as caterpillars. Others pass the winter as eggs (e.g., Hairstreaks) or pupae (Elfins and other Callophrys), while a few species, mainly Tortoiseshells (Nymphalis) and Angelwings (Polygonia), spend the winter as adults, hibernating in holes in trees, crevices in rock, or other shelters, like buildings.

Science now recognizes about 20 000 butterfly species worldwide, and this great variety is thought to relate to the broad diversity of plant species, since larvae typically use only a relatively narrow range of food plants. The North American Euphilotes butterflies, for instance, feed only on members of the Buckwheat family (Polygonaceae); the larvae eat the flowers and fruits, and the adults sip the nectar.

Within Canada, 302 butterfly species are described from coast to coast to coast, with the majority of species found in British Columbia (182). High species richness (141-162 species) is also found in the provinces from Alberta through to Quebec. While many Canadian species are widespread, with the potential to be found in almost any province or territory (e.g., Painted Lady, Mourning Cloak, Canadian Tiger Swallowtail), a few species appear to be highly restricted in their distribution. For example, although further survey work may eventually describe a more extensive distribution for the species, Johansen's Sulphur has only been found on a single hillside near Bernard Harbour in Nunavut.

National general status ranks have not yet been completed for butterflies. However, on average, provinces and territories reported that less than 1% of the butterflies in their regions were *At Risk*, 3% *May Be At Risk,* and 6% were *Sensitive* (**Figure II-iii**). The majority of butterflies are ranked as *Secure* (average

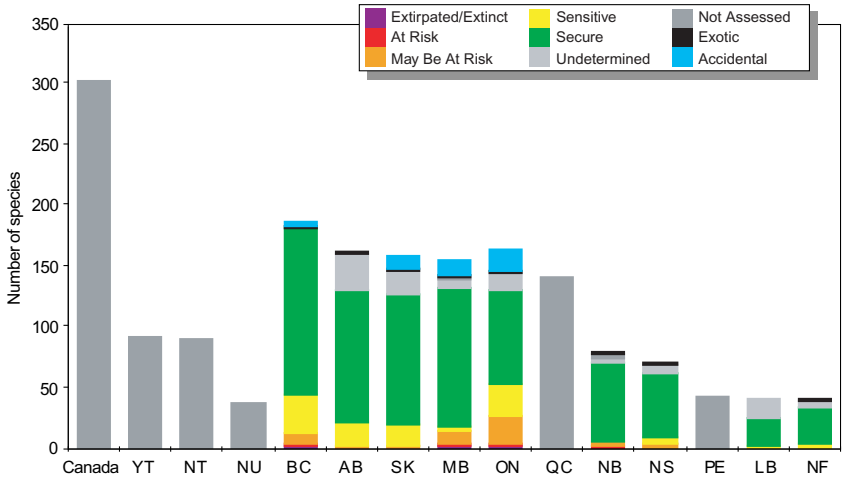


FIGURE II-iii. Summary of the general status of butterflies in Canada. The status of this large group is not well known — a large proportion of our 284 regularly occurring species are either *Not Assessed* or *Undetermined*.

45%), but it is important to note that the average proportion *Not Assessed* was quite high (37%), with a further 8% *Undetermined*. Canada has yet to report any recent extinctions; however, a few species are known to have experienced local extirpations, including the Southern Hairstreak (Ontario), Ridings' Satyr (Manitoba), and the Viceroy (British Columbia).

Exotic butterflies in Canada include the European Skipper, which arrived in Ontario in about 1910. Spreading south and west, this species has today become a major pest of Timothy Grass. Still more "successful" is the now familiar Cabbage White, introduced at Quebec City in about 1860 and now found throughout most of North America. Not surprisingly, most experts agree that the modification and elimination of suitable habitat pose the greatest threat to native butterflies across the country. Butterflies associated with highly jeopardized natural communities, like the pine oak barrens and tallgrass prairies of Ontario and the Garry oak woodlands and the Okanagan and Silmilkameen valleys of British Columbia, are particularly susceptible.

Freshwater fishes

fish: *any of numerous cold-blooded strictly aquatic craniate vertebrates ... that have typically an elongated somewhat spindle-shaped body terminating in a broad caudal fin, [and] limbs in the form of fins....*

Quick facts:

- Globally, there are about 10 000 freshwater fishes (about 20% of all vertebrate species).
- Canada is home to 230 resident species of freshwater fishes, although as many as 7 *Extirpated/Extinct* species have also occurred here at one time.
- Ontario and Quebec (155 and 114 species, respectively) have much higher species richness than other regions.
- Across provinces, an average of 53% of species are ranked *Secure*.
- From 0 to 10% of freshwater fish are considered *At Risk*, depending on the province or territory.
- At least 10% of Canada's freshwater fish species richness is made up of *Exotic* species.
- Seven species are *Extinct* in Canada, while two more are *Extirpated* in one or more provinces.
- *Exotic* species (e.g., Sea Lamprey) are implicated in freshwater fish extinctions.

Arguably, more than any other vertebrate group, fishes are tied to a single dominant feature of their habitat: water. With sleek bodies designed to reduce drag, fins for steering and propulsion, swim bladders to buoy them at any depth, and special current-sensing canals running the length of their bodies (lateral line system), fishes are exquisitely adapted to movement through the underwater world. But water provides more to fishes than just a physically supportive medium in which to navigate. Water temperature, chemical composition, speed, and pattern of flow influence everything from whether fishes can breathe to where conditions are suitable for them to deposit their eggs (spawn). The physical connections among water bodies determine the distribution of fish species and the potential for colonization by other fishes, which may be predators, prey, or

Freshwater Institute, Fisheries and Oceans Canada

Walleye, a species of importance to recreational fishers.

competitors. A break in the flow between water bodies is one of the most important factors in generating new fish species: genetic differences among fish populations can accumulate over time when a conduit for the exchange and inter-breeding of individuals is blocked. Indeed, it may have been just these kinds of barriers, some half a billion years ago, that set one group of fishes on the path to land, as the ancestor of all modern-day tetrapods (mammals, birds, amphibians, reptiles).

Whether it is that fishes are older than other vertebrates or the fact that 70% of the planet is covered by water, fish are certainly the most species-rich vertebrate group, making up about half (25 000) of all vertebrate species worldwide. Of these, approximately 10 000 species are freshwater species, a somewhat surprising proportion given that only about 3% of the world's water is fresh. Canada contains about one-quarter of the world's fresh water and thus has a considerable responsibility for the protection of freshwater fish habitat. Within our streams, rivers, and lakes, there are 230 species of fishes. Two major groups of Canada's freshwater fishes contain members familiar because of their prominence in recreational and commercial fisheries: the salmons and allies (Salmoniformes), including salmons, trouts, ciscoes, and whitefish; and the perches and allies (Perciformes), including the perches, basses, walleye, and drums. These two groups account for about 12% and 20%, respectively, of Canadian freshwater fish species. A third group, Cypriniformes, represents the largest assemblage (29%) of freshwater Canadian fish species. It includes the minnows, dace, chub, suckers, shiners, and redhorses. Several other familiar but smaller groups are the catfishes, pikes and pickerels, and sculpins, together accounting for another 15% of Canadian species.

While a few of these species (e.g., Lake Trout, White Sucker, Slimy Sculpin, Lake Whitefish) extend across almost the whole country, many species are concentrated in particular provinces and territories. As a result, species richness varies across provinces and territories - the highest species richness occurs in Ontario (155 species) and Quebec (114 species). Species richness falls steadily east of Quebec and west of Ontario, being lowest in Atlantic Canada and the northern territories (under 50 species). Reasons for high species richness in Ontario and Quebec may be related to the large number and extent of water bodies there, a relatively mild climate in parts, and the fact that two major drainage basins overlap in these provinces. Still, overlap of drainage basins can be only part of the explanation, as Ontario has 42 species that do not occur anywhere else in Canada. This is 15 more of such species than the next province, British Columbia (27 species), and at least 38 more than any of the other regions, including Quebec (four species). Ontario still retains its place as the most species-rich province for freshwater fish, even when an adjustment for its 19% non-native (Exotic) species is made. Some other regions have no *Exotic* species (e.g., Yukon, Labrador); however, the proportion of *Exotic* freshwater fish species is high (at least 10%) relative to other groups ranked in the report.

A significant number of *Exotic* species is one factor that threatens Canada's native freshwater species in the Great Lakes. A notable example is the Sea Lamprey, a primitive parasitic "fish" that has contributed to the extinction within Canada of at least one species, the Deepwater Cisco, in the Great Lakes. In British Columbia, the Brown Bullhead is implicated in the extinction of two species of lake stickleback. A total of seven freshwater fish species are extinct in Canada,

with an additional species, the Blackfin Cisco, extirpated from freshwater bodies in Ontario. Other *Exotic* species have less obvious effects on native fishes than the mortal wounds inflicted by Sea Lampreys. For instance, introduced species are often voracious predators, either eating native fishes or competing with them for their regular diet of invertebrates (e.g., worms, leeches, insects, snails) or other fishes. Other factors that can influence the distribution and abundance of freshwater fishes are related to habitat alteration (e.g., dam construction, impoundments), overexploitation, and pollution.

The overall effect of these impacts on freshwater fish species in Canada is not clear, because national general status rankings have not yet been completed for this group. However, on average, provinces and territories reported about 2% *At Risk*, 4% *May Be At Risk*, and 12% *Sensitive* general status ranks for freshwater fish in their region (**Figure II-iv**). The majority of freshwater fishes are ranked as *Secure* (average 53%), but it is important to note that the average proportion *Undetermined* (17%) was quite high, with a further 1% *Not Assessed*.

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Northern Pike, highly piscivorous lie-in-wait predator.

It might be wondered whether our lack of enough data to allow general status assessments of these *Undetermined* species is important. In this respect, it is worth recalling that these lesser-known species form part of ecosystems that support other wildlife, including predatory fish species. Many of these predators are of direct economic importance, forming part of the Canadian commercial freshwater fishery, which had a market value of over $147 million in 1998, and a recreational fishery (freshwater and marine) that had a value of over $4.9 billion in 1995. Economic impacts then join the roster of reasons to work in the future towards determining the general status of all Canadian freshwater fish species.

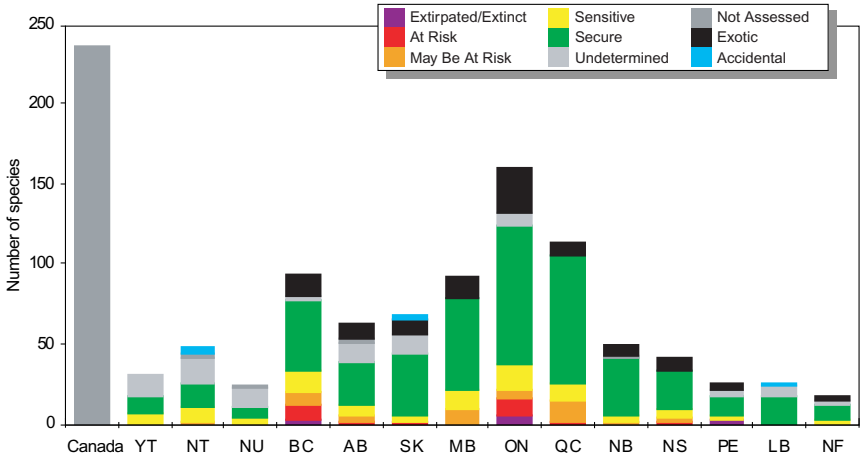

FIGURE II-iv. Summary of the general status of freshwater fishes in Canada. The geographic distribution of our 230 extant species is highly skewed; from a peak in species richness in Ontario (155 species) and, to a lesser degree, Quebec (114), richness declines towards the east, west, and north. Note that the fish fauna of many provinces include relatively large numbers of *Exotic* species.

Amphibians

am·/phib·/i·/an: *an amphibious organism; especially : any of a class (Amphibia) of cold-blooded vertebrates (as frogs, toads, or salamanders) intermediate in many characters between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.*

Quick facts:

- There are about 4 780 amphibian species globally.
- Canada is home to 45 species of amphibians — 24 frogs and toads and 21 salamanders.
- Ontario has more amphibian species (23) than any other province or territory.
- Twenty-nine (64%) amphibian species in Canada are considered *Secure.*
- Four (9%) amphibian species in Canada are considered *At Risk.*
- Amphibians are believed to be environmental indicator species.
- Globally, populations of many amphibian species are believed to be declining.

Comprising mostly frogs, toads, and salamanders, much about amphibians is captured in their name: "double life." This refers to the complex life cycle of amphibians, with most having an aquatic stage as a gilled "tadpole" before going through a remarkable metamorphosis to become air-breathing, four-limbed adults. The transition from water to air is also reflected in amphibian history. Amphibians are thought to have been the first vertebrate group to colonize land some 350 million years ago, their ancestors ultimately giving rise to modern amphibians on the one hand and to reptiles, birds, and mammals on the other hand. Despite success in colonizing the land, amphibians have never completely lost their dependence on water. Most species deposit jelly-like eggs in water, where the tadpoles then hatch and mature. Even amphibian species that lead largely terrestrial lives never escape the requirement to maintain a moist skin. This is because amphibians use their porous skin to supplement breathing, a feat that requires moisture to be efficient.

M. Runtz

Yellow-spotted Salamander wending its way to a spring breeding pond.

Amphibians play the role of both prey and predator in the ecosystems of which they are a part, these being predominantly wetlands and forests. At all life stages, amphibians are food for fish, birds, reptiles, mammals, and even invertebrates and other amphibians. In their turn, amphibians consume vast quantities of insects and other invertebrates, many considered pests by humans. Yet, despite their importance in nature, amphibians frequently escape our notice, probably because they are less conspicuous than other animals (e.g., mammals, birds). Moreover, because differences among amphibian species are often subtle, few people have any idea of their astounding species richness. Recent estimates indicate that the number of described amphibian species globally (4 780) exceeds that of mammals (4 629).

Canada boasts 45 species of amphibians: 21 salamanders and 24 frogs and toads. While all provinces and territories are home to some amphibians, the distribution of species is by no means even. Ontario has the most species (23), followed closely by Quebec (21) and British Columbia (21). A substantial number of the species in British Columbia, including seven salamander species, occur in no other region of Canada. Most amphibian species found in Canada have the majority of their range in the United States. However, 14 amphibian species have 50% or more of their range in Canada. Four of these, the Canadian Toad, Mink Frog,

Leopard Frog in a marsh.

B.T. Aniskowicz

Wood Frog, and Blue-spotted Salamander, have upwards of 75% of their range in Canada. All amphibians in Canada meet the northern limits of their range here. As such, Canada offers opportunities to study the ability of these animals to adapt their physiology to our severe winters and short summers. Perhaps the best example of this exceptional physiological adaptation is the phenomenal ability of Wood Frogs to survive freezing solid over winter.

While 64% (29 species) of amphibians are *Secure*, nearly a quarter (22%, 10 species) are designated *At Risk* or *May Be At Risk* (**Figure II-v**). This precarious state may in part be explained by living a life at their ecological and geographic limits. Yet human-caused factors, like draining of wetlands and forest clearing or fragmentation, are also threats to the persistence of amphibian species in Canada. Besides loss of habitat, amphibians are also thought to be more sensitive and more widely exposed to a host of environmental stresses by virtue of their aquatic and terrestrial life stages and porous skins. Indeed, many scientists regard them as "canaries in the coal mine," a reference to their potential value as indicator species of environmental decline. For this reason, reports of a number of bizarre morphological deformities in amphibians, such as extra eyes or legs, are particularly unsettling. This, joined by an apparent global decline in amphibian populations, even in seemingly pristine habitats, has sparked a great deal of interest in the status of these animals the world over. Surveys, based on the calls of breeding male toads and frogs, have provided valuable data with which to monitor population sizes and changes in species distribution. Incorporating survey information into this report has resulted in the most up-to-date assessment of the general status of these species in Canada.

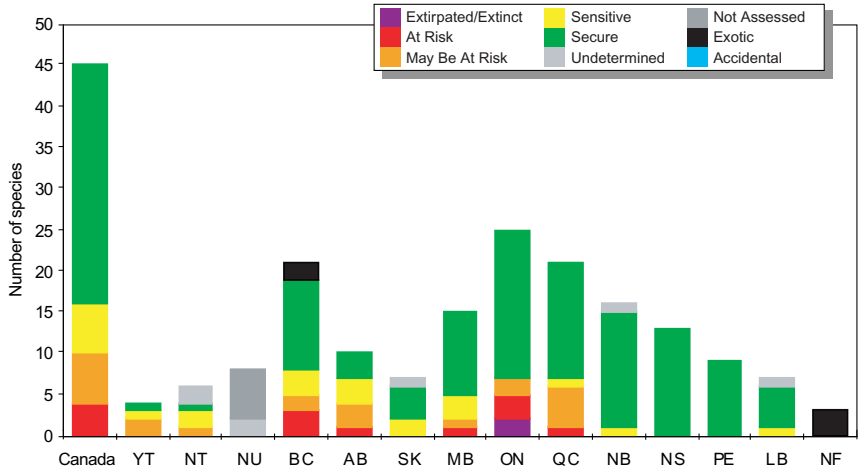

FIGURE II-v. Summary of the general status of amphibians in Canada. The relative status of amphibians varies among regions; especially pronounced is the high proportion of species regarded as *Secure* in the Atlantic provinces. Over 60% of Canada's 45 amphibians are thought to be *Secure* nationally.

Reptiles

rep·/tile: *any of a class (Reptilia) of air-breathing vertebrates that include the alligators and crocodiles, lizards, snakes, and turtles with a body usually covered with scales or bony plates.*

Quick facts:

- The global species richness of reptiles exceeds 6 500 species.
- Canada has 42 species of terrestrial reptiles: 10 turtles, 25 snakes, and seven lizards.
- Canadian waters provide habitat for two resident species of marine reptiles — all turtles.
- Ontario contains the most reptile species (26).
- Less than half (43%, 18 species) of Canadian reptile species are considered *Secure.*
- One-fifth (21%, nine species) of Canadian reptile species are considered *At Risk.*
- Yukon Territory, Newfoundland, and Labrador have no reptile species.
- Only one reptile has more than 50% of its range in Canada (Northern Alligator Lizard).

M. Runtz

Alert Northern Water Snake.

The reptiles encompass a number of major groups technically distinguished from one another mostly by features of their skulls. More common distinctions relate to the overall body plans familiar to everyone: turtles and tortoises, lizards, snakes, and crocodiles. Additional small and little-known groups include the amphisbaenids (worm lizards) and the primitive lizard-like tuataras of New Zealand. Despite some pronounced differences in anatomy, reptiles are similar to each other in a number of ways. Most reptile species lay shelled eggs, which are resistant to drying. This feature separates them from the amphibians, which lay gelatinous eggs, and may have contributed to reptiles' historically more extensive colonization of the terrestrial environment. Yet all reptiles continue to share with amphibians an ectothermic ("cold-blooded") physiology, relying on external sources of heat to maintain their body temperature, which in turn directly affects their activity level. Ectothermy accounts for why many reptiles, especially in temperate zones like Canada, can be seen alternately basking in the sun and then retreating to the shade. Reptiles are unlike amphibians, however, in having a characteristically dry and scaled skin. Differences in scale number and scale distribution are often used by taxonomists to distinguish closely related reptile species. However, for the reptiles themselves, scales are important in forming a barrier to the environment, especially to water loss, a quality essential in hot dry habitats. In contrast to fish scales, which are separate and detachable, reptile scales

B.T. Aniskowicz

Painted Turtle hatchling floats among bulrush stalks.

are thickened protrusions of a continuous skin, a feature that leads to their harvesting for various types of leather goods.

Reptiles occupy a large range of habitats and ecological roles. Represented on land, in fresh water, and even in marine realms, they are important predators upon adult and juvenile forms of other vertebrates, such as fish, birds, amphibians, mammals, and other reptiles, as well as a host of invertebrates. They are also prey to representatives of most of these same groups. Despite being an important component of many ecosystems and consuming many species considered pests by humans, reptiles are often feared and despised. Snakes bear the brunt of human fear, even though globally a relatively small proportion are venomous (about 17%).

The various groups of reptiles emerged over a protracted period starting about 300 million years ago. Reptile diversity reached a peak with the now-extinct (except when birds are considered modern descendants) dinosaurs. Ironically, the extinction of the most popular group of reptiles ever vastly predates the origin of its biggest fans, humans. With the age of dinosaurs now long gone, modern reptiles number about 6 500 species globally, with more than half of these lizards (about 3 500), and most of the remainder snakes (about 2 300).

Canada's terrestrial reptiles comprise a total of 42 species: 10 turtles, 25 snakes, and seven lizards. In addition to these terrestrial reptiles, four species of marine turtle are found in the Pacific and Atlantic ocean regions. Across Canada, Ontario has the most reptiles overall (26), followed by Quebec with 16 species and British Columbia with 15 species. Significantly, many species of reptiles from British Columbia occur nowhere else in Canada (e.g., Sharptail Snake, Western Pond Turtle, Pigmy Short-horned Lizard). At the other end of the species richness scale, the Yukon, Newfoundland, and Labrador have no species of reptiles. Reptiles are the only species group ranked in this report for which a province or territory reports no species at all. Canada's low numbers of reptile species in general as compared with the United States and the rest of the world may be due to Canada's relatively short summers, which leave less time for reptile eggs to develop. Certainly, the fact that the territories contain very few reptiles supports this idea. This possibility is also reflected in the proportion of species ranges in Canada. Only one species, the Northern Alligator Lizard, has more than 50% of its range in Canada.

A large proportion of reptiles in Canada are in need of attention: less than half (43%, 18 species) are ranked as nationally *Secure* (**Figure II-vi**). Fully one-fifth (21%, nine species) of Canadian reptile species are designated *At Risk*, the majority of these being snakes, but with turtle and lizard representatives as well. The risk to these animals cannot be attributed to any single factor. Certainly, human fear of reptiles, especially snakes, contributes to mortality through deliberate killing. In addition, significant mortality occurs on roadways, where

At Risk,

reptiles bask to absorb heat from sun-warmed asphalt, or which reptiles (e.g., turtles) may simply be slow in crossing. Pesticides and contaminants are also thought to contribute to mortality, with some concerns that contaminants concentrated in adults are passed to eggs, causing deformity or death in young. Marine turtles face special threats, which can include overharvesting, entanglement in fishing gear, the commercial collection of their eggs, and the ingestion of sea trash. Yet for most reptiles, the biggest single threat is undoubtedly loss of suitable habitat or its fragmentation into "islands" cut off from other populations. Combined, these factors contribute to what is believed to be a global decline in the number of reptile species, an interesting, if sad, parallel to the situation for amphibians.

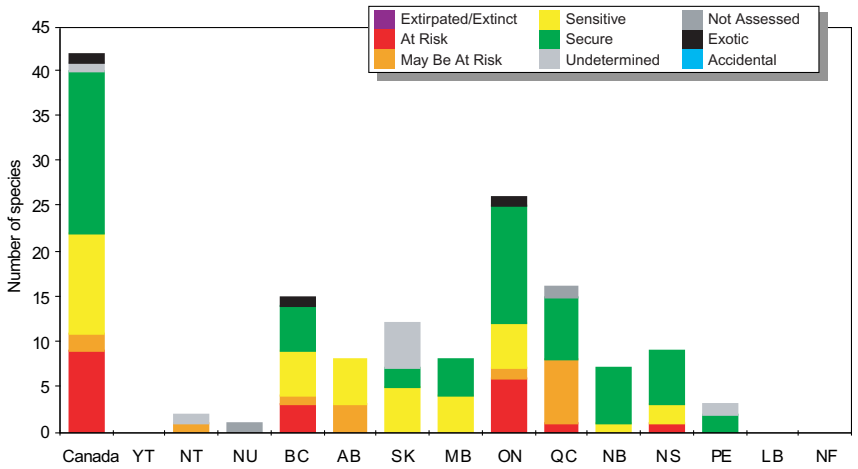

FIGURE II-vi. Summary of the general status of terrestrial reptiles in Canada. With more than half of Canada's 42 species classified as *At Risk, May Be* or *Sensitive,* terrestrial reptiles appear relatively vulnerable. No reptiles are found in the Yukon, Newfoundland, or Labrador.

Birds

bird: *any of a class (Aves) of warm-blooded vertebrates distinguished by having the body more or less completely covered with feathers and the forelimbs modified as wings.*

Quick facts:

- Canada is home to about 462 resident species of birds, excluding *Extirpated/Extinct* and *Accidental* species.
- British Columbia and Ontario have the most bird species (362 and 318, respectively), excluding *Accidental* and *Extirpated/Extinct* species.
- Three hundred and forty-five (75%) Canadian bird species are considered *Secure.*
- Twenty-one (5%) Canadian bird species are considered *At Risk.*
- Harris' Sparrow is the only endemic Canadian bird.
- A large number of *Accidental* species (173) find their way to Canada.
- Migration and colonial nesting present challenges for bird conservation.

A charismatic group, birds are arguably the best-known group of organisms on the planet. In part, this is because most bird species are active by day, many have attractive songs or colour, and birds are present on every continent. Also likely important in the appreciation of birds is their impressive diversity of form. They range in size and proportion from ostriches to eagles, penguins, ducks, parrots, and hummingbirds, to name only a few. Such conspicuous variety speaks to an accomplished record of adaptation to their environment. This is all the more impressive because birds are a relatively recent evolutionary radiation, the first birds arising between 140 and 220 million years ago from a reptile-like ancestor.

Perhaps the single most captivating feature to have evolved in birds is their command of the air. Even for the small proportion of flightless birds, the development of wings has had profound effects on other aspects of their biology. Conversion of forelimbs to wings has meant that birds have developed an array of bill shapes to help them grasp, scratch, and dig. More obviously, the diversity of bill shapes (long probing, broad filtering, curved tearing, sharp spearing, stubby

Spruce Grouse hen settled on her nest.

M. Runtz

seed-crushing) reflects the variety of birds' feeding habits and the ecological roles that birds perform in the environment. Pollinators, seed dispersers, carrion feeders, and predators on everything from insects to other vertebrates, birds are a critical link in ecosystems of many kinds.

Importantly, the role of many birds in specific ecosystems can vary over the course of a year. This is due to one of the most compelling aspects of bird biology: the phenomenon of annual migration. Annual migrations are timed to avoid the stress of extremes in climate while allowing birds to take advantage of seasonally concentrated and abundant resources. In North America, most bird migration occurs north–south along four main "flyways." Some of the most impressive travellers of these routes are among the two-thirds of North American shorebirds (e.g., plovers, sandpipers, curlews, oystercatchers) that breed in the Arctic but winter in the Neotropics (Central and South America), some travelling over 25 000 kilometres to complete this annual marathon. Similarly, many species of Canadian songbirds winter in the Neotropics as well as the southern U.S. states, this annual exchange of birds with warmer parts of the United States finding a human reflection in the "snowbird" Canadians who migrate each winter.

There are more than 9 600 bird species distributed globally, about 639 species having been reported in Canada at some time. Fully one-quarter of these are considered *Accidental*, more than any other group ranked in this report. Such a large proportion of *Accidental* species result from birds' ability to fly: the large distances they can cover allow large mistakes in navigation and expose them to a potential for being blown off course by bad weather. When *Accidental* species are ignored, 462 species occur regularly within our borders. About 10% of these are shorebirds, 60% "landbirds" (e.g., warblers, sparrows, finches, woodpeckers, ravens, grouse, owls, eagles), 22% waterbirds or seabirds (e.g., murrelets, puffins, terns, herons, loons, grebes), and a further 8% waterfowl (e.g., ducks, geese, swans). Most provinces and territories are home to over 100 species of birds, with Alberta, British Columbia, and Ontario over the 300 mark. Because so many birds are migratory, especially in countries like Canada with strong seasonality, it is not surprising that there is only one species of bird that breeds only in Canada (Harris' Sparrow). Yet while Canada may not hold the rarest or richest bird fauna, it does contain some of the most important bird habitat in the world. For example, 210 species of birds breed in our boreal forest, an area covering nearly a third of Canada and representing a third of the world's boreal forest. Likewise, the Canadian prairies, rich in sloughs and "potholes," long have been touted as the "duck factory," referring to their role in our production of more than three-quarters of the waterfowl harvested annually in North America. Our vast coastline and associated ocean waters provide a home for immense colonies of breeding seabirds, like the millions found breeding each year on the islands of Newfoundland's Witless Bay. For two seabird species (Iceland Gull, Ivory Gull), Canada represents 100% of the North American breeding range. This is also true for two of our shorebird species (Common Ringed Plover, Purple Sandpiper). Finally, in the case of the Whooping Crane, Canada harbours the only self-sustaining population in the world.

The majority (75%) of Canadian bird species are ranked nationally as *Secure* (**Figure II-vii**). Some of these species do show evidence of population declines (e.g., Horned Lark, Vesper Sparrow). However, because they are still widespread or common, they are considered *Secure* in this report. Four species (about 1% of Canadian species) are already *Extirpated/Extinct* (Labrador Duck, Great Auk, Greater Prairie-Chicken, Passenger Pigeon), while 21 species (5%) are nationally *At Risk* (e.g., Burrowing Owl, Marbled Murrelet, Eskimo Curlew, Sprague's Pipit). A further 2% of species are placed nationally in the *May Be At Risk* category, with another 12% *Sensitive.* Finally, less than 4% of species were *Not Assessed* or *Undetermined.*

Habitat loss is the most important factor implicated in the loss and decline of bird populations in Canada. Other factors negatively impacting birds include habitat fragmentation, contaminants (e.g., spent lead shot, which some waterfowl eat), some pesticides, accidental mortality (e.g., fishery by-catch), and the introduction

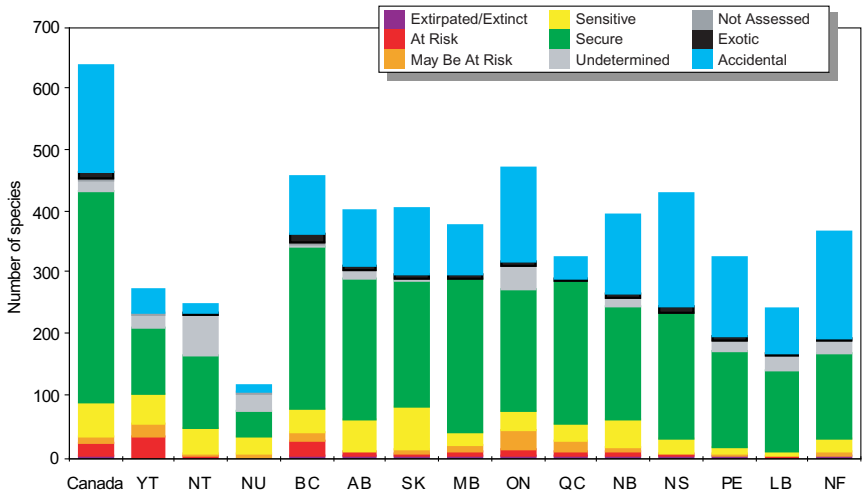

FIGURE II-vii. Summary of the general status of birds in Canada. Up to 639 bird species have been recorded in Canada, although a quarter of those are regarded as *Accidental species,* which do not reside in Canada. As many as 345 (75%) of our resident extant bird species are considered nationally *Secure.*

B.T. Aniskowicz

Male King Eider resting on an arctic bay.

of *Exotic* predators that prey on adults and nestlings (e.g., house cats). Most of these impacts can be complicated or exaggerated by the seasonal movement or colonial nature typical of many species. For instance, most seabird species concentrate in dense breeding colonies for part of the year, while many shorebirds aggregate to rest and feed during migration ("stopovers"). For example, the Bay of Fundy supports well over 4 million Semipalmated Sandpipers (about 70% of the world population of this species) during the southward leg of their migration. Concentration of so many individuals in one spot means that even the loss of a small piece of habitat can have catastrophic effects on many species. However, the seasonal movement of birds is probably most challenging to bird conservation efforts, because it necessitates linking populations, their size, status, and impacts upon them, to areas that may be spatially separated, sometimes by thousands of kilometres. The effort to link up birds moving between different geographic locales is one of the main reasons that the banding of birds with alpha-numeric leg bands is so important. Bird banding and related efforts (e.g., annual volunteer surveys like the Christmas Bird Count) are just some of the many examples of a coordinated effort across nations aimed at conserving migratory birds. The North American Bird Conservation Initiative (NABCI), a joint agreement between Canada, the United States, and Mexico, is the most recent and ambitious attempt at such cooperation.

Mammals

mam·/mal: *any of a class (Mammalia) of warm-blooded higher vertebrates (as placentals, marsupials, or monotremes) that nourish their young with milk secreted by mammary glands, have the skin usually more or less covered with hair, and include humans.*

Quick facts:

- There are 4 629 mammal species globally.
- Canada is home to 209 resident species of mammals, 45 of which are extant marine species.
- British Columbia has the most terrestrial mammal species in Canada (118).
- The Pacific ocean region has the most marine mammal species in Canada (26).
- About two-thirds (66%, 108 species) of terrestrial and about two-thirds (69%, 31 species) of marine mammal species in Canada are considered *Secure.*
- Five (3%) terrestrial and three (7%) marine mammal species are considered *At Risk.*
- Forty-three percent (71 species) of Canadian terrestrial mammal species are rodents.
- The Vancouver Island Marmot is endemic to Canada (occurs nowhere else in the world).

B.T. Aniskowicz

Deer Mouse foraging in the branches of a maple tree.

Science now recognizes three major groups of living mammals, including the monotremes, marsupials, and placentals. Monotreme mammals, the least diverse and most poorly studied of the three, are set apart because they lay eggs (e.g., Platypus). Marsupial mammals are all "pouched" and include, among others, numerous species of opossums and kangaroos. Placental mammals all bear live young, which are nourished before birth in the mother's uterus through a specialized embryonic organ attached to the uterus wall, the placenta. The placenta is derived from the same membranes that surround the embryos in the amniote egg of reptiles, birds, and monotreme mammals. The term "placental mammals" is somewhat of a misnomer, because marsupials also have placentas. The difference is that the placenta of marsupials is very short-lived and does not make as much of a contribution to fetal nourishment as it does in placental mammals.

Mammals are believed to have evolved from therapsid reptiles about 240 million years ago. The class Mammalia, of which humans are a part, now comprises 26 orders and close to 5 000 species, most of which are rodents and bats. All mammals are endotherms ("warm-blooded"), meaning that they maintain a relatively high and narrow range of body temperature. This allows them to be equally active over a huge range of external temperatures, unlike ectothermic vertebrates (e.g., fish, reptiles, amphibians), whose activity level is dictated by the ambient temperature. But the cost of a high body temperature is the need for much more fuel (food). A requirement for relatively large amounts of fuel is part of the reason why mammals may frequently have disproportionately large effects on the ecosystems to which they belong. In other cases, it is mammals' numerical abundance or behaviour that is most important in natural communities. For

Cow Moose and her twin calves.

M. Runtz

instance, at their peak, American Bison are thought to have numbered as many as 50 million — a single species concentration that literally shaped the vegetation communities of the North American prairies. Similarly, the American Beaver is widely regarded as a "keystone species" of forest watersheds, its damming behaviour a primary agent of landscape change.

Besides the impact that mammals may have on the landscape, perhaps the most noticeable feature of this group is the impressive diversity of their form and the habitats they occupy. In Canada, 206 species from 10 orders cover everything from Star-nosed Moles tunnelling through the soils of a maple-beech forest to moose plodding through a boreal bog to Little Brown Bats flying from a cave in the Canadian Shield to Atlantic Walrus loafing on an ice floe. About 75% of Canadian mammals are associated with terrestrial habitats, 5% with freshwater habitats, and 20% with marine habitats. About 40% of our terrestrial mammals are rodents (e.g., mice, voles, squirrels). Rodents and bats combined make a large contribution to the higher species richness found in northwestern North America and are the main reason that mammal diversity is considerably higher in the western parts of Canada than in the east. British Columbia (118 species) and Alberta (91 species) support over 50% of all mammal species found in the country. In particular, British Columbia is notable for having the highest number of mammal species found nowhere else in Canada (30), 26 more than Ontario, the province with the next highest number.

Terrestrial mammals

Globally, about 2% (82 species) of all described mammalian species have gone extinct in the past 500 years. In Canada, the majority (66%, 108 species) of Canada's terrestrial mammal species are ranked nationally as *Secure* (**Figure II-viii**). Still, three terrestrial mammal species are already *Extirpated* (Woodland Caribou, Black-footed Ferret, Grizzly Bear) in some or all of Canada, and five (3%) more are *At Risk*. Nationally, a relatively small proportion (5%) of species are classed as

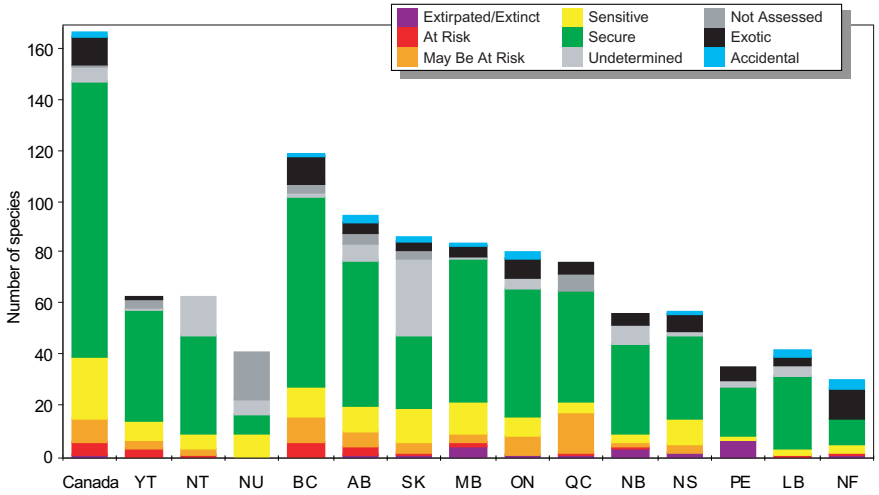

FIGURE II-viii. Summary of the general status of terrestrial mammals in Canada. The distribution of Canada's 164 extant and regularly occurring terrestrial mammal species is skewed geographically, with a richness peak in British Columbia (118 species) followed by a relatively smooth decline through to the east in Newfoundland (26 species).

May Be At Risk, although more (15%) are considered *Sensitive* and worthy of continued scrutiny. As with most groups, a variety of factors may contribute to the decline or imperilment of mammalian species. Among these, habitat loss and habitat modification are most important. Other factors that may contribute to the loss or decline of populations of some species include environmental contaminants and, in some cases, the potential for overharvesting. Some characteristics of mammalian species may make them more vulnerable on average to the usual range of threats, including a low reproductive rate, a long gestation and parental care period, limited or specialized habitat requirements, specialized diet, large body size, and a competitor and/or predator relationship with humans.

Marine mammals

Whereas most mammals are terrestrial or associated with freshwater habitats, about 2% of the world's mammalian species spend part or all of their time in marine habitats. There are two main groups of marine mammals: the Pinnipeds (seals, sea lions, walrus) and the Cetaceans (whales, dolphins, porpoises). The Pinnipeds are easily recognized as mammals, having nostrils and four limbs (modified into flippers) and breeding on land (or ice). By contrast, the Cetaceans are surprising mammals, having lost their hind limbs, having a single nostril on top of their heads (blowhole), and being unable to move about on land. Yet both Pinnipeds and Cetaceans are indeed mammals, having placentas and live births, suckling their young, being "warm-blooded," and breathing air with lungs.

Ursus Photography

Humpback Whale, found in the Pacific and Atlantic Oceans and famous for its' haunting songs .

Ursus Photography

Walrus loafing on an ice floe.

Canadian waters are home to about a quarter of the world's Cetaceans and Pinnipeds: about 35 species of whales, dolphins, and porpoises and a further 11 species of seals, sea lions, and walrus. In addition, we have one species of sea otter. Marine mammal species richness is almost the same between the Atlantic (24 species) and Pacific (26 species) Canadian waters, even though not all species are shared between the two ocean regions. The Eastern Arctic and Western Arctic ocean regions have many fewer species (10 and six species, respectively). However, they contain species occurring nowhere else in Canada — for example, the Atlantic Walrus and the bizarre tusked Narwhal. Due to their highly migratory nature, some of the larger Cetaceans (e.g., Fin Whale, Right Whale, Blue Whale, and Humpback Whale) can be found in Canada only during the summer months. At this time of year, the cool temperate waters off the coasts of British Columbia and the Atlantic provinces provide highly productive feeding grounds rich in zooplankton, krill, and forage fish species.

About two-thirds (69%, 31 species) of Canada's marine mammal species are considered *Secure* (**Figure II-ix**), but two species have already been extirpated in the Atlantic ocean region (Gray Whale and Atlantic Walrus), and one species (Sea Mink) is *Extinct.* A further three (7%) species are classified as *At Risk* nationally, including the Black Right Whale, which is widely considered to be the most *Endangered* large whale in the world today. Five more marine mammal species are considered *Sensitive.*

A variety of factors are implicated in the decline of marine species. These range from pollution to collisions with ships to entanglement in fishing gear. Other factors, including the recent increase in recreational whale-watching operations in Canadian waters, may also be having a negative impact on marine mammal populations, although such impacts are as yet unclear. Additionally, both vessel traffic and noise associated with offshore oil and gas developments have been thought to negatively affect whale populations. More controversial is the impact of hunting on both Cetaceans and Pinnipeds. Certainly, it is the case that some extreme population reductions, extirpations (e.g., Atlantic Walrus in the Atlantic ocean region in the past), and extinctions have been due to overhunting for marine mammal by-products, such as food, oils, and furs.

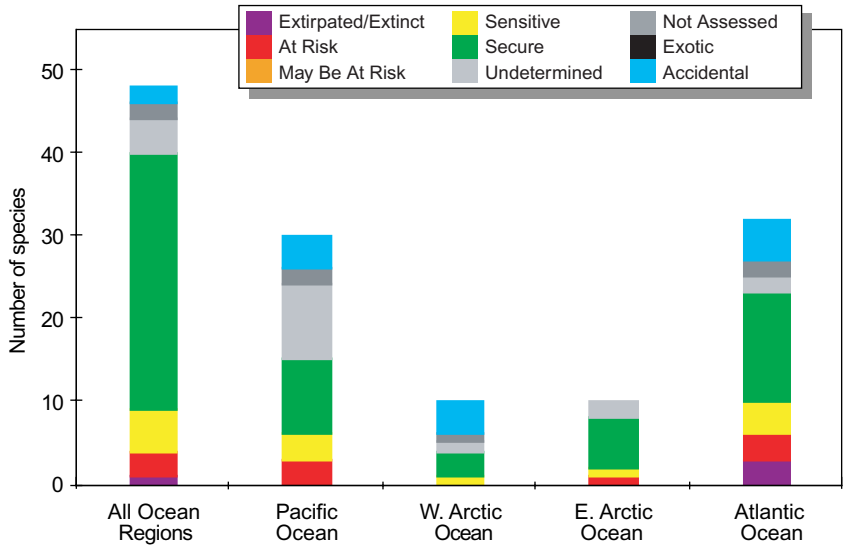

FIGURE II-ix. Summary of the general status of marine mammals in Canada. The distribution of Canada's 45 regularly occurring/extant species of marine mammals is skewed towards the Pacific and Atlantic ocean regions, with 26 and 24 species, respectively. Considerably fewer species make their home in Canada's Western Arctic and Eastern Arctic ocean regions (six and 10 species, respectively). Overall, few (about 7%) marine mammals are known to be *At Risk* nationally.

Section 3: General Summary

General status ranks presented in this report are summaries of a great deal of information distilled for a region or Canada as a whole. These ranks and what they reveal about the distribution and relative number of wild species across Canada can be examined in a number of ways. Results of this report can be used to generate an overview of the general status of taxa for various regions and the country as a whole (**Figure III-i**), to develop useful general conclusions about the distribution of an important fraction of Canada's total species richness (**Figures III-ii**), to evaluate the spread certain groups of *Exotic* species across the country (**III-iii**), and to highlight gaps in our knowledge (**Figure III-iv**). We encourage those readers who use the data further to let us know what they find (see **Appendix 1** for list of contacts).

The *Wild Species 2000* status ranks and summary findings are intended to form a foundation for future status monitoring efforts directed at Canadian wild species.

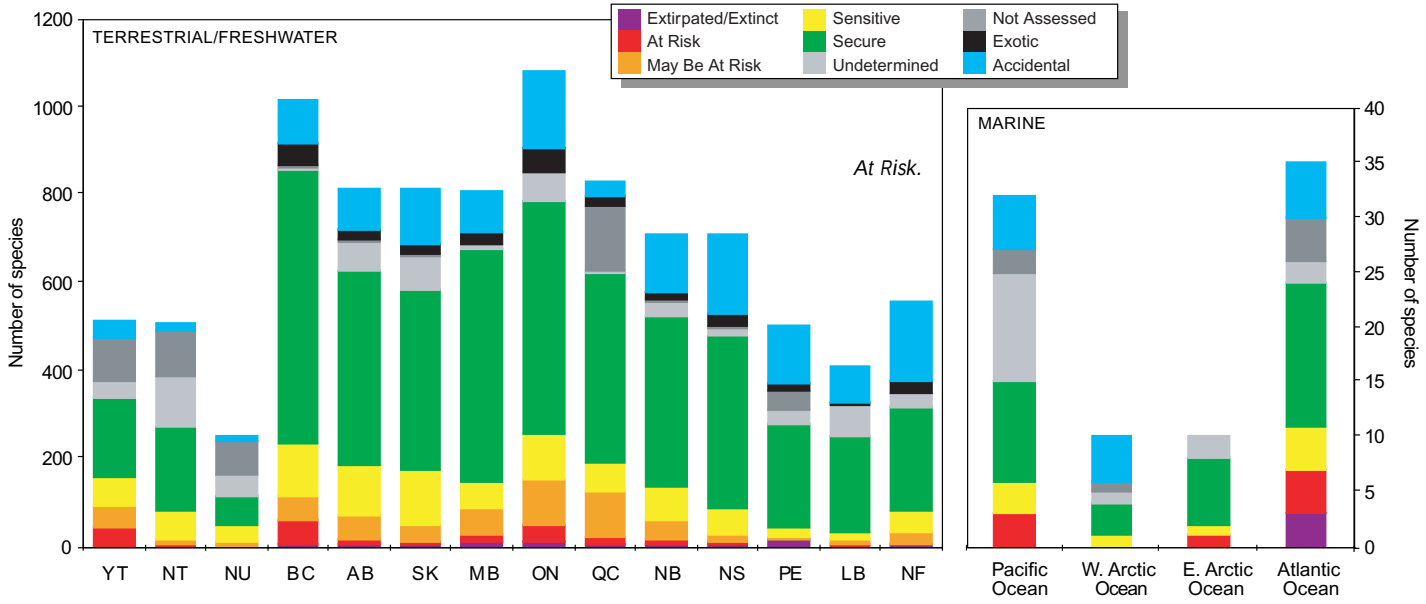

FIGURE III-i. Summary of overall species status. The vast majority of Canada's wild species are *Secure* at all geographic scales. About 65% of Canada's resident species are considered *Secure*. At the regional scale, Nova Scotia and Manitoba contain the greatest proportion of *Secure* species, each with over 70%. Across the different species groups, the proportion of *Secure* species is highly variable, ranging from a low of 40% for marine and terrestrial reptiles to a high of 67% for marine and terrestrial mammals. Considerable differences also occur among taxa in the number of *Accidental* and *Not Assessed* or *Undetermined species*. For example, 27% of birds on our list are considered *Accidental* species, and 45% of butterflies were either *Not* or *Undetermined*. However, the data also paint a graver picture for other wild species in Canada. Of the species that were ranked, 5% are known to be *At Risk*, and another 5% *May Be* One percent have been eliminated from Canada altogether. That some provinces have witnessed local extirpations, including Prince Edward Island (14 species), Ontario (12 species), and Manitoba (nine species), indicates that several species may be experiencing a reduction in their historical range. In particular, reptiles appear to be the most vulnerable to extinction in Canada, with almost one-quarter known to be *At Risk*.

Regionally, British Columbia and the Yukon contain the greatest total number and proportion of species *At Risk*. Differences between regions may be due to a variety of interacting factors, including species diversity, geography, climate, history, land use practice, human population size, and economic activity.

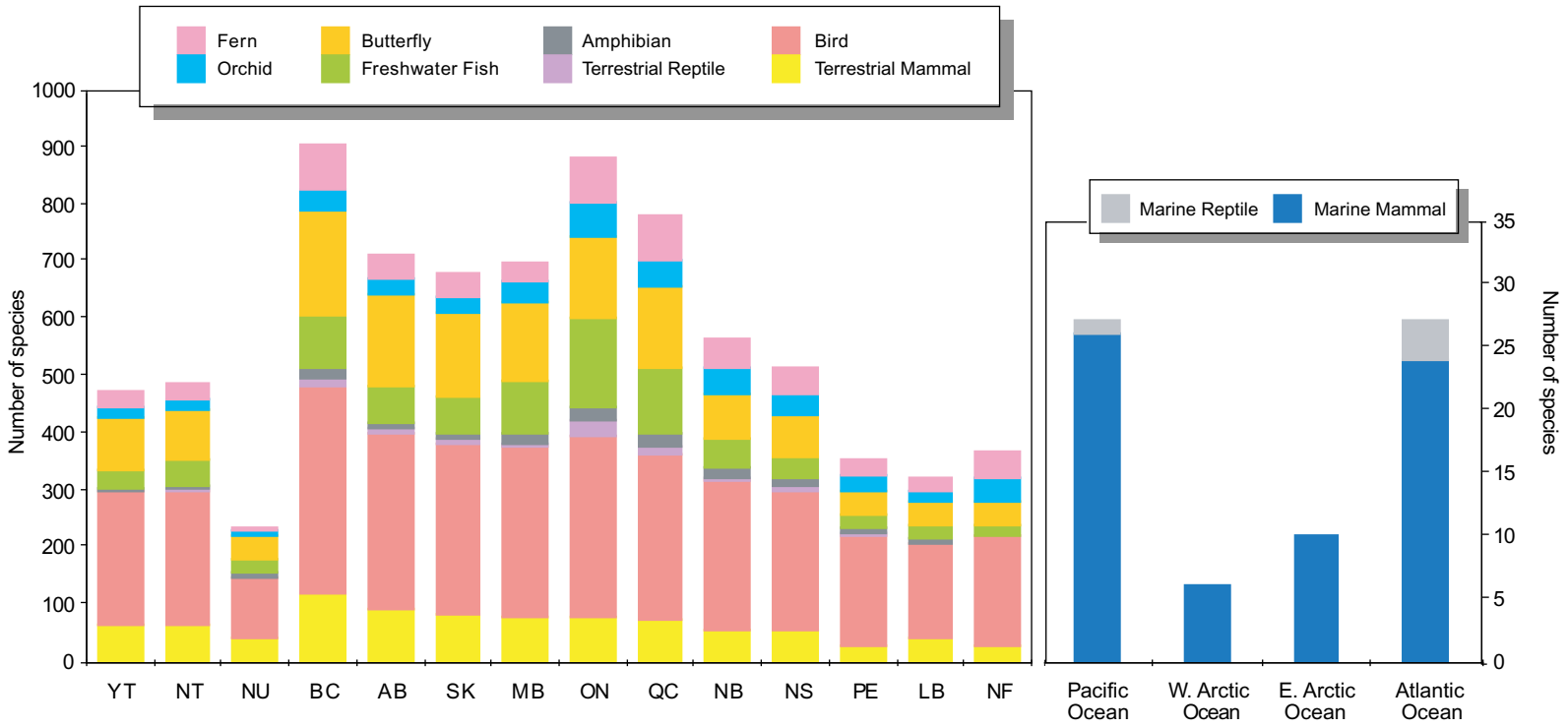

FIGURE III-ii. Summary of overall species richness. Canada contains more than 70 000 described species within the terrestrial and marine realms, yet only a small fraction (2%) of this variety is captured in this report. Birds comprise the largest species group studied (639 species), followed by butterflies (302 species) and freshwater fish (237 species).

The greatest species richness in Canadian ocean waters occurs just off the coast, along the continental shelf. Pacific and Atlantic ocean regions contain over half of our 47 marine mammals and turtles (excluding *Extirpated/Extinct* and *Accidental* species), while the frigid Western Arctic and Eastern Arctic ocean regions contain 12% and 21%, respectively.

Note: Overall species richness values should not be directly compared for the terrestrial and marine realms, as only two marine taxa (turtles, mammals) were assessed in this report.

On land, differences in glacial history, climate, geography, human land use, etc. across Canada have combined to produce wide regional variation in species richness. As such, no province or territory contains all 1 426 resident wild species, nor does any province or territory contain the full set of species of a given taxonomic group (e.g., all amphibians). Two general rules relating to species richness seem to prevail in Canada: 1. Northern provinces/territories tend to have fewer species than southern ones; 2. Provinces/territories covering larger areas tend to have more species than smaller ones. While the territories contain fewer species, many species found in the north possess unique features that allow them to flourish in an otherwise harsh environment, one characterized by a short growing season, low temperatures, long periods of darkness, and low precipitation.

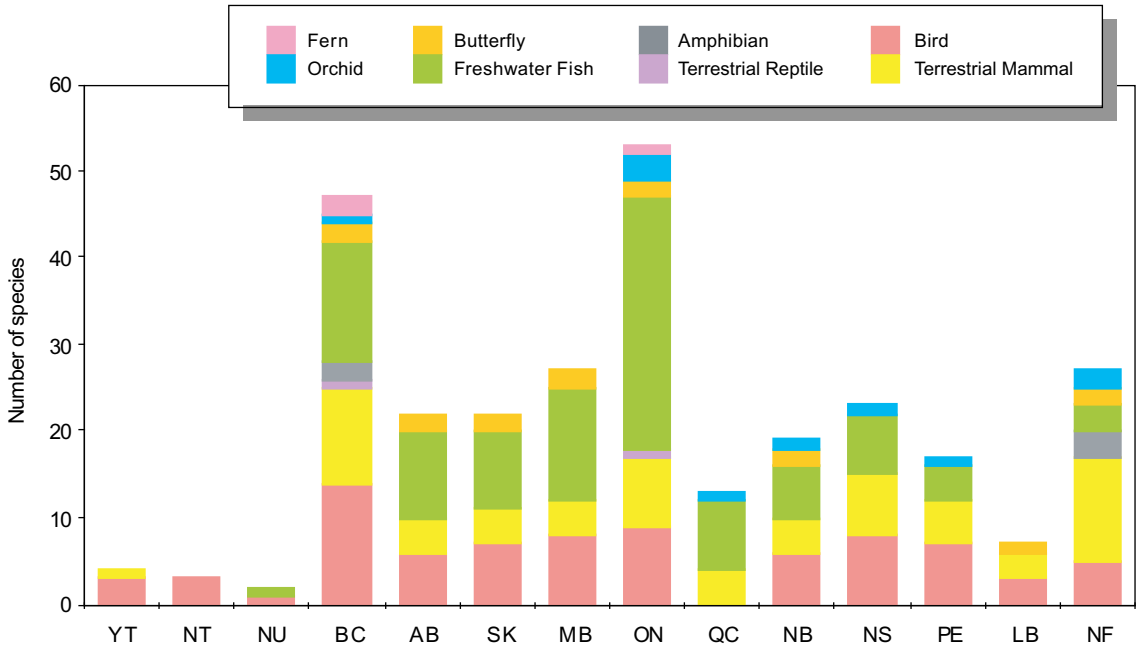

FIGURE III-iii. Summary of *Exotic* species. *Exotics* are of two general types: 1. foreign species that did not previously exist anywhere in Canada (e.g., California Quail, Norway Rat) or 2. native species that have been moved from one region in Canada to another (Eastern Cottontail introduction to British Columbia). Species may be inadvertently brought to Canada or relocated within Canada via ship ballast water, via packing materials, and as stowaways aboard all types of transportation vessels, while others are introduced deliberately for use in agriculture, landscaping, the pet industry, and commercial/scientific research. As predators, parasites, and competitors of native species, *Exotics* are considered one of the greatest emerging challenges for biodiversity conservation. Importantly, most other elements of society are equally concerned by the *Exotic* invasion. The fields of forestry, agriculture, fisheries, human heath, and conservation all regard *Exotic* species with the potential to invade natural and managed landscapes and wreak severe biological and economic havoc.

Exotic species that proliferate in Canada tend to be those that originate from other temperate regions of the globe. Species are also introduced from warm, arid, tropical and subtropical regions, but they often do not survive because of their inability to tolerate Canadian winters. For the same reason, *Exotic* species are generally uncommon in the Yukon, Northwest Territories, and Nunavut, where the harsh climate reduces the likelihood of survival. Lower rates of trade and tourism also contribute to the fact that relatively few *Exotic* species are found in northern Canada. Because *Exotics* are associated with human activity, it is not surprising that their greatest abundance is in Ontario, with its high trade and tourism activity.

Island flora and fauna may be especially plagued by *Exotic* species, since they tend to lack the capacity to tolerate novel predators/competitors. For example, Newfoundland has been especially inundated with introduced *Exotics* — having proportionally more *Exotic* species (7%) than any other region in Canada. Even more striking is the fact that 12 of Newfoundlands' 26 mammal species (46%) are *Exotics*.

Freshwater fish represent the most significant group of *Exotic* species recorded in this report — 21 species in total. The most extreme regional case being that of Ontario, where close to 20% of its freshwater fish species have been recorded as *Exotics*. In addition to their inadvertent introduction to Canada by way of ship ballast water (e.g., European Ruffe), the spread of *Exotic* fish has been aided by intentional introductions aimed at augmenting sport/commercial fishing (e.g., Brown Trout).

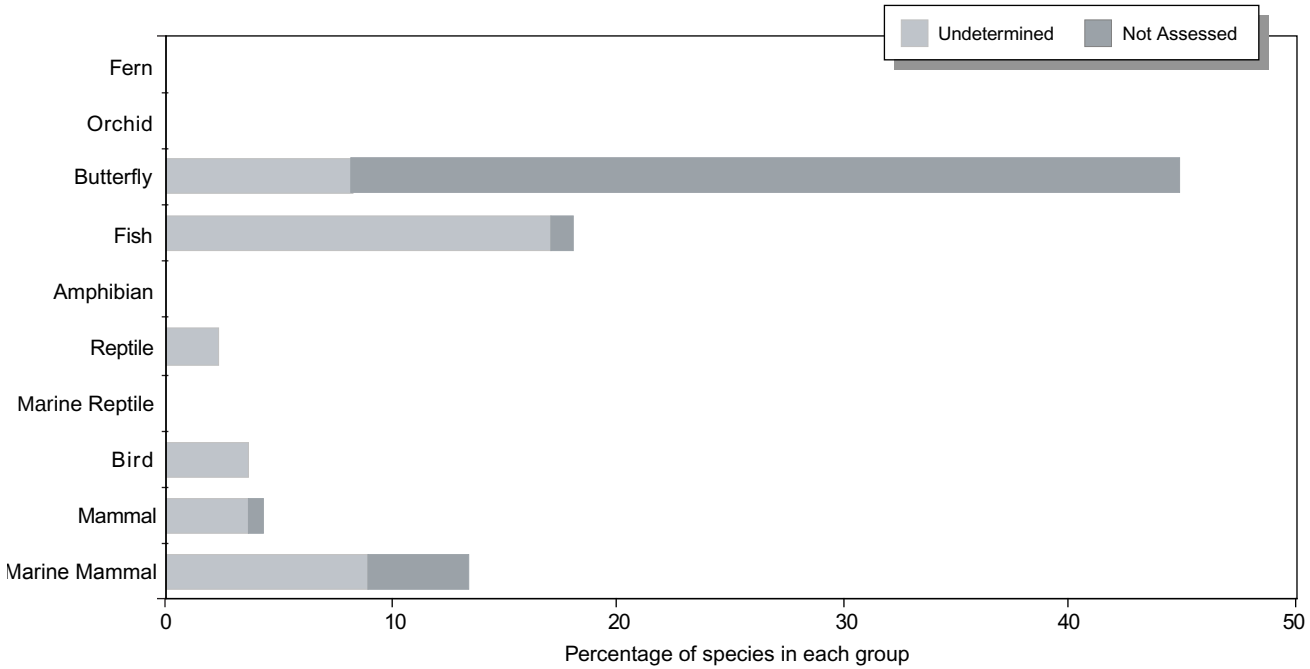

FIGURE III-iv. Summary of "data gaps". With our vast landscape and large number of wild species, it is not surprising that for some species we simply have too little information to evaluate their status. As much as 42% of the 284 extant butterfly species are poorly known across Canada, and this, combined with the fact that 5 provinces and territories were unable to assess the status of their butterfly species, makes butterflies the least well known taxon considered in this report. The Cherry Gall Azure and Booth's Sulphur appear to be the most poorly known species, with a status of *Undetermined* or *Not Assessed* for all five provinces and territories in which they occur. Our current lack of knowledge regarding the status of butterflies suggests a possible focus for future surveys and research. In contrast, the status of our ferns, orchids and amphibians appears to be relatively well known - no species in these groups were *Undetermined* or *Not Assessed*.

While monitoring the status of already rare or jeopardized species is a necessary and important contribution to preserving Canada's biodiversity, it does not address the need to detect (and manage) declines before they reach such critical thresholds. As such, this report complements detailed conservation efforts for species at risk by providing a very coarse scale, early-warning picture of the general status of a much greater array of Canadian species.

As a first attempt to evaluate the general status of our flora and fauna, this report yields a simple point-in-time snapshot of just a portion of Canada's full list of wild species. Such a snapshot is important since it provides a solid baseline against which future changes in the distribution and abundance of an array of important species can be compared. With the completion of each additional *Wild Species* report, the value of this report will continue to grow.

Section 4: Next Steps

The vision of the general status assessment approach is of a single platform for wild species assessment and monitoring: a tool that places all kinds of species from all regions of Canada on the same page in the same data language; a tool that allows everyone from the resource manager to the high school student the ability to place a species in a geographic, taxonomic, and ecological context and to gain an impression of the species' general status in that context. *Wild Species 2000* is the first and biggest step towards the realization of that vision: assessments have been made of an unprecedented number and variety of Canadian species from every province, territory, and ocean region. But it is only the first step. Provinces, territories, and federal agencies represented in the *Accord for the Protection of Species at Risk* have committed to both an ongoing process and a comprehensive one. This means that the next *Wild Species* report due in 2005 will aim to:

• **Incorporate new data for those species already assessed.** *Wild Species 2000* is a snapshot of how some of our species are faring at the time of writing, but these species' status can change for better or worse. So, general status assessments must be repeated periodically with new data that reflect the best estimate of these species' status at that time.

• **Address gaps in coverage for those species groups already assessed.** Data were lacking for some species in some regions (*Not Assessed*), or the data were not strong enough to allow a confident assessment of the species' general status to be made (*Undetermined*). It is hoped that part of the effect of *Wild Species 2000* will be to raise the profile of existing data gaps and so stimulate people to contribute data for these species or even to collect new data to address these shortfalls.

• **Increase the number and variety of species assessed.** Over 1 600 species were assessed in this report, accounting for most of our vertebrate species (mammals, birds, reptiles, amphibians, freshwater fishes), an important group of insects (butterflies), and two high-profile groups of plants (ferns, orchids). Still, there are more than 70 000 described species in Canada, most of them invertebrates (e.g., insects, spiders, crustaceans, worms, molluscs, jellyfishes), plants, and fungi. Future reports will aim to get greater representation from these groups.

M. Runtz

Rainbow Bluet damselfly perched on a grass blade.

The next *Wild Species* report requires new data to expand, improve, or update the database of information on Canada's wild species: a considerable challenge. Still, at its inception, the present report also seemed daunting, yet it has been successfully completed. This success is built on the contribution of data and knowledge from individuals, institutions, and agencies across Canada. We hope that many of these same sources will be able to provide new information collected in the course of their ongoing interests and responsibilities. We also hope that more people will be encouraged by the release of this first report to contribute data on their own or become involved with general status assessments in their home province or territory. If you want to help in the effort to collect information on Canada's species, see **Appendix 3** at the end of this report.

***Wild Species 2000* has entailed an immense amount of work from a huge array of Canadians. Future reports will benefit from lessons learned during this first report, and efficiencies will certainly be found. However, future reports will still require long hours from lots of people across the country. That effort is necessary because human impacts upon species can be complex, subtle, and ongoing. But that effort is a small price to pay to sustain the majesty that is Canada's natural heritage.**

Appendix 1 - Contacts coordinates for the Wild Species Working Group

The following people within government agencies coordinated the general status assessments and produced this report. Contact them if you have questions about the general status of species and this report.

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Appendix 2 - Glossary

amphisbaenids: a family of subterranean lizards also known as worm lizards, which are generally limbless and have a cylindrical body and a small, wedge-shaped head adapted for digging

arthropods: large phylum of invertebrates, which includes crustaceans, spiders, insects, millipedes, centipedes, and the fossil trilobites; have a segmented body, a thick exoskeleton, and a large number of jointed appendages acting as jaws, legs, gills, or sense-organs

biodiversity: the variety of life, from genes and species to communities, ecosystems, functions, and processes

bryophytes: small plants, including mosses, mostly terrestrial, and attached to the substrate by rhizoids

cold-blooded: see ectothermic

COSEWIC: Committee on the Status of Endangered Wildlife in Canada, which determines the detailed national status of wild Canadian species, subspecies, and separate populations suspected of being at risk

craniate vertebrate: vertebrate with a skull

crustaceans: diverse subphylum of arthropods, which have two pairs of antennae, one pair of mandibles (mouth-parts used for seizing and cutting food), and two pairs of maxillae (limb-link structures located behind the mandibles used when eating)

ecosystem: a community of organisms interacting with each other and with their physical environment

ectothermic: having a body temperature determined primarily by the temperature of the environment; cold-blooded; poikilothermic

endemic: native to, and restricted to, a particular geographical region

endothermic: warm-blooded; maintaining a body temperature largely independent of the environment

extant: existing or living at the present time

extinction: elimination of a taxon (e.g., species)

extirpated: no longer in existence in a particular region, but still living in other areas of the world

exotic species: species that have been moved beyond their natural range as a result of human activity; in this report, *Exotic* species have been purposefully excluded from all other categories

frond: leaf of a fern, which differs from a typical leaf in that it bears reproductive organs on its surface

gamete: a mature reproductive cell (usually haploid), which fuses with another gamete of the opposite sex to form a zygote (usually diploid); the male gametes are known as sperm (spermatozoa), and the female gametes as eggs (ova)

gametophyte: the haploid sexual phase of a plant, which exhibits an alternation of generations, from which gametes are produced, usually by mitotic division; the haploid gametophyte is typically formed by meiotic division of a diploid sporophyte

general status: the numerical rank (ranging from 0 to 8) of a species as assessed in this report, based upon a series of criteria that capture information where available on population size and distribution as well as any trends (increasing or decreasing) in these attributes, and any known threats to populations or their habitat; species received a general status rank in each province, territory, or ocean region in which they are known to be present, as well as an overall Canada-wide general status rank

geographic distribution: the current area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred, or projected sites of occurrence, excluding cases of vagrancy and significant areas where the species does not occur

habitat: the locality, site, and particular type of local environment occupied by an organism

habitat fragmentation: the process of dividing a continuous habitat into non-continuous, smaller subunits

haploid: having only a single set of chromosomes

herbivorous: feeding on plants

indicator species: a species, the presence or absence of which is indicative of a particular habitat, community, or set of environmental conditions

insectivore: feeding on insects

introduced species: see exotic species

invertebrate: animal lacking a spinal column

keystone species: a species having a major influence upon community structure, often in excess of that expected from its relative abundance

liverworts (Hepaticae): a class of Bryophytes whose members live in damp places or in water; a simple liverwort has a small, flat, green, repeatedly forked, ribbon-like body, lying close to the ground; some resemble mosses but without the conducting tissue

marsupials: mammals for which the placenta is very short-lived and does not make as much of a contribution to fetal nourishment as it does in placental mammals; placental development is very limited; the young is born 10–12 days after the breaking of the egg, crawls into the mother's pouch, and attaches itself to the teat

migration: periodic or seasonal movement of an organism or group from one habitat or location to another, typically of relatively long distance from one area to another

molluscs: soft-bodied, unsegmented invertebrates usually having a calcareous shell, such as snails, octopus, and squids

monotremes: egg-laying mammals with reptilian features, comprising the Platypus and Echidna

NABCI: North American Bird Conservation Initiative, a joint agreement between Canada, the United States, and Mexico to conserve migratory birds

native species: indigenous; living naturally within a given area

natural heritage: natural resources that are passed on to future generations

phylum (pl. phyla): in animal taxonomy, one of the major groupings, coming below subkingdom and kingdom, and comprising superclasses and all lower taxa

pinna: one of a number of first-order leaflets in a compound leaf typical of many ferns

pinnule: one of a number of second-order leaflets in a compound leaf, such as is typical of many ferns, where the pinnae are themselves divided into leaflets

placenta: a specialized embryonic organ attached to the uterus wall, by which embryos of viviparous species are nourished and waste products removed; the placenta is derived from the same membranes that surround the embryos in the amniote egg of reptiles, birds, and monotreme mammals

placentals: mammals that bear live young, which are nourished before birth in the mother's uterus through the placenta

pollinator: organism that transfers pollen from the anther to the receptive area of a flower

population: a group of organisms of one species, occupying a defined area and usually isolated to some degree from other similar groups

population trend: an estimate of the change in the number of individuals over time

range: the limits of the geographical distribution of a species or group

rodents: organisms belonging to an order of herbivorous or scavenging mammals in which the incisors are reduced to one pair in each jaw and have enamel that grows continually

species: group of organisms formally recognized as distinct from other groups

species richness: the absolute number of species in a given area

spore: a plant reproductive cell capable of developing into a new individual, directly or after fusion with another spore

sporophyte: the diploid, spore-producing, asexual generation in the life cycle of a plant; typically formed by fusion of haploid gametes

taiga: northern coniferous forest biome; the ecosystem adjacent to the arctic tundra

taxon (pl. taxa): a group of organisms of any rank (e.g., family, genus, species)

taxonomy: the theory and practice of describing, naming, and classifying organisms; systematics; biosystematics

tetrapod: an informal grouping that includes the vertebrate animals that have four limbs: Amphibia, Reptilia, Aves, Mammalia

therapsid reptile: reptile ancestral to mammals that ranged from the latter part of the Permian to the early Jurassic

traditional ecological knowledge: environmental expertise possessed by indigenous, tradition-based, non-western, non-industrial societies

Appendix 3 - References and further information

Organizations, programs, and policies

A National Framework for the Conservation of Species at Risk (1996)

Accord for the Protection of Species at Risk (1996, revised 1998)

Association for Biodiversity Information - Canada - http://www.abi-canada.ca/

COSEWIC - http://www.cosewic.gc.ca/cosewic/default.cfm

Invasive species - http://www.invasivespecies.gov/

Species at Risk (Canada) - http://www.speciesatrisk.gc.ca

The Nature Conservancy - http://www.tnc.org/international/work/art550.html

General resources on biological diversity

Bocking, S. (ed), *Biodiversity in Canada: An Introduction to Environmental Studies,* Broadview Press. - http://www.trentu.ca/biodiversity/ A companion to the book.

Heywood, V.H. (editor). 1995. *Global Biodiversity Assessment.* Cambridge: Cambridge University Press.

Integrated Taxonomic Information System (ITIS) - http://sis.agr.ca/itis/
A taxon-based biological information system

Mosquin, T. and P.G. Whiting. 1992. *Canada Country Study of Biodiversity: Taxonomic and Ecological Census, Economic Benefits, Conservation Costs, and Unmet Needs.* Draft report for delegations to the International Convention on Biological Diversity, Brazil, 1992. Ottawa: Canadian Museum of Nature.

National Center for Biotechnology Information - http://www.ncbi.nlm.nih.gov/Taxonomy/taxonomyhome.html/index.cgi?chapter=resources#thetop
Links to information about a wide range of different groups of organisms

NatureServe - http://www.natureserve.org/
A source for authoritative conservation information on more than 50,000 plants, animals, and ecological communities of the United States and Canada.

Nearctica - http://www.nearctica.com/content/content.htm
A site that lists many of the most useful sites providing information on different types of organisms

Tree of Life - http://phylogeny.arizona.edu/tree/phylogeny.html
A worldwide project to construct the phylogeny (evolutionary history and relationships among) of all species

Tudge, C. 2000. *The Variety of Life: A Survey and a Celebration of All the Creatures that Have Ever Lived.* New York: Oxford University Press.

University of California Museum of Paleontology (UCMP) http://www.ucmp.berkeley.edu/help/taxaform.html
Provides general information on a wide variety of organisms both living and extinct

Taxon-specific resources

Ferns

Cody, W.J. and D.M. Britton. 1989. *Ferns and Fern Allies of Canada.* Ottawa: Federal Publications Inc.

Orchids

Native Orchid Study Group - Orchid Society of the Royal Botanical Gardens - http://www.rbg.ca/orchids/

Butterflies

Butterflies of North America - http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bflyusa.htm

North American Butterfly Association - http://www.naba.org/

Fish

FishBASE - http://www.fishbase.org/search.cfm

Fishes of Canada - http://www.aquatic.uoguelph.ca/fish/fish.htm

Amphibians

Amphibian Web - a web-based directory of status of the world's amphibian species - http://www/amphibiaweb.org

CARCNET - Canadian Amphibian and Reptile Conservation Network - http://eqb-dqe.cciw.ca/partners/carcnet/carcnethome.html

Frogweb (US) - http://www.frogweb.gov/

Frogwatch - http://www.mp2pwrc.usgs.gov/FrogWatch/index.htm

Partners in Amphibian and Reptile Conservation PARC - http://www.parcplace.org/default.htm

Reptiles

CARCNET - Canadian Amphibian and Reptile Conservation Network - http://eqb-dqe.cciw.ca/partners/carcnet/carcnethome.html

Halliday, T. and K. Adler (editors). 1986. *The Encyclopedia of Reptiles and Amphibians.* New York: Facts on File.

Birds

Bird Studies Canada - http://www.bsc-eoc.org/~bsc/bscmain.html

Erskine, A.J. 1977. *Birds in Boreal Canada: Communities, Densities and Adaptations.* Canadian Wildlife Service Report Series No. 41.

North American Bird Conservation Initiative - NABCI - http://www.cws-scf.ec.gc.ca/Trends/nabci.html

Partners in Flight - PIF - http://www.partnersinflight.org/

Mammals

Mammals - Assessment of species diversity in the Mixedwood Plains ecozone - http://www.cciw.ca/eman-temp/reports/publications/Mixedwood/mammal/intro.htm

Marine mammals - http://www.aquatic.uoguelph.ca/mammals/whales/marine_frame.htm

General status of toads in Canada, an example of the type of data
that can be found on the CD and at the Wild Species website (http://www.wildspecies.ca).

General Status of Toads in Canada

Canada	Scientific Name	Common Name	YT	NT	NU	BC	AB	SK	MB	ON	QC	NB	NS	PE	LB	NF
4	*Bufo americanus*	American Toad	--	--	5	--	--	--	4	4	4	4	4	4	4	7
4	*Bufo boreas*	Western Toad	3	5	--	4	3	--	--	--	--	--	--	--	--	--
2	*Bufo cognatus*	Great Plains Toad	--	--	--	--	2	3	1	--	--	--	--	--	--	--
3	*Bufo hemiophrys*	Canadian Toad	--	2	--	--	2	4	4	--	--	--	--	--	--	--
1	*Bufo fowleri*	Fowler's Toad	--	--	--	--	--	--	--	1	--	--	--	--	--	--

Legend

0	Extirpated/Extinct	3	Sensitive	6	Not Assessed
1	At Risk	4	Secure	7	Exotic
2	May Be At Risk	5	Undetermined	8	Accidental

The Canadian Endangered Species Conservation Council (CESCC) was formed in 1998 under the Accord for the Protection of Species at Risk in Canada. The Council is made up of provincial and territorial ministers with responsibilities for wildlife and the federal Ministers of the Environment, Fisheries and Oceans and the Minister responsible for Parks Canada. Its mandate includes overseeing the assessment of the status of species and the recovery of species at risk, and communicating the progress to the public. It also serves as a forum for resolving issues that may arise out of the Accord.