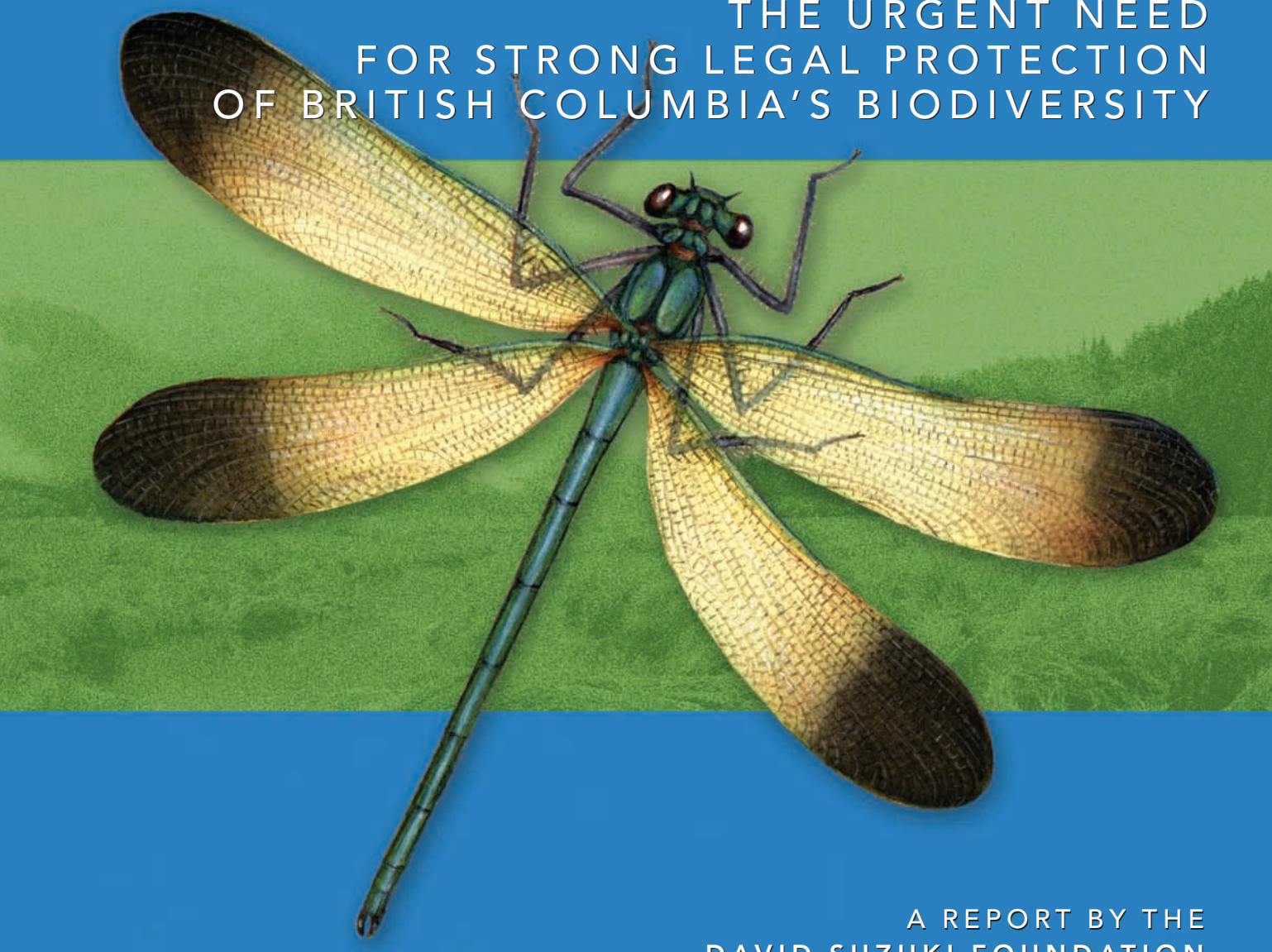
Rich Wildlife Poor Protection

THE URGENT NEED FOR STRONG LEGAL PROTECTION OF BRITISH COLUMBIA'S BIODIVERSITY



A REPORT BY THE
DAVID SUZUKI FOUNDATION
AND SIERRA LEGAL

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Poor Protection

THE URGENT NEED FOR STRONG LEGAL PROTECTION OF BRITISH COLUMBIA'S BIODIVERSITY

SIERRA LEGAL
advocates for the environment

David Suzuki Foundation

SOLUTIONS ARE IN OUR NATURE

Rich Wildlife, Poor Protection:
The urgent need for strong legal protection of British Columbia's biodiversity

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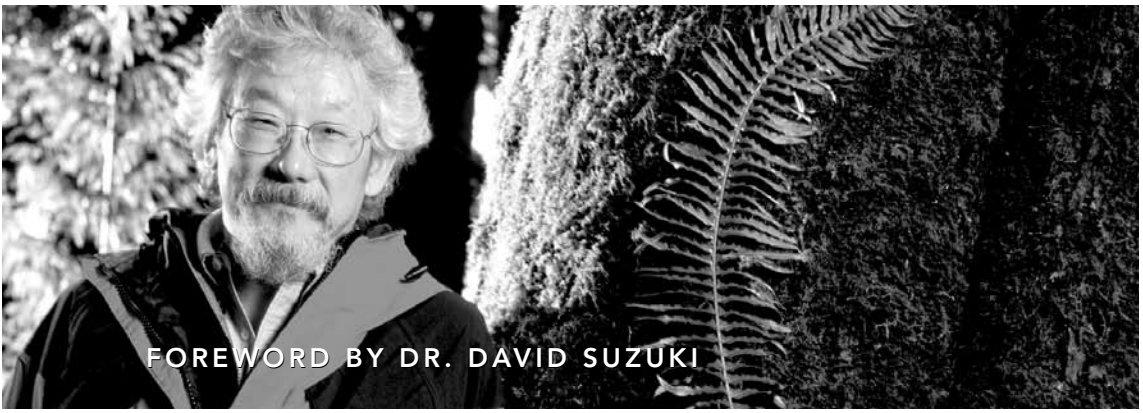
We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity.

– E. O. Wilson



FOREWORD BY DR. DAVID SUZUKI

One of my proudest moments came in 1992, when I attended the Convention on Biological Diversity at the inaugural Earth Summit in Rio de Janeiro, Brazil. It was there that I witnessed the world's nations coming together for the sake of protecting the diverse species on our planet. The Convention recognized for the first time in an international agreement that conservation of biological diversity is "a common concern of humankind."

My family and I were filled with pride when our country stepped forward as the first nation to sign the Convention. Our commitment required Canada and 167 other signatory countries to promote the conservation of biodiversity through a suite of domestic initiatives, including the adoption of laws for the protection and recovery of species threatened with extinction. It was a banner moment and one that filled us all with hope.

Fast-forward 15 years and you'll be disappointed to learn that the most significant international effort to protect biodiversity on the planet has had little effect on Canada and its policy makers. In the years since we placed our international reputation on the line, Canada has put forward weak laws or in some cases failed to implement any laws to protect biodiversity at risk. Quintessentially Canadian wildlife like the polar bear and certain populations of caribou are among the species thought to be most vulnerable to extinction.

In my home province of British Columbia we still have no stand-alone endangered species legislation to protect our natural heritage. In fact, experts tell us that some 1,300 species are currently threatened in B.C. and only a fraction of those receive any kind of protection. Underlying the real tragedy is that much of Canada's biodiversity, including a large proportion of those species that are now threatened with extinction, exists in B.C. One of the iconic species, the Northern Spotted Owl, has been reduced to less than 20 birds and yet the provincial government is not acting to stop logging in the old-growth forest that the Spotted Owl depend on.

The threats to other species are well known. Fragmentation and loss of habitat, overexploitation of wildlife, invasion of exotic species, and man-made toxins have all taken their

toll on our precious plants and wildlife. The effects of climate change alone are predicted to result in the premature extinction of 15 to 37 per cent of species on the planet within our children's lifetime (by 2050).

Today, our planet is undergoing a major biodiversity crisis. The good news is that with strong laws and appropriate planning in our own backyard, we can successfully reverse or at least slow this terrifying trend. In May 2007, the Ontario government passed the strongest set of laws protecting species at risk in Canada.

This report presents the ecological and legal arguments for the protection of species in B.C. Protecting wildlife and its habitat is crucial today as it's one of the greatest gifts we can give future generations.

Dr. David Suzuki
FOUNDER
DAVID SUZUKI FOUNDATION

Introduction

The Gyrfalcon*, North America's largest falcon, over-winters in B.C. before migrating North to the Arctic tundra to nest.*

British Columbia has been blessed with exceptional biodiversity.

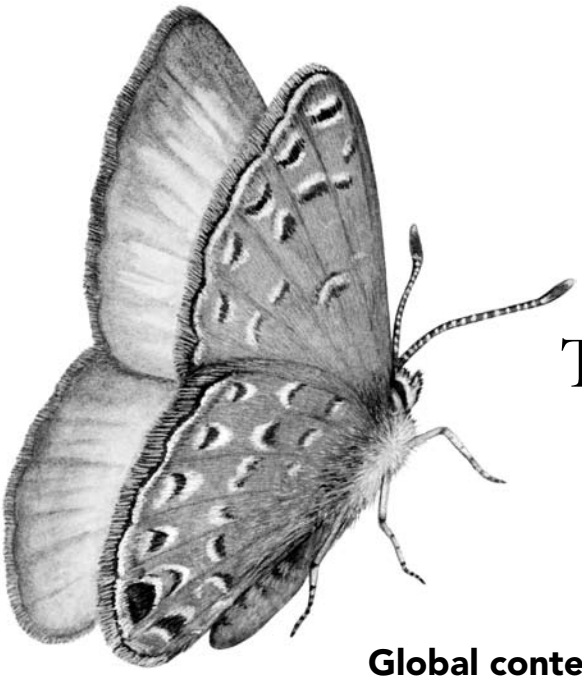
B.C. is Canada's richest province, biologically. It hosts 76 per cent of Canada's bird species, 70 per cent of its freshwater fish species, and 60 per cent of its conifer species.[1] Well over 3,600 species and subspecies call B.C. home,[2] and many of these, such as the mountain goat and mountain caribou, live mostly – or only – in the province. For other species, such as migratory Trumpeter Swans and Sandhill Cranes, B.C. is a critical wintering ground or stopover. Unlike most Canadian and U.S. jurisdictions, B.C. still has nearly all the large carnivores (including grizzly bears, wolverines, wolves, and cougars) that were present at the time of European settlement.[3]

However, the province is squandering this unique biological inheritance.

Our analysis of the conservation status of the major terrestrial and freshwater wildlife groups in the province[4] (amphibians, birds, fish, mammals, reptiles and turtles, and vascular plants) and inventoried invertebrates (molluscs, dragonflies and damselflies, and butterflies) shows that:

- B.C. has lost 49 known species and subspecies since presettlement (including the Dawson caribou, Greater Sage-Grouse and western pond turtle);[5]
- a further 1,300 species and subspecies are at risk of also disappearing from the province;
- of these species at risk, only 68 (or approximately five per cent) receive any kind of "protection" under B.C. laws. None receive essential habitat protection; and[6]
- even species protected under the strongest of these laws are teetering on the verge of extinction. For example, the Spotted Owl – with only 17 birds left in existence in Canada – cannot receive the legal protection they need to survive.

To safeguard its unusually abundant biodiversity, B.C. laws and policies protecting species and their habitat need to be strengthened, and B.C. must introduce a strong provincial *Endangered Species Act.*



Behr 's Hairstreak *is a small butterfly dependent on one of the most endangered ecosystems in Canada, the antelope brush habitat of the southern Okanagan.*

The Biological Problem

Global context: biodiversity crisis

Our planet is undergoing a biodiversity crisis. At least 16,000 species are threatened with extinction, including 12 per cent of birds, 23 per cent of mammals and 32 per cent of amphibians.[7] The effects of global warming alone are predicted to cause the extinction of 15 to 37 per cent of species by 2050 – within our children's lifetime.[8]

Biodiversity loss has negative consequences for human health and welfare. According to the United Nation's 2005 Millennium Ecosystem Assessment, two-thirds of the direct benefits people obtain from biodiversity are currently being degraded or used unsustainably.[9] These "ecosystem services" include:

- the provision of materials such as food, fuels and fibres;
- the regulation of the climate, disease outbreaks, wastes and pollination;
- the support of processes such as nutrient cycling and water purification; and
- opportunities for aesthetic, recreational and spiritual use.

Biodiversity loss affects not just the production of economic commodities like our food, timber and medicines, but many other services that are essential to the functioning of our society and economy. For example, declines in the populations of bees, butterflies and other pollinators as a result of habitat destruction, pesticide use and invasive pests are estimated to cost farmers millions of dollars each year in reduced crop yields.[10]

Rich wildlife: B.C.'s unique biological heritage

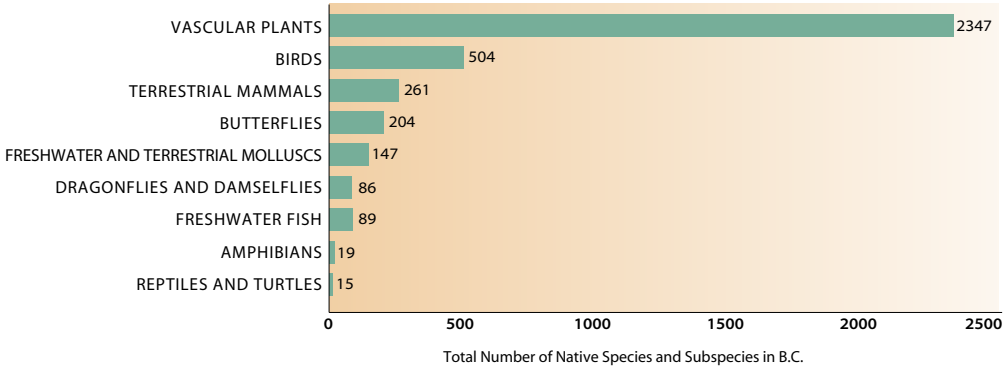
British Columbia's biodiversity is unparalleled in Canada. B.C. is home to:[15]

- 76 per cent of Canada's bird species;
- 70 per cent of its freshwater fish species;
- 66 per cent of its butterfly species;

- 60 per cent of its conifer species;
- 56 per cent of its fern species; and
- 41 per cent of its orchids.

Well over 3,600 species and subspecies call B.C. home (see Figure 1). This number is likely a gross underestimate of the full biological richness of the province, not including poorly understood, and inventoried species such as fungi, lichens and most insects.[16]

FIGURE 1 Biological richness of wildlife in B.C.



NOTE – Excludes species in the following categories: populations, marine species, non-vascular plants, accidentals, exotics or introduced species, and species listed as no status by the B.C. Conservation Data Centre. For a full list of species at risk excluded in the analysis, see Appendix 2. Source: B.C. Conservation Data Centre.
NOTE 2 – Vascular plants include grasses, flowers, shrubs and trees.

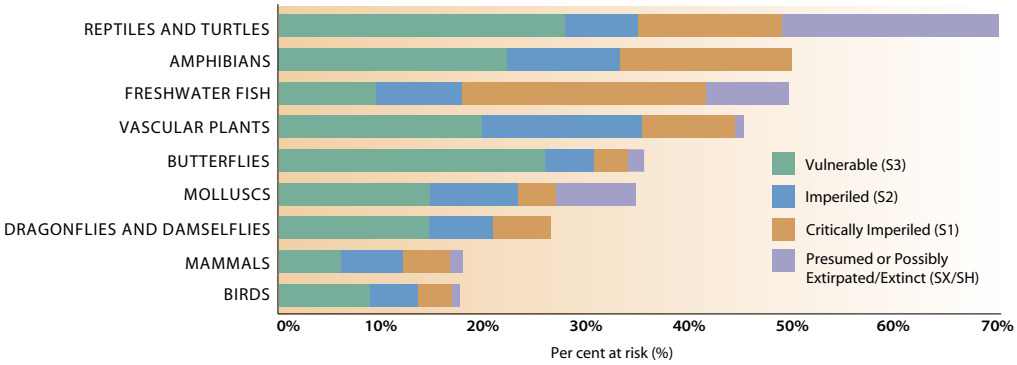
The remarkable biological richness of the province is linked to its climatic and geographic diversity. B.C. is home to an enormous variety of major ecosystem types, from wet and humid rainforests to dry deserts and grasslands. Its rugged topography results in wide ranges in elevation and corresponding environmental conditions such as temperature and humidity (e.g., from forested valley-bottoms to arctic-like alpine areas within only a few square kilometres). In addition, the province's coastline contains more than 30,000

NATURE'S HIDDEN ECONOMY: POLLINATION SERVICES

Pollination is a critical regulating ecosystem service provided by insects (such as bees, wasps, flies and butterflies), birds (such as Hummingbirds) and even some small mammals (such as bats). About a third of the food we eat, including apples, peaches, chocolate, almonds, coffee and berries, are dependent on animal pollinators for their production. The economic value of all pollinator services to U.S. agriculture has been estimated to be 5.7 to 13.4 billion U.S. dollars (6.7 to 15.8 billion Canadian dollars) a year.[11] The full economic significance for Canadian agriculture has yet to be quantified, although the European races of the western honeybee alone have been valued at 854 million U.S. dollars (one billion Canadian dollars) each year.[12]

However, there is increasing evidence of widespread reductions in pollination services in southern Canada and elsewhere due to declining numbers of pollinating insects.[13] This decline is linked to the destruction of natural habitat from urbanization, the overuse of toxic pesticides, and increased disease outbreaks exacerbated by industrial agricultural management.[14]

FIGURE 2 Percentage of species at risk within major wildlife groups in B.C.



NOTE – Total number of native species and subspecies at risk in relation to the known species and subspecies in each group are: reptiles and turtles 10/15; amphibians 9/19; freshwater fish 42/89; vascular plants 1014/2347; butterflies 70/204; freshwater and terrestrial molluscs 50/147; dragonflies and damselflies 22/86; terrestrial mammals 46/261; and birds 86/504. Estimates exclude species at risk in the following categories: populations, marine species, non-vascular plants, accidentals, exotics or introduced species, and species listed as no status by the B.C. Conservation Data Centre. For a full list of species at risk excluded in the analysis, see Appendix 2. For a description of the risk categories, see Table 1. **Source. B.C. Conservation Data Centre.**

kilometres of near-shore environment, with many archipelagos of islands ranging in size from a few meters across to hundreds of kilometres in area. The variety of habitats from temperate rainforests to dry grasslands, has led to the evolution of an amazing number of species.[17]

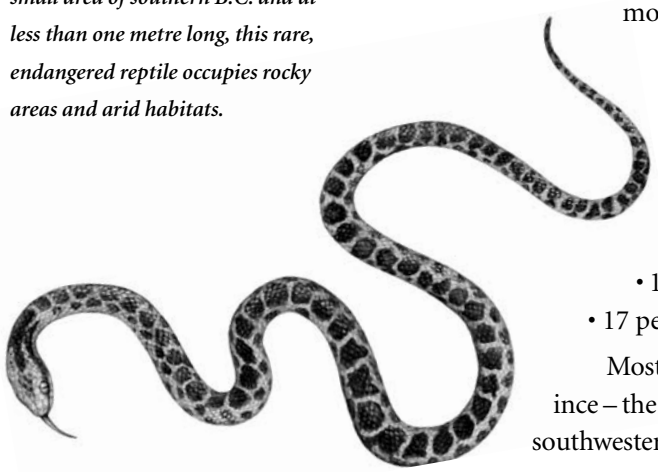
B.C.'s biological wealth at risk

Unfortunately, B.C.'s biological wealth is under serious threat.

According to the provincial government's Conservation Data Centre – the agency tasked with monitoring species at risk in B.C – well over 1,300 species and subspecies living in the province are now thought to be at risk of disappearing.[18]

Among the major wildlife groups in the province, reptiles and turtles (67 per cent), amphibians (47 per cent) and freshwater fish (47 per cent) are the most at risk of local extinction from B.C.

The Night Snake *only exists in a small area of southern B.C. and at less than one metre long, this rare, endangered reptile occupies rocky areas and arid habitats.*

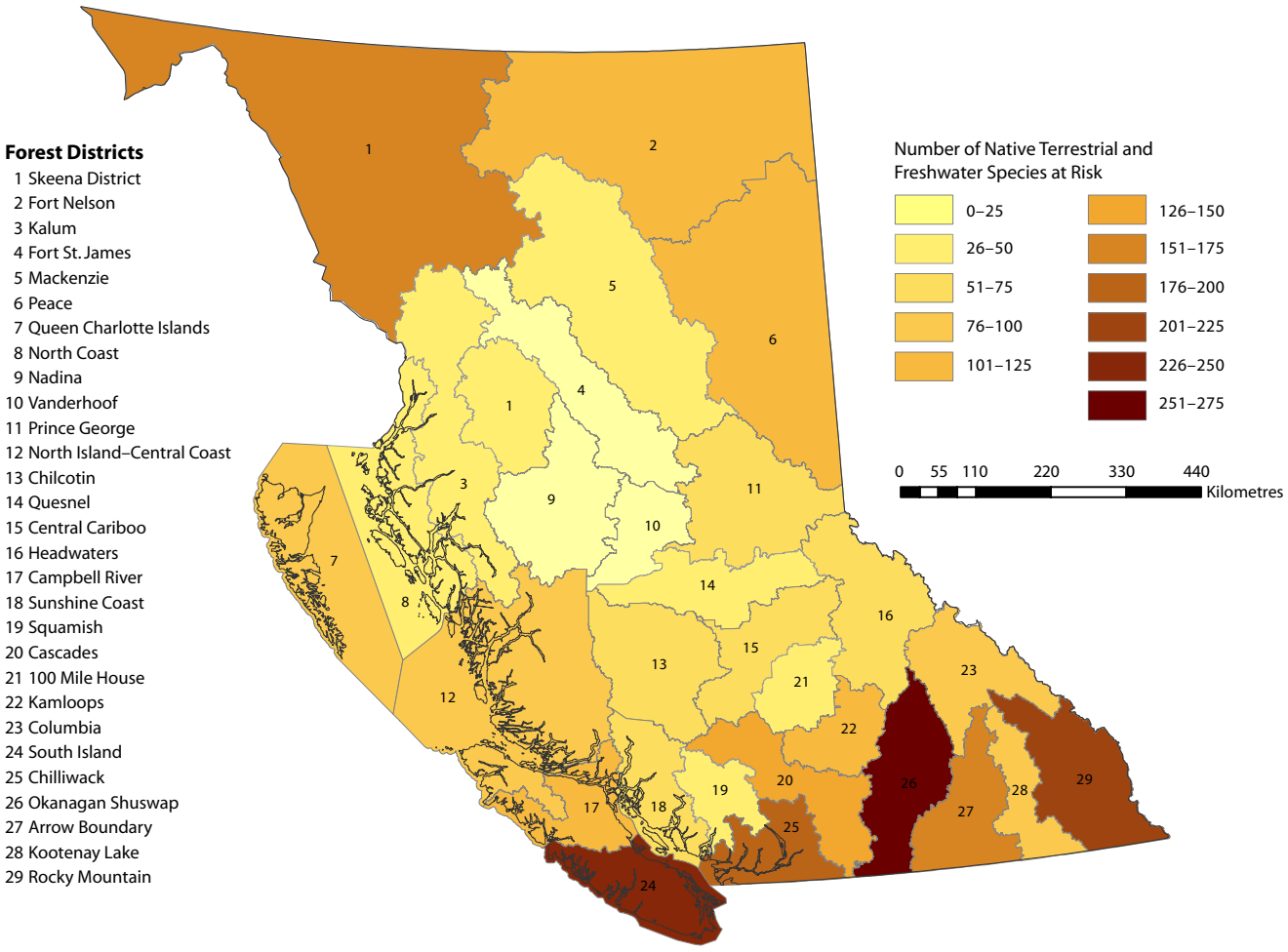


Many other wildlife groups in B.C. similarly contain high numbers of at risk species, including (see Figure 2):

- 43 per cent of vascular plants;
- 34 per cent of butterflies;
- 33 per cent freshwater and terrestrial molluscs;
- 26 per cent of dragonflies and damselflies;
- 18 per cent of terrestrial mammals; and
- 17 per cent of birds.

Most of these species at risk are located in four "hotspots" in the province – the south island region of Vancouver Island, the Lower Mainland of southwestern B.C., the southern Rocky Mountain Trench and the Okanagan

FIGURE 3 Hotspots of Species at Risk in B.C.



Valley (see Figure 2). Some species at risk in these regions are at the outer extent of their range, making them particularly vulnerable to decline.[19] In addition, extensive areas within these "hotspots" have been intensively impacted by human land-use and other associated threats. For example, the Lower Mainland, southern Vancouver Island and the Okanagan have high human population densities relative to other regions in the province. This has resulted in habitat loss, fragmentation and degradation, as well as over-exploitation (over-fishing and over-hunting) of native species and the introduction of invasive species.[20]

Detailed descriptions of these and other findings, as well as the methods used to derive them, are presented in Appendices 1 through 5.

The Legal Problem

Named for its incredible ability to leap as a means of avoiding its predators, the Dromedary Jumping Slug *is native to B.C.'s west coast forests and to date only occupies seven localities on southern Vancouver Island.*

Global context: international promises

In 1992 Canada took a leadership role in coordinating and being the first industrialized nation to sign the international *Convention on Biological Diversity* (CBD).[21] The CBD commits Canada and 167 other signatory countries to promote the conservation of biodiversity through domestic initiatives, including the adoption of laws for the protection and recovery of species threatened with extinction.

B.C., as part of the Canadian delegation, actively participated in the agreement negotiations, and formally acknowledged it would honour the commitments Canada made. B.C.'s responsibilities under the CBD were later outlined in an agreement between the provinces and the federal government called the *National Accord for Protection of Species at Risk* in Canada (1996).[22]

Signatories agreed to either enact endangered species legislation or to use existing laws to protect species at risk within their respective jurisdictions. B.C. chose the latter, arguing that existing wildlife and resource management laws, such as the *Wildlife Act* and *Forest Practices Code*, would protect species at risk in the province.

Canadian context: species fall through jurisdiction cracks

Canada's Constitution grants power to the provinces to manage public lands and exploit natural resources, but ignores its responsibility to the environment.[23] It thereby creates "jurisdictional cracks" for species to fall through. Unfortunately, the federal *Species At Risk Act* (*SARA*) doesn't address this dilemma.[24] *SARA* defines federal authority as narrowly as possible to avoid stepping on provincial toes. This means automatic protections for only migratory birds and aquatic species, or species that reside on federal lands. Because more than 99 per cent of B.C.'s land base is under provincial jurisdiction, the majority of B.C.'s at risk species are not protected.

B.C. context: legally failing species

B.C. claims that its existing wildlife and resource management laws protect species at risk in the province – but the more than 1,300 species and subspecies at risk are clear evidence to the contrary.

B.C. laws and policies are failing our species because they do not require mandatory protection for species and their habitat, and recovery strategies for species known to be at risk. Only four species – the Burrowing Owl, the sea otter, the Vancouver Island marmot and the White Pelican – are formally acknowledged under B.C.'s marginal laws, and the protections afforded them are minimal.

Furthermore, the biodiversity laws and policies that do exist in B.C. are ineffective because:

- they are not systematic or comprehensive;
- they lower biodiversity protection to maintaining the economic status quo; and
- they ignore essential needs of species at risk, such as habitat protection.

B.C.'s laws and policies relating to biodiversity fall into three major categories:

- protected areas (e.g., parks);
- laws regulating wildlife outside of parks; and
- land-use planning processes.

Protected areas: scenic, but not protecting species

B.C.'s existing network of protected areas doesn't effectively protect species at risk because they don't overlap with species' habitat needs.[25]

Parks and protected areas are critical for the protection of biodiversity, including species at risk. However, most of B.C.'s parks aren't located where threatened species live. Historical motivation for protecting areas has more often been to preserve scenic beauty and recreational opportunities, not biological diversity. For example, B.C.'s parks system protects a disproportionate amount of high-altitude "rock and ice" ecosystems, areas which are scenic, but home to relatively few threatened species, and also under little threat from human development (e.g., habitat loss to urbanization, agriculture or logging).[26]

The most biologically rich and imperiled landscapes – the south island region of Vancouver Island, the Lower Mainland of southwestern B.C., the southern Rocky Mountain Trench and the Okanagan Valley (see Figure 3) – remain largely unprotected. Not surprisingly, these regions attract urban development, agriculture and other intensive land-use practices because of their low elevations, accessibility and nutrient-rich soil conditions.

B.C. is synonymous with **Grizzly Bears** *because the province is currently home to nearly half of Canada's grizzlies.*

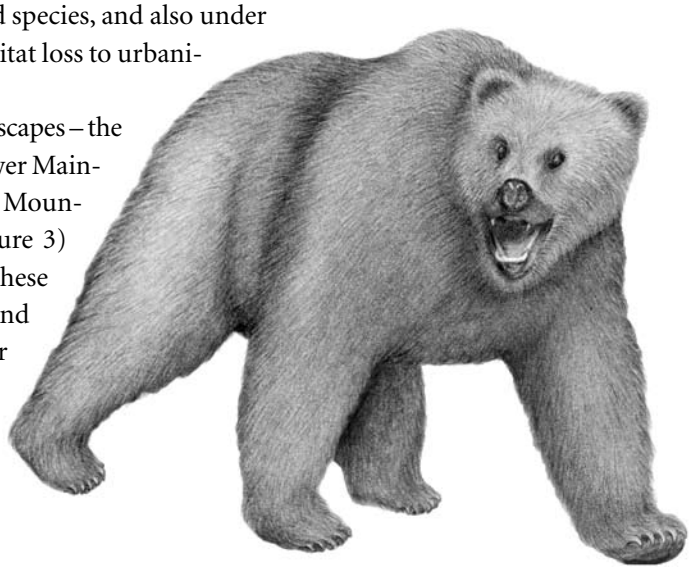
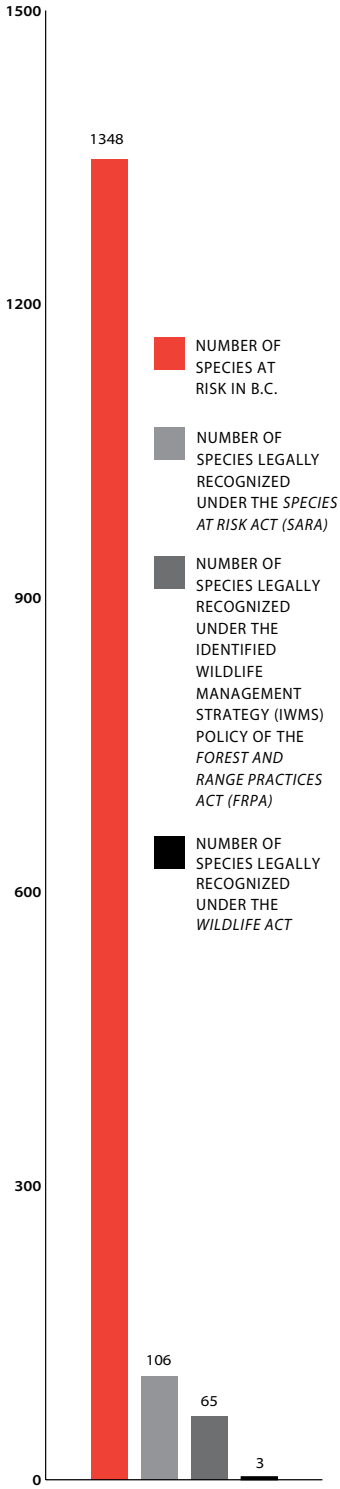


FIGURE 4 Levels of legal protection for native terrestrial species and subspecies at risk in B.C.



Not only do B.C.'s parks and protected areas poorly capture the habitat of most species at risk, most are too small, too isolated from other protected areas, and too affected by human activities (such as logging, mining, and sport hunting), both inside the parks and nearby, to maintain natural and abundant distributions of wildlife.[27] This is especially true for wide-ranging species, such as migratory animals (e.g., salmon) or large carnivores (e.g., grizzly bears) that require large, core areas of habitat protected from human development.[28]

In the 1990s, the Protected Area Strategy (PAS) aimed to provide better representation of the province's ecosystems within B.C.'s protected areas. However, the PAS's failure has been well documented.[29] Major ecological regions are still not proportionately protected within the parks system, and as a consequence most of B.C.'s rare and endangered species live outside of B.C.'s protected landscapes.

Outside of protected areas: species on their own

Species inside parks areas are vulnerable, but species at risk outside protected areas have next to no protection.

At least 87 per cent of the B.C.'s native terrestrial and freshwater species at risk don't receive any protection under either B.C. laws or federal endangered species legislation (see Figure 4).

Species at risk in B.C. that receive marginal protections under existing laws include:

- 65 species considered "Identified Wildlife" under the Identified Wildlife Management Strategy (IWMS) of B.C.'s *Forest and Range Practices Act (FRPA);*
- three species listed under B.C.'s *Wildlife Act*; and
- 106 species listed under the federal *Species at Risk Act.*

FOREST AND RANGE PRACTICES ACT

Given the significant proportion of B.C.'s land base that is subject to forestry operations, any effective provincial biodiversity protection strategy would need to be compatible with B.C.'s forestry regulations. This is especially important, since B.C. is home to many endemic forest-dwelling species that exist nowhere else on the planet (e.g., Vancouver Island Marmot), and others that live mostly in B.C., such as mountain caribou and the Marbled Murrelet (see Appendix 5).

However, B.C.'s *Forest and Range Practices Act,* the primary legislation regulating forestry in B.C., states that biodiversity protection measures must not "unduly reduce the supply of timber from British Columbia's forests."[30]

This "log-first, wildlife last" approach to biodiversity is epitomized by the Identified Wildlife Management Strategy (IWMS). The B.C. government claims its IWMS protects habitat for species at risk, as well as species regionally affected by logging. It has also ordered that IWMS implementation cannot reduce the logging rate in B.C. by more than one per

NOTE – Number of native terrestrial species and subspecies at risk in B.C. that are legally recognized under federal law (SARA) or provincial wildlife legislation (IWMS: Identified Wildlife Management Strategy of the Forest Range and Practices Act; or the Wildlife Act). Source: B.C. Conservation Data Centre

cent.[31] This means that a strategy intended to protect species from the effects of logging cannot significantly affect logging – a limitation rendering the policy nearly useless.

B.C.'s Forest Practices Board found IWMS inadequate in terms of protecting habitat to assist species conservation.[32] Even if the IWMS protected habitat, the policy itself makes clear that it does not address key habitat needs for species at risk, such as "habitat supply, habitat connectivity, and population viability and other issues such as access management. Such issues should be taken into account during strategic or landscape level planning."[33]

The inherent constraints of the IWMS render it ineffective at protecting the habitat of species at risk.

THE *WILDLIFE ACT*

The *Wildlife Act* was developed from laws regulating hunting, and it still has that orientation. Although the province, through the Conservation Data Centre (CDC), tracks and maintains lists of hundreds of threatened and endangered species, the *Wildlife Act* mysteriously only applies to four: the Burrowing Owl, White Pelican, Vancouver Island marmot, and sea otter. The act prohibits hunting or killing those species, but does not protect the species' habitat or require action to be taken to improve the species' chances of survival (i.e., recovery).

In May 2004 the government introduced amendments to the *Wildlife Act,* which would have somewhat improved biodiversity protections.[34] But these amendments still do not protect habitat. Furthermore, no species have been given protection under that law, so it doesn't apply to anything and remains in legal limbo.

Land-use planning: haphazard and underutilized

Given that most of B.C.'s species at risk live outside of existing protected areas, land-use planning could be a potent tool for species protection in B.C. Land-use planning could establish additional parks and conservancies to formally protect habitat, for example, or situate development and industry away from the habitat of vulnerable species.

However, there is no systematic conservation-based land-use planning process in B.C. The processes that have occurred, such as Land and Resource Management Plans, have largely failed to integrate the needs of biodiversity, particularly species at risk.[35]

Decisions regarding where habitat should be protected and where resource extraction and other uses are ecologically acceptable need to be an outcome of conservation-based planning. Such planning should be founded on a set of explicit conservation goals including:

- protecting the full range of ecosystem types found in the region (forests, grasslands, wetlands, etc.);
- maintaining viable populations of all native species;

Redwood Sorrel ***is an endangered vascular plant that is native to B.C.'s southern Vancouver Island and Haida Gwaii.***

- sustaining critical ecological services, such as water filtration and nutrient cycling; and
- building a conservation network that is resilient to global warming.[36]

Conservation-based land-use planning should not solely be limited to regions dominated by wilderness or crown lands. Three of the four "hotspots" of species at risk in B.C. occur in human-dominated landscapes (the south island region of Vancouver Island, the Lower Mainland of southwestern B.C., and the Okanagan Valley; see Figure 3). Though opportunities for establishing large protected areas in such regions are severely constrained because of the high proportion of private land, conservation-based land-use planning should inform local and regional decision making on how landscapes can be better managed for environmental stewardship. The protection of lands within B.C.'s Agricultural Land Reserve, as well as "greenbelt" initiatives in urban and other developed landscapes are two examples of how this type of planning can work in B.C.

The Species-at-Risk Coordination Office

Under pressure to take more action on species at risk, the B.C. government appointed a provincial Species-at-Risk Coordination Office (SARCO) in October 2004 to assist with implementation of SARA. The office was to accelerate the implementation of recovery strategies for species at risk in B.C., with an initial focus on Spotted Owl, mountain caribou, and Marbled Murrelet. Although the office has been in place for more than two years, on-the-ground implementation has been minimal.

Frustrated by inaction while species teeter on the brink of extinction, B.C. environmental groups launched a federal court case in December 2005, seeking federal intervention to protect the critically endangered Spotted Owl.[37]

The B.C. government's approach: economy first, species last

The B.C. government claims its approach to conservation maintains a "balance between the needs of wildlife and the needs of the people".[38] However, this approach has resulted in ever-growing numbers of species and subspecies at risk in the province, as well as the

B.C. FAILS TO PROTECT CANADA'S MOST ENDANGERED BIRD

There is no better example of B.C.'s inadequate protection for endangered species than the Northern Spotted Owl. In Canada, the Spotted Owl is only found in B.C., and only 17 birds remain of an estimated historic population of 500 pairs. Their primary threat is loss of its old-growth habitat by logging.[42] However, provincial laws prioritize logging over species protection, even when a species is on the verge of extinction. B.C. environmentalists have been in court since the mid-1990s in an effort to save the bird. The Spotted Owl is predicted to be extinct in Canada by 2010, and the B.C. government's seeming inability to protect an endangered species, while managing to stage the Olympics, is striking.

collapse of wild fish stocks, local timber supply shortages and other crises, and criticism of the approach is widespread. An academic analysis concluded:

> *… [The] B.C. government has not sufficiently met its national and international obligations due to its low performance in the legal listing of scientifically recognized species at risk of extinction, a misconception of the purpose of species-at-risk legislation, arbitrary constraints on the protection of species, and a lack of legal commitment to their recovery.*[39]

Rather than changing course, the provincial government seems more interested in finding ways to abdicate its responsibility for the protection of our natural heritage.

For example, the B.C. government has been considering "global significance" as a means of avoiding responsibility.[40] Rather than protecting all species at risk within the province, the government is considering deferring responsibility to other jurisdictions, if significant populations are found outside of B.C., or elsewhere in the world.

The abdication of action within B.C.'s borders to protect species at risk is ecologically risky. Local populations of species at risk are often genetically unique or perform distinctive ecological roles (e.g., salmon-fishing grizzly bears in coastal B.C.).[41] The persistence of species at risk in B.C. is also critical for the provision of "ecological services" that benefit human communities (e.g., nutrient cycling, pollination, as well as cultural and recreational services). Given the ongoing loss of habitat worldwide to human land-use, and further species declines predicted to result from global warming, the failure to protect species where they are found undermines global action to ensure their survival and is an abandonment of past commitments under international agreements (e.g., it contravenes the Convention on Biological Diversity).

Once abundant across the province's native grasslands, today* Blue Grama *– a very drought resistant grass species – only occupies seven sites, four within the Rocky Mountain Trench.

Eighty per cent of the world's Cassin's Auklet *population nests in Canada, with more than half of those found on Triangle Island, B.C.*

The Solution

To protect British Columbia's exceptional biological richness, B.C. needs to make biodiversity protection a priority in terms of land-use planning, protected areas and legislation. B.C. must also introduce strong endangered species legislation to protect and recover species at risk outside of formally designated protected areas.

Our recommendations are:

1. **Create strong endangered species legislation that will prioritize species and their habitat.**
2. **Establish and complete conservation-based land-use planning, particularly in species at risk "hotspots" of the province – the south island region of Vancouver Island, the Lower Mainland of southwestern B.C., the Rocky Mountain Trench and the Okanagan Valley.**
3. **Complete a province-wide protected areas strategy that:**
   - **prioritizes protection of ecological integrity;**
   - **identifies and protects at risk species and their habitat;**
   - **protects the full range of ecosystem types;**
   - **maintains viable populations of native species;**
   - **sustains critical ecological services; and**
   - **is resilient in the face of global warming.** [43]
4. **Properly fund the Conservation Data Centre of B.C. to fully monitor species at risk in the province. Focused attention should be given to those wildlife groups (e.g., fungi, lichens, insects and other invertebrates), whose presence and conservation status is poorly known in B.C.**

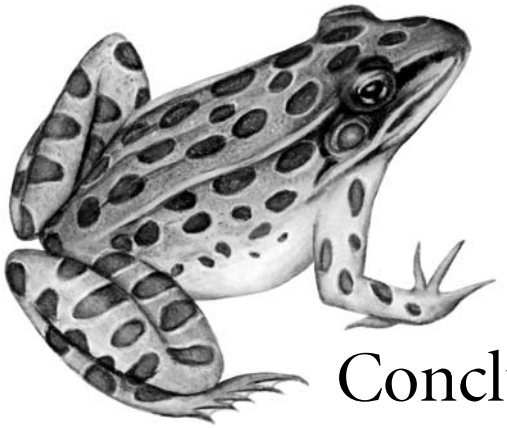
5. Create and fund an independent scientific committee[44] to examine the backlog of species that are known to be at risk in the province[45] and which thus may be candidates for legal listing under new endangered species legislation.

EFFECTIVE ENDANGERED SPECIES LEGISLATION

Studies of other provincial endangered species legislation and best practices shows that effective laws must:

1. enshrine the principle that healthy ecosystems are essential to healthy human societies and economies;
2. recognize that biological diversity is essential to healthy ecosystems;
3. identify, protect and recover at-risk biodiversity across B.C.;
4. protect and recover biodiversity by protecting habitat;
5. identify, assess and develop recovery strategies for at-risk biodiversity on the basis of sound science;
6. enshrine the precautionary principle; the principle of inter-generational equity; and the polluter-pays principle;
7. require citizen, community and First Nations participation;
8. require accountability and transparency;
9. be enforced; and
10. be funded.

Forthcoming – Nixon, S. and D. Page. 2007. *Model Endangered Species Legislation for British Columbia. Sierra Legal.*



Conclusion

The* Northern Leopard Frog *currently exists in only one location of the Kootenays, making it one of the most at risk species in B.C.

British Columbia is blessed with biodiversity that is on par with some of the great wilderness areas on the planet, such as the Amazon, the boreal and the Great Barrier Reef. However, as we have shown, B.C. has already lost dozens of species to extirpation or extinction, and hundreds more are at risk of being similarly eliminated from the province. According to the government's own data, high levels of endangerment now exist in all major wildlife groups in the province (e.g., amphibians, reptiles and turtles, vascular plants, freshwater fishes, etc.).

Successive governments have not put a priority on protecting biodiversity, but have relied on the natural riches of B.C. to attract tourists and new residents and build communities. This report substantiates the need for a different approach.

This approach includes conservation-based land-use planning, protected areas and a provincial Endangered Species Act, which would provide the means for effective protection and recovery of species at risk in Canada's most biologically rich region, and thereby fulfill the province's national and international responsibilities for the conservation of its irreplaceable natural heritage.

The cost of losing B.C.'s rich biodiversity is immeasurable. B.C. has a domestic and an international responsibility to stop squandering its remaining biological wealth and ecological integrity. It's time to protect B.C.'s biodiversity by law.

Appendices

APPENDIX 1

Conservation Status of British Columbia's Natural Heritage

SPECIES ADDRESSED

Our assessment of the conservation status of biodiversity in B.C. is based on an analysis of 3,672 native and regularly occurring, terrestrial and freshwater species and subspecies in the province (hereby referred to as "species") (see Figure 1).

Similar studies have been done elsewhere in Canada[46] and internationally (e.g., the IUCN red list[47]), though our analysis is one of the first in the country to report levels of endangerment among a wide breadth of biological organization (i.e., below the species level to include subspecies). Only nine major wildlife groups have been sufficiently studied by the province's Conservation Data Centre (CDC) to allow for a comprehensive assessment of species endangerment[48] (see Figure 1). This includes all vertebrates except for marine mammals and fish (i.e., amphibians, birds, freshwater fish, terrestrial mammals, reptiles and turtles), all vascular plants (i.e., ferns and fern allies, conifers and flowering plants), and better-known and inventoried invertebrates (i.e., freshwater and terrestrial molluscs, dragonflies and damselflies, and butterflies).[49]

Wildlife groups whose constituent species have been poorly studied were not included in the analysis (e.g., non-vascular plants and fungi), even if the CDC has ranked some of the species in these groups as being at risk. As a result, our study does not count at least 18 marine species and 379 non-vascular plants known to be at risk in the province. In addition, we did not include geographically or genetically distinct populations at risk ranked by the CDC (15 species), though some of them have been listed under SARA (e.g., mountain caribou) because comprehensive tallies of populations at risk have not been completed. We also excluded accidentals, introduced species, vascular plants of unknown or mixed origin and species ranked as "no status" by the CDC. In total, 407 species listed at risk by the CDC were not included in this study (see Appendix 2).

METHODS USED TO ASSESS LEVELS OF ENDANGERMENT

We calculated levels of relative endangerment (i.e., percentage of species at risk) based on an enumeration of at risk wildlife, identified and ranked by the CDC, relative to the number of species and subspecies known to exist within major wildlife groups in the province (i.e., species richness). The calculation was made as follows:

$$\textbf{Level of Endangerment (\%)} = \frac{\text{Total Number of Species and Subspecies at Risk Within the Wildlife Group}}{\text{Overall Species Richness Within the Wildlife Group}}$$

We used the online B.C. Species and Ecosystem Explorer to obtain available CDC ranks at the sub-national scale.[50] Species richness of various wildlife groups was determined from published taxonomic checklists of known species and subspecies for the province (see Appendix 3).

The CDC assigns conservation status ranks at the sub-national level (S ranks) on a scale from one through five, using a methodology developed by NatureServe (see Table 1). The levels range from critically imperiled (S1) to secure (S5). Species that are no longer found in the province (presumed either extinct or extirpated) are assigned a rank of SX, whereas species that are possibly extirpated or have not been searched for are ranked SH (historical). We considered species at risk to be those organisms ranked by the CDC between SX/SH (presumed extinct/extirpated) to S3 (vulnerable) levels. Though not enumerated as being

HOW CONSERVATION RANKS ARE ASSIGNED BY THE B.C. CONSERVATION DATA CENTRE

Experts with the CDC identify, rank, and track species at risk in the province. Status ranks are assigned by the CDC on a scale of one to five (see Table 1) based on an analysis of the following factors:

- estimated number of occurrences in the wild;
- viability of these occurrences;
- short-term and long-term trends in population size, number of occurrences, or geographic distribution;
- overall estimated population size;
- geographic distribution (range of extent);
- area of occupancy;
- actual or potential threats facing the population and habitat (based on the severity, scope and immediacy of these threats);
- intrinsic vulnerability; and
- environmental specificity.[54]

TABLE 1
Definitions for interpreting NatureServe sub-national (S) conservation ranks at the provincial scale

RANK	CONSERVATION STATUS	DEFINITION
SX	Presumed Extirpated	Species is believed to be extirpated from the province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
SH	Possibly Extirpated	Species occurred historically in the province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years.
S1	Critically Imperiled	At extreme risk of extirpation from the province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines.
S2	Imperiled	At high risk of extirpation from the province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
S3	Vulnerable	At moderate risk of extirpation from the province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
S4	Apparently Secure	Uncommon but not rare in the province; some cause for long-term concern due to declines or other factors.
S5	Secure	Common, widespread, and abundant in the province.
SNR	Unranked	Conservation status not yet assessed in the province
SNA	Not Applicable	Conservation status is not applicable because the species is not a suitable target for conservation activities (e.g., exotics).
SU	Unrankable	Currently unrankable due to lack of information or due to substantially conflicting information about its status or trends

NOTE – NatureServe reports range ranks (e.g., S1S2) when there is uncertainty about the conservation status of a particular species. In this report range ranks were rounded to the higher rank (i.e., S1 in the example) or averaged (S2S4 to S3). The original range rank for each species can be obtained at http://www.natureserve.org

at risk in this study, some species ranked S4 (apparently secure) may still be of conservation concern due to their small range or low abundance (e.g., Black Oystercatcher), declining populations (e.g., Chinook salmon), or vulnerability to long-term threats (e.g., western toad).[51] A review recently suggested that government should closely monitor S4 species, as they may be candidates for at risk status in the near future, should they decline further in terms of abundance, distribution and/or demographic condition.[52]

It is important to stress that our estimate of levels of endangerment are based on the conservation status of species in B.C. itself, not their status at the national (N) or global (G) scales. Indeed, a species identified and ranked by the CDC, as being at risk provincially (ranked SX/SH to S3), could very well be secure within its entire national (N4 or N5) or global range (G4 or G5).[53] An example of such a species is the badger, which although is critically imperiled and facing extinction from B.C. (provincially ranked S1), is considered to be secure outside the province and in other parts of its global range (globally ranked G5).

B.C.'S BIOLOGICAL RICHNESS

B.C. is Canada's most biodiversity rich province, containing 66 per cent of the Canada's known butterfly species, 70 per cent of its freshwater fish species, 76 per cent of its bird species, 60 per cent of its conifer species, 56 per cent of its fern species, and 41 per cent of its orchids[55]. At least 3,672 species and subspecies are found within the major terrestrial wildlife groups in the province (see Figure 1). This estimate does not include the thousands of additional species of non-vascular plants (bryophytes, liverworts and hornworts), fungi, and invertebrates whose taxonomy is poorly understood and whose inventories are largely incomplete (and thus were not enumerated in this study).

EVIDENCE OF WIDESPREAD SPECIES ENDANGERMENT

Our review of wildlife tracked and listed by the CDC indicates at least 1,348 species and subspecies are currently at risk among the major wildlife groups in the province. This number is a significant underestimate of the total number of species at risk thought to occur in the province[56], as it does not include those groups of species, which we excluded from our analysis for methodological reasons (see Appendix 3).

Though species at risk are found throughout British Columbia, most are clustered into four main "hotspots" – the south island region of Vancouver Island, the Lower Mainland of southwestern British Columbia, the Rocky Mountain Trench and the Okanagan Valley (see Figure 3). These areas of high species endangerment coincide with intense human population density, expansion and development, resulting in a number of proximate threats to biodiversity; including habitat loss and fragmentation, pollution, invasive species and the threat of over-exploitation (e.g., over-hunting and over-fishing). The high number of species at risk in these areas is also due to natural reasons such as the presence of numerous populations at risk that are at the outer extent of their range.[57]

Among the major wildlife groups in the province, our analysis indicates that amphibians, reptiles and turtles, vascular plants and freshwater fish exhibit extremely high levels of sub-national endangerment (> 40 per cent, see Figure 2 and Table 2). These numbers are particularly troubling given the relatively lower richness of some of these groups (e.g., reptiles and turtles, amphibians) and the fact that the Canadian range for many of these species is found mostly in B.C.[58] The regional plight of amphibians in B.C. is consistent with global trends elsewhere, which indicate that at least a one-third of frogs and salamanders worldwide are threatened with extinction.[59] Unlike these groups, dragonflies and damselflies, terrestrial mammals and birds exhibit a lower level of regional endangerment (< 30 per cent at risk, see Figure 2 and Table 2). That said, a number of important keystone and umbrella species and subspecies in these groups are threatened with extirpation or extinction; including the Vancouver Island Marmot, mountain caribou and many raptors (e.g., northern goshawk and Swainson's Hawk).

B.C.'S CASUALTY LIST: HISTORIC AND LOOMING LOCAL EXTINCTIONS

British Columbia has lost 49 known species and subspecies since presettlement (see Appendix 4). Four of these species are extinct globally (e.g., Dawson Caribou, Passenger Pigeon). The rest have

TABLE 2
Conservation status of native species and subspecies within major wildlife groups in B.C.

STATUS	AMPHIBIANS	BIRDS	FRESHWATER FISH	TERRESTRIAL MAMMALS	REPTILES & TURTLES	BUTTERFLIES	DRAGONFLIES & DAMSELFLIES	FRESHWATER & TERRESTRIAL MOLLUSCS	VASCULAR PLANTS	TOTAL NUMBER	PERCENT OF TOTAL
Presumed Extinct or Extirpated (SX)	0	4	1	3	3	2	0	1	4	18	0.5%
Possibly Extirpated (SH)	0	0	2	0	0	1	0	10	18	31	0.8%
Critically Imperiled (S1)	3	15	12	23	2	7	5	5	203	275	7.5%
Imperiled (S2)	2	23	15	6	1	9	5	12	347	420	11.4%
Vulnerable (S3)	4	44	16	10	4	51	12	21	442	604	16.4%
Apparently Secure (S4)	7	107	22	18	3	40	17	24	656	894	24.3%
Secure (S5)	3	120	51	24	2	91	47	68	677	1083	29.5%
Other (SNR, SU, SNA or non-CDC source)	0	191	142	5	0	3	0	6	0	347	9.4%
Total Richness	19	504	261	89	15	204	86	147	2347	3672	

NOTE 1 – The table shows the conservation status of native terrestrial species and subspecies within major wildlife groups in British Columbia. The tallies for amphibians, birds, terrestrial mammals, reptiles and turtles and vascular plants are based on full checklists of described species and subspecies in B.C. (taxonomic lists are provided in Appendix 3). Tallies for freshwater fish, butterflies, dragonflies and damselflies and freshwater molluscs are based on partial checklists of species evaluated by the B.C. Conservation Data Centre. All tallies exclude species at risk in the following categories: populations, marine species, non-vascular plants, accidentals, exotics or introduced species, and species listed as no status by the CDC. A full list of species at risk excluded in the analysis is given in Appendix 2.
Source: B.C. Conservation Data Centre

NOTE 2 – See Table 1 for a definition of each conservation status rank. NatureServe reports range ranks (e.g., S1S2) when there is uncertainty about the conservation status of a particular species. In this report range ranks were rounded to the higher rank (i.e., S1 in the example) or averaged (S2S4 to S3). The original range rank for each species can be obtained from the B.C. Species and Ecosystem Explorer. Available at http://srmapps.gov.bc.ca/apps/eswp/

NOTE 3 – "Other" category includes native terrestrial species and subspecies that have not yet been ranked by the CDC (SNR), currently unrankable (SU), species that are unsuitable for conservation ranking (SNA) as well as species and subspecies missing from CDC databases, but included in provincial standard taxonomic checklists (i.e., non-CDC source; see Appendix 3).

been extirpated, meaning that although absent from the province today, they are found elsewhere within their global range. A further, 7.5 per cent of species and subspecies we examined are critically imperiled (S1) and thus at extreme risk of being similarly eliminated (see Table 2). Though such species may be found elsewhere, and in some cases in a secure form (e.g., Fringed Pinesap), extirpation can have serious genetic and ecological consequences. For example, the loss of genetically unique populations of salmon (e.g., Cultus lake sockeye salmon) or white sturgeon weakens the overall gene pool of these species.[60] Genetic diversity is important, and a critical means by which species respond to environmental change (including global warming) through adaptation. The loss of the southern mountain caribou, a critically imperiled population of woodland caribou, could have negative ecological implications (e.g., trophic relationships) in the interior rainforests where it is found.

At least 37 species and subspecies among the major wildlife groups studied in our review are at risk of global extinction as they are endemic to the province, and thus found nowhere else on the planet (see Appendix 5). The global range of hundreds of more species is found mostly or almost exclusively in B.C., so that extirpation from the province would have global implications as well. This includes many large carnivores in North America, which have been largely eliminated from most of their national and/or global range with the exception of B.C. Indeed, unlike most neighbouring jurisdictions, B.C. has retained all of its large carnivores since European settlement, with one possible exception; the Vancouver Island wolverine. Large carnivores are at a much greater risk of extirpation elsewhere, due to the historic loss and fragmentation of their habitat and mortality from hunting, trapping and other forms of human interference (e.g., grizzly bear).

APPENDIX 2: SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
POPULATIONS N=15	
Acipenser transmontanus pop. 1 (White Sturgeon – Kootenay River population)	Critically Imperiled (S1)
Acipenser transmontanus pop. 2 (White Sturgeon – Columbia River population)	Critically Imperiled (S1)
Acipenser transmontanus pop. 3 (White Sturgeon – Nechako River population)	Critically Imperiled (S1)
Acipenser transmontanus pop. 4 (White Sturgeon – Lower Fraser River population)	Imperiled (S2)
Acipenser transmontanus pop. 5 (White Sturgeon – Upper Fraser River population)	Critically Imperiled (S1)
Acipenser transmontanus pop. 6 (White Sturgeon – Middle Fraser River population)	Critically Imperiled (S1)
Thymallus arcticus pop. 1 (Arctic Grayling – Williston Watershed population)	Critically Imperiled (S1)
Lampetra richardsoni pop. 1 (Western Brook Lamprey – Morrison Creek population)	Critically Imperiled (S1)
Lota lota pop. 1 (Burbot – lower Kootenay population)	Critically Imperiled (S1)
Rangifer tarandus pop. 1 (Caribou – southern population)	Critically Imperiled (S1)
Rangifer tarandus pop. 14 (Caribou – boreal population)	Vulnerable (S3)
Rangifer tarandus pop. 15 (Caribou – northern mountain population)	Vulnerable (S3)
Melanerpes lewis pop. 1 (Lewis's Woodpecker – Georgia Depression population)	Presumed Extirpated (SX)
Sturnella neglecta pop. 1 (Western Meadowlark – Georgia Depression population)	Presumed Extirpated (SX)
Sialia mexicana pop. 1 (Western Bluebird – Georgia Depression population)	Possibly Extirpated (SH)
ACCIDENTAL OR INTRODUCED SPECIES: N=3	
Coturnicops noveboracensis (Yellow Rail)	Critically Imperiled (S1)
Pooecetes gramineus affinis (Vesper Sparrow, *affinis* subspecies)	Critically Imperiled (S1)
Phoebastria albatrus (Short-tailed Albatross)	Not Applicable (SNA)
NO STATUS SPECIES: N=1	
Pituophis catenifer (Gopher snake)	Vulnerable (S3)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
MARINE SPECIES: N=18	
Haliotis kamtschatkana (Northern abalone)	Imperiled (S2)
Eschrichtius robustus (Grey whale)	Imperiled (S2)
Phocoena phocoena (Harbour porpoise)	Vulnerable (S3)
Megaptera novaeangliae (Humpback whale)	Critically Imperiled (S1)
Orcinus orca pop. 2 (Killer whale – Northeast Pacific offshore population)	Vulnerable (S3)
Orcinus orca pop. 1 (Killer whale – Northeast Pacific resident population)	Imperiled (S2)
Orcinus orca pop. 3 (Killer whale – West Coast transient population)	Imperiled (S2)
Callorhinus ursinus (Northern Fur seal)	Not Applicable (SNA)
Eumetopias jubatus (Northern Sea lion)	Imperiled (S2)
Enhydra lutris (Sea otter)	Imperiled (S2)
Mesoplodon carlhubbsi (Arch-beaked whale)	Not Applicable (SNA)
Mesoplodon stejnegeri (Bering Sea Beaked whale)	Not Applicable (SNA)
Balaenoptera musculus (Blue whale)	Critically Imperiled (S1)
Balaenoptera physalus (Fin whale)	Critically Imperiled (S1)
Eubalaena glacialis (Northern Right whale)	Possibly Extirpated (SH)
Balaenoptera borealis (Sei whale)	Possibly Extirpated (SH)
Physeter macrocephalus (Sperm whale)	Critically Imperiled (S1)
Dermochelys coriacea (Leatherback)	Critically Imperiled (S1)
NON-VASCULAR PLANT SPECIES: N=370	
Heterodermia sitchensis (Seaside Centipede)	Imperiled (S2)
Hypogymnia heterophylla (Seaside Bone)	Critically Imperiled (S1)
Nephroma occultum (Cryptic Paw)	Imperiled (S2)
Pseudocyphellaria rainierensis (Old growth Specklebelly)	Critically Imperiled (S1)
Sclerophora peronella (Frosted Glass-whiskers)	Critically Imperiled (S1)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Acaulon muticum var. rufescens	Critically Imperiled (S1)
Aloina bifrons	Imperiled (S2)
Alsia californica	Imperiled (S2)
Amblyodon dealbatus	Imperiled (S2)
Amblystegium fluviatile	Imperiled (S2)
Amblystegium humile	Imperiled (S2)
Amblystegium noterophilum	Imperiled (S2)
Amblystegium tenax	Imperiled (S2)
Amblystegium varium	Critically Imperiled (S1)
Amphidium mougeotii	Imperiled (S2)
Andreaea heinemannii	Critically Imperiled (S1)
Andreaea megistospora ssp. epapillosa	Imperiled (S2)
Andreaea mutabilis	Critically Imperiled (S1)
Andreaea rothii	Imperiled (S2)
Andreaea rupestris var. papillosa	Critically Imperiled (S1)
Andreaea schofieldiana	Critically Imperiled (S1)
Andreaea sinuosa	Critically Imperiled (S1)
Andreaeobryum macrosporum	Critically Imperiled (S1)
Anoectangium sendtnerianum	Critically Imperiled (S1)
Anoectangium tenuinerve	Critically Imperiled (S1)
Aongstroemia longipes	Imperiled (S2)
Atrichum haussknechtii	Imperiled (S2)
Atrichum tenellum	Critically Imperiled (S1)
Aulacomnium acuminatum	Critically Imperiled (S1)
Barbula amplexifolia	Critically Imperiled (S1)
Barbula convoluta var. gallinula	Critically Imperiled (S1)
Barbula eustegia	Critically Imperiled (S1)
Bartramia halleriana (Haller's apple moss)	Critically Imperiled (S1)
Bartramia stricta (apple moss)	Critically Imperiled (S1)
Brachydontium olympicum	Critically Imperiled (S1)
Brachythecium calcareum	Critically Imperiled (S1)
Brachythecium campestre	Critically Imperiled (S1)
Brachythecium groenlandicum	Imperiled (S2)
Brachythecium holzingeri	Critically Imperiled (S1)
Brachythecium populeum	Imperiled (S2)
Brachythecium reflexum var. pacificum	Critically Imperiled (S1)
Brachythecium trachypodium	Critically Imperiled (S1)
Brachythecium velutinum var. venustum	Critically Imperiled (S1)
Brotherella roellii	Vulnerable (S3)
Bryhnia hultenii	Critically Imperiled (S1)
Bryobrittonia longipes	Imperiled (S2)
Bryoerythrophyllum alpigenum	Critically Imperiled (S1)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Bryoerythrophyllum columbianum (Columbian carpet moss)	Imperiled (S2)
Bryoerythrophyllum ferruginascens	Critically Imperiled (S1)
Bryum algovicum var. algovicum	Imperiled (S2)
Bryum algovicum var. rutheanum	Critically Imperiled (S1)
Bryum arcticum	Critically Imperiled (S1)
Bryum blindii	Critically Imperiled (S1)
Bryum calobryoides	Critically Imperiled (S1)
Bryum calophyllum	Critically Imperiled (S1)
Bryum canariense	Imperiled (S2)
Bryum capillare var. barbatum	Critically Imperiled (S1)
Bryum capillare var. flaccidum	Critically Imperiled (S1)
Bryum capillare var. torquescens	Imperiled (S2)
Bryum cyclophyllum	Imperiled (S2)
Bryum erythroloma	Imperiled (S2)
Bryum gemmiparum	Critically Imperiled (S1)
Bryum muehlenbeckii	Imperiled (S2)
Bryum pseudotriquetrum var. bimum	Critically Imperiled (S1)
Bryum schleicheri	Imperiled (S2)
Bryum stenotrichum	Imperiled (S2)
Bryum tenuisetum	Possibly Extirpated (SH)
Bryum turbinatum	Imperiled (S2)
Bryum uliginosum	Critically Imperiled (S1)
Bryum violaceum	Critically Imperiled (S1)
Callicladium haldanianum	Imperiled (S2)
Calliergon richardsonii	Imperiled (S2)
Calliergon trifarium	Imperiled (S2)
Campylium calcareum	Critically Imperiled (S1)
Campylium hispidulum	Imperiled (S2)
Campylium radicale	Critically Imperiled (S1)
Campylium stellatum var. protensum	Critically Imperiled (S1)
Campylopus flexuosus	Imperiled (S2)
Campylopus japonicus	Critically Imperiled (S1)
Campylopus schimperi	Imperiled (S2)
Ceratodon purpureus var. rotundifolius	Critically Imperiled (S1)
Ceratodon purpureus var. xanthopus	Critically Imperiled (S1)
Cinclidium arcticum	Critically Imperiled (S1)
Cirriphyllum piliferum	Critically Imperiled (S1)
Claopodium pellucinerve	Critically Imperiled (S1)
Cnestrum alpestre	Imperiled (S2)
Cnestrum glaucescens	Critically Imperiled (S1)
Cnestrum schisti	Critically Imperiled (S1)
Coscinodon cribrosus	Critically Imperiled (S1)
Crossidium seriatum	Critically Imperiled (S1)
Crossidium sp. 1	Imperiled (S2)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Crumia latifolia	Imperiled (S2)
Ctenidium schofieldii	Imperiled (S2)
Cynodontium tenellum	Imperiled (S2)
Cyrtomnium hymenophylloides	Imperiled (S2)
Cyrtomnium hymenophyllum	Imperiled (S2)
Daltonia splachnoides	Critically Imperiled (S1)
Desmatodon cernuus	Imperiled (S2)
Desmatodon guepinii	Critically Imperiled (S1)
Desmatodon heimii	Imperiled (S2)
Desmatodon latifolius var. muticus	Imperiled (S2)
Desmatodon leucostoma	Critically Imperiled (S1)
Desmatodon obtusifolius	Imperiled (S2)
Desmatodon randii	Critically Imperiled (S1)
Desmatodon systylius	Critically Imperiled (S1)
Dichelyma falcatum	Imperiled (S2)
Dicranella cerviculata	Imperiled (S2)
Dicranella howei	Critically Imperiled (S1)
Dicranella schreberiana var. robusta	Imperiled (S2)
Dicranella stickinensis	Critically Imperiled (S1)
Dicranodontium subporodictyon	Imperiled (S2)
Dicranoweisia crispula var. contermina	Imperiled (S2)
Dicranum angustum	Critically Imperiled (S1)
Dicranum bonjeanii	Imperiled (S2)
Dicranum fragilifolium	Imperiled (S2)
Dicranum fuscescens var. congestum	Possibly Extirpated (SH)
Dicranum fuscescens var. flexicaule	Critically Imperiled (S1)
Dicranum majus var. orthophyllum	Critically Imperiled (S1)
Dicranum spadiceum	Imperiled (S2)
Didymodon asperifolius	Critically Imperiled (S1)
Didymodon johansenii	Critically Imperiled (S1)
Didymodon leskeoides	Critically Imperiled (S1)
Didymodon nevadensis	Critically Imperiled (S1)
Didymodon nigrescens	Imperiled (S2)
Didymodon rigidulus	Imperiled (S2)
Didymodon rigidulus var. icmadophilus	Critically Imperiled (S1)
Didymodon rigidulus var. rigidulus	Imperiled (S2)
Didymodon subandreaeoides	Imperiled (S2)
Didymodon vinealis var. brachyphyllus	Imperiled (S2)
Didymodon vinealis var. nicholsonii	Critically Imperiled (S1)
Diphyscium foliosum	Imperiled (S2)
Discelium nudum	Critically Imperiled (S1)
Ditrichum schimperi	Imperiled (S2)
Ditrichum zonatum var. scabrifolium	Imperiled (S2)
Drepanocladus aduncus var. kneiffii	Imperiled (S2)
Drepanocladus aduncus var. polycarpus	Imperiled (S2)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Drepanocladus capillifolius	Imperiled (S2)
Drepanocladus crassicostatus	Imperiled (S2)
Drepanocladus lapponicus	Critically Imperiled (S1)
Drepanocladus pseudostramineus	Imperiled (S2)
Drepanocladus sendtneri	Imperiled (S2)
Drepanocladus trichophyllus	Critically Imperiled (S1)
Drepanocladus tundrae	Critically Imperiled (S1)
Drepanocladus uncinatus var. symmetricus	Imperiled (S2)
Encalypta affinis ssp. affinis	Critically Imperiled (S1)
Encalypta affinis ssp. macounii	Imperiled (S2)
Encalypta alpina	Imperiled (S2)
Encalypta brevicolla	Imperiled (S2)
Encalypta brevipes	Imperiled (S2)
Encalypta intermedia	Imperiled (S2)
Encalypta longicolla	Imperiled (S2)
Encalypta mutica	Imperiled (S2)
Encalypta spathulata	Critically Imperiled (S1)
Entodon concinnus	Critically Imperiled (S1)
Entosthodon fascicularis	Imperiled (S2)
Entosthodon rubiginosus (rusty cord-moss)	Critically Imperiled (S1)
Epipterygium tozeri	Imperiled (S2)
Eucladium verticillatum	Imperiled (S2)
Eurhynchium pulchellum var. barnesii	Imperiled (S2)
Eurhynchium riparioides	Imperiled (S2)
Fabronia pusilla (silver hair moss)	Critically Imperiled (S1)
Fissidens fontanus	Critically Imperiled (S1)
Fissidens pauperculus (poor pocket moss)	Critically Imperiled (S1)
Fissidens ventricosus	Imperiled (S2)
Fontinalis hypnoides	Critically Imperiled (S1)
Fontinalis patula	Critically Imperiled (S1)
Funaria muhlenbergii	Imperiled (S2)
Geheebia gigantea	Imperiled (S2)
Gollania turgens	Critically Imperiled (S1)
Grimmia affinis	Imperiled (S2)
Grimmia anomala	Critically Imperiled (S1)
Grimmia elatior	Imperiled (S2)
Grimmia elongata	Critically Imperiled (S1)
Grimmia holzingeri	Imperiled (S2)
Grimmia incurva	Critically Imperiled (S1)
Grimmia mollis	Critically Imperiled (S1)
Grimmia montana	Imperiled (S2)
Grimmia plagiopodia	Critically Imperiled (S1)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Grimmia teretinervis	Critically Imperiled (S1)
Grimmia unicolor	Critically Imperiled (S1)
Herzogiella seligeri	Imperiled (S2)
Heterophyllium haidensis	Imperiled (S2)
Homalothecium arenarium	Imperiled (S2)
Hygrohypnum alpestre	Critically Imperiled (S1)
Hygrohypnum duriusculum	Imperiled (S2)
Hygrohypnum norvegicum	Critically Imperiled (S1)
Hygrohypnum polare	Critically Imperiled (S1)
Hygrohypnum styriacum	Imperiled (S2)
Hymenostylium insigne	Imperiled (S2)
Hypnum cupressiforme var. filiforme	Critically Imperiled (S1)
Hypnum cupressiforme var. lacunosum	Critically Imperiled (S1)
Hypnum holmenii	Critically Imperiled (S1)
Hypnum plicatulum	Imperiled (S2)
Hypnum pratense	Imperiled (S2)
Hypnum procerrimum	Imperiled (S2)
Isopterygiopsis muelleriana	Critically Imperiled (S1)
Leptodontium recurvifolium	Imperiled (S2)
Lescuraea incurvata var. gigantea	Critically Imperiled (S1)
Lescuraea incurvata var. tenuiretis	Critically Imperiled (S1)
Lescuraea julacea	Critically Imperiled (S1)
Lescuraea radicosa var. denudata	Critically Imperiled (S1)
Lescuraea radicosa var. pallida	Critically Imperiled (S1)
Lescuraea saxicola	Critically Imperiled (S1)
Loeskypnum badium	Imperiled (S2)
Loeskypnum wickesiae	Imperiled (S2)
Meesia longiseta	Imperiled (S2)
Meesia uliginosa var. alpina	Critically Imperiled (S1)
Micromitrium tenerum	Presumed Extirpated (SX)
Mielichhoferia macrocarpa (Porsild's bryum)	Critically Imperiled (S1)
Mielichhoferia mielichhoferiana	Critically Imperiled (S1)
Mnium arizonicum	Critically Imperiled (S1)
Myrinia pulvinata	Critically Imperiled (S1)
Myurella sibirica	Critically Imperiled (S1)
Neckera pennata var. pennata	Imperiled (S2)
Oedipodium griffithianum	Critically Imperiled (S1)
Oreas martiana	Critically Imperiled (S1)
Orthothecium intricatum	Imperiled (S2)
Orthothecium strictum	Imperiled (S2)
Orthotrichum affine	Imperiled (S2)
Orthotrichum alpestre	Imperiled (S2)
Orthotrichum cupulatum	Critically Imperiled (S1)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Orthotrichum hallii	Critically Imperiled (S1)
Orthotrichum pallens	Imperiled (S2)
Orthotrichum pylaisii	Critically Imperiled (S1)
Orthotrichum rivulare	Critically Imperiled (S1)
Orthotrichum speciosum var. elegans	Imperiled (S2)
Orthotrichum tenellum	Critically Imperiled (S1)
Phascum vlassovii	Critically Imperiled (S1)
Philonotis fontana var. americana	Imperiled (S2)
Philonotis fontana var. pumila	Imperiled (S2)
Philonotis marchica	Critically Imperiled (S1)
Philonotis yezoana	Imperiled (S2)
Physcomitrella patens	Critically Imperiled (S1)
Physcomitrium immersum	Presumed Extirpated (SX)
Physcomitrium pyriforme	Imperiled (S2)
Plagiobryum demissum	Critically Imperiled (S1)
Plagiomnium ciliare	Critically Imperiled (S1)
Plagiothecium nemorale	Critically Imperiled (S1)
Plagiothecium platyphyllum	Critically Imperiled (S1)
Pleuroziopsis ruthenica	Critically Imperiled (S1)
Pohlia andalusica	Critically Imperiled (S1)
Pohlia atropurpurea	Imperiled (S2)
Pohlia bolanderi	Imperiled (S2)
Pohlia bulbifera	Critically Imperiled (S1)
Pohlia camptotrachela	Critically Imperiled (S1)
Pohlia cardotii	Imperiled (S2)
Pohlia columbica	Critically Imperiled (S1)
Pohlia elongata	Imperiled (S2)
Pohlia erecta	Critically Imperiled (S1)
Pohlia filum	Imperiled (S2)
Pohlia lescuriana	Critically Imperiled (S1)
Pohlia longicolla	Critically Imperiled (S1)
Pohlia ludwigii	Imperiled (S2)
Pohlia melanodon	Critically Imperiled (S1)
Pohlia obtusifolia	Imperiled (S2)
Pohlia pacifica	Critically Imperiled (S1)
Pohlia sphagnicola	Imperiled (S2)
Pohlia tundrae	Critically Imperiled (S1)
Pohlia vexans	Imperiled (S2)
Polytrichum alpinum var. septentrionale	Critically Imperiled (S1)
Polytrichum commune var. perigoniale	Possibly Extirpated (SH)
Polytrichum longisetum	Imperiled (S2)
Polytrichum sphaerothecium	Critically Imperiled (S1)
Pottia bryoides	Critically Imperiled (S1)
Pottia nevadensis	Critically Imperiled (S1)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Pottia wilsonii	Critically Imperiled (S1)
Pseudephemerum nitidum	Presumed Extirpated (SX)
Pseudobryum cinclidioides	Critically Imperiled (S1)
Psilopilum cavifolium	Critically Imperiled (S1)
Pterygoneurum kozlovii (alkaline wing-nerved moss)	Imperiled (S2)
Pterygoneurum lamellatum	Critically Imperiled (S1)
Ptychomitrium gardneri	Imperiled (S2)
Pylaisiella intricata	Critically Imperiled (S1)
Racomitrium canescens ssp. latifolium	Imperiled (S2)
Racomitrium heterostichum var. affine	Imperiled (S2)
Racomitrium pacificum	Vulnerable (S3)
Racomitrium panschii	Critically Imperiled (S1)
Racomitrium pygmaeum	Critically Imperiled (S1)
Rhabdoweisia crispata	Imperiled (S2)
Rhizomnium gracile	Imperiled (S2)
Rhizomnium punctatum	Critically Imperiled (S1)
Rhodobryum roseum	Critically Imperiled (S1)
Rhynchostegium serrulatum	Critically Imperiled (S1)
Schistidium agassizii	Imperiled (S2)
Schistidium apocarpum ssp. canadense	Critically Imperiled (S1)
Schistidium atrichum	Critically Imperiled (S1)
Schistidium boreale	Imperiled (S2)
Schistidium confertum	Critically Imperiled (S1)
Schistidium dupretii	Imperiled (S2)
Schistidium frigidum	Imperiled (S2)
Schistidium heterophyllum	Critically Imperiled (S1)
Schistidium lancifolium	Critically Imperiled (S1)
Schistidium pulchrum	Critically Imperiled (S1)
Schistidium pulvinatum	Critically Imperiled (S1)
Schistidium relictum	Critically Imperiled (S1)
Schistidium rivulare ssp. latifolium	Critically Imperiled (S1)
Schistidium robustum	Imperiled (S2)
Schistidium splendens	Critically Imperiled (S1)
Schistidium vancouverense	Imperiled (S2)
Scleropodium touretii var. colpophyllum	Critically Imperiled (S1)
Scorpidium turgescens	Imperiled (S2)
Scouleria marginata (margined streamside moss)	Critically Imperiled (S1)
Seligeria acutifolia	Critically Imperiled (S1)
Seligeria campylopoda	Imperiled (S2)
Seligeria careyana	Critically Imperiled (S1)
Seligeria subimmersa	Critically Imperiled (S1)
Seligeria tristichoides	Imperiled (S2)
Sematophyllum micans	Imperiled (S2)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Sphagnum annulatum	Critically Imperiled (S1)
Sphagnum aongstroemii	Critically Imperiled (S1)
Sphagnum balticum	Imperiled (S2)
Sphagnum bartlettianum	Imperiled (S2)
Sphagnum contortum	Imperiled (S2)
Sphagnum jensenii	Critically Imperiled (S1)
Sphagnum junghuhnianum var. pseudomolle	Critically Imperiled (S1)
Sphagnum majus ssp. majus	Critically Imperiled (S1)
Sphagnum majus ssp. norvegicum	Critically Imperiled (S1)
Sphagnum nitidum	Critically Imperiled (S1)
Sphagnum obtusum	Critically Imperiled (S1)
Sphagnum orientale	Critically Imperiled (S1)
Sphagnum platyphyllum	Critically Imperiled (S1)
Sphagnum quinquefarium	Imperiled (S2)
Sphagnum rubiginosum	Critically Imperiled (S1)
Sphagnum schofieldii	Critically Imperiled (S1)
Sphagnum sjorsii	Critically Imperiled (S1)
Sphagnum subobesum	Critically Imperiled (S1)
Sphagnum subsecundum var. andrusii	Critically Imperiled (S1)
Sphagnum subsecundum var. inundatum	Critically Imperiled (S1)
Sphagnum wilfii	Critically Imperiled (S1)
Sphagnum wulfianum	Imperiled (S2)
Splachnum luteum	Imperiled (S2)
Splachnum rubrum	Critically Imperiled (S1)
Splachnum vasculosum	Critically Imperiled (S1)
Stegonia latifolia var. latifolia	Critically Imperiled (S1)
Stegonia latifolia var. pilifera	Critically Imperiled (S1)
Tayloria froelichiana	Critically Imperiled (S1)
Tayloria lingulata	Imperiled (S2)
Tayloria serrata var. serrata	Imperiled (S2)
Tayloria serrata var. tenuis	Imperiled (S2)
Tayloria splachnoides	Critically Imperiled (S1)
Tetraplodon angustatus	Imperiled (S2)
Tetraplodon pallidus	Critically Imperiled (S1)
Tetraplodon urceolatus	Critically Imperiled (S1)
Tetrodontium brownianum	Imperiled (S2)
Tetrodontium repandum	Critically Imperiled (S1)
Timmia megapolitana	Imperiled (S2)
Timmia norvegica	Imperiled (S2)
Timmia sibirica	Critically Imperiled (S1)
Tomentypnum falcifolium	Imperiled (S2)
Tortella arctica	Critically Imperiled (S1)
Tortella humilis	Critically Imperiled (S1)
Tortella inclinata	Imperiled (S2)

APPENDIX 2 (CONTINUED): SPECIES AT RISK EXCLUDED FROM THE ANALYSES

SCIENTIFIC NAME [ENGLISH COMMON NAMES IN PARENTHESES]	STATUS IN BRITISH COLUMBIA
Tortula amplexa	Imperiled (S2)
Tortula bolanderi	Critically Imperiled (S1)
Tortula laevipila var. laevipila (twisted oak moss)	Critically Imperiled (S1)
Tortula laevipila var. meridionalis (twisted oak moss)	Critically Imperiled (S1)
Tortula ruralis var. hirsuta	Imperiled (S2)
Tortula scotteri	Critically Imperiled (S1)
Tortula subulata	Imperiled (S2)
Trematodon ambiguus	Imperiled (S2)
Trematodon boasii	Critically Imperiled (S1)
Trematodon montanus	Critically Imperiled (S1)
Trichostomum arcticum	Critically Imperiled (S1)
Trichostomum crispulum	Critically Imperiled (S1)
Tripterocladium leucocladulum	Imperiled (S2)
Ulota curvifolia	Critically Imperiled (S1)
Ulota drummondii	Imperiled (S2)
Weissia brachycarpa	Critically Imperiled (S1)
Wijkia carlottae	Imperiled (S2)
Zygodon gracilis	Critically Imperiled (S1)

NOTE – see Table 1 for a definition of each conservation status rank. NatureServe reports range ranks (e.g., S1S2) when there is uncertainty about the conservation status of a particular species. In this report range ranks were rounded to the higher rank (i.e., S1 in the example) or averaged (S2S4 to S3). The original range rank for each species can be obtained at http://www.natureserve.org

APPENDIX 3

Methods of Analysis

EXCLUSIONS

The following groups were excluded from analysis in this study. A full list of individual species is provided in Appendix 2.

POPULATIONS

Populations of species at risk were not included in the analysis since comprehensive lists for most groups do not exist. Only records indicating a species and subspecies in the Species Level field of the Conservation Data Centre's (CDC) B.C .Species and Ecosystems Explorer were considered.

NO STATUS

Species listed as 'no status' in the B.C. Status field of the Conservation Data Centre's (CDC) B.C. Species and Ecosystems Explorer were excluded from the analysis. 'No status' species were generally the parent species of subspecies that exist in B.C. 'No status' records were excluded so as not to double count species.

EXOTIC OR INTRODUCED SPECIES

Species considered 'exotic' in the B.C. Status field of the Conservation Data Centre's (CDC) B.C. Species and Ecosystems Explorer were excluded from the analysis. Birds listed as exotic or introduced in Cannings (1998) were also excluded from the analysis. Amphibians considered exotic by E-Fauna B.C. were excluded from the analysis.

ACCIDENTALS

Species listed as 'accidental' in the B.C. Status field of the Conservation Data Centre's (CDC) B.C. Species and Ecosystems Explorer were excluded from the analysis. Birds listed as accidental in Cannings (1998) were also excluded from the analysis.

MARINE SPECIES

Marine species were excluded from the analysis as their protection and recovery under law is not the responsibility of the province, but the federal government instead. These species were generally listed as 'cetacea' in the Order field of the Conservation Data Centre's (CDC) B.C. Species and Ecosystems Explorer , while other non-cetacean marine species were simply recognized and removed.

NON-VASCULAR PLANTS

Non-vascular plants (bryophytes, liverworts and hornworts) were excluded from the analysis since taxonomic classifications are incomplete and/or their conservation status remains largely unknown for most members of the group.

SPECIES OF UNKNOWN OR MIXED ORIGIN

Vascular plants of unknown origin or mixed native and exotic origin according to Meidinger et al. (2004) were excluded from the analysis.

TAXONOMIC LISTS USED TO ENUMERATE THE SPECIES RICHNESS OF WILDLIFE GROUPS

TERRESTRIAL MAMMALS

The complete species and subspecies list for terrestrial mammals in B.C. was obtained from the Royal B.C. Museum mammals index[61] and the Conservation Data Centre (CDC) B.C. Species and Ecosystems Explorer.

VASCULAR PLANTS

The complete species, subspecies and variety list for vascular plants in B.C. was obtained from the CDC and the standard provincial list prepared by the BC Ministry of Forests and Range.[62]

AMPHIBIANS

The complete species and subspecies list for amphibians in B.C. was obtained from the CDC and E-Fauna B.C.[63]

BIRDS

The complete species and subspecies list for birds in B.C. was obtained from the CDC and "The birds of British Columbia". [64]

REPTILES AND TURTLES

The complete species and subspecies list was obtained from the CDC and E-Fauna B.C.[65]

FRESHWATER FISH

Comprehensive taxonomic lists below the species level are unavailable.

FRESHWATER AND TERRESTRIAL MOLLUSCS

Comprehensive taxonomic lists below the species level are unavailable.

DRAGONFLIES AND DAMSELFLIES

Comprehensive taxonomic lists below the species level are unavailable.

BUTTERFLIES AND SKIPPERS

Comprehensive taxonomic lists below the species level are unavailable.

APPENDIX 4

British Columbia's Casualty List

Species no longer found in B.C. (extinct, presumed or possibly extirpated);
49 species and subspecies

SCIENTIFIC NAME	ENGLISH COMMON NAME	STATUS IN B.C.
BIRDS N=4		
Ectopistes migratorius	Passenger Pigeon	Extinct (GX)
Centrocercus urophasianus	Greater Sage-Grouse	Presumed Extirpated (SX)
Coccyzus americanus	Yellow-billed Cuckoo	Presumed Extirpated (SX)
Eremophila alpestris strigata	Horned Lark, strigata subspecies	Presumed Extirpated (SX)
BUTTERFLIES; n = 3		
Euchloe ausonides insulanus	Large Marble, undescribed island subspecies	Presumed Extirpated (SX)
Limenitis archippus	Viceroy	Presumed Extirpated (SX)
Plebejus saepiolus insulanus	Greenish Blue, insulanus subspecies	Possibly Extirpated (SH)
FRESHWATER FISH; n = 3		
Coregonus sp. 1	Dragon Lake Whitefish	Extinct (GX)
Gasterosteus sp. 12	Hadley Lake Limnetic Stickleback	Extinct (GX)
Gasterosteus sp. 13	Hadley Lake Benthic Stickleback	Extinct (GX)
FRESHWATER AND TERRESTRIAL MOLLUSCS; n = 11		
Cryptomastix devia	Puget Oregonian	Presumed Extirpated (SX)
Deroceras hesperium	Evening Fieldslug	Possibly Extirpated (SH)
Fisherola nuttalli	Shortface Lanx	Possibly Extirpated (SH)
Fluminicola fuscus	Ashy Pebblesnail	Possibly Extirpated (SH)
Fossaria vancouverensis		Possibly Extirpated (SH)
Musculium partumeium	Swamp Fingernailclam	Possibly Extirpated (SH)
Planorbella columbiensis	Caribou Rams-horn	Possibly Extirpated (SH)
Sphaerium occidentale	Herrington Fingernailclam	Possibly Extirpated (SH)
Valvata humeralis	Glossy Valvata	Possibly Extirpated (SH)
Valvata tricarinata	Threeridge Valvata	Possibly Extirpated (SH)
Vertigo elatior	Tapered Vertigo	Possibly Extirpated (SH)
REPTILES and TURTLES; n = 3		
Actinemys marmorata	Western Pond Turtle	Presumed Extirpated (SX)
Phrynosoma douglasii	Pigmy Short-horned Lizard	Presumed Extirpated (SX)
Pituophis catenifer catenifer	Gopher Snake, catenifer subspecies	Presumed Extirpated (SX)
TERRESTRIAL MAMMALS; n = 3		
Rangifer tarandus dawsoni	Dawson Caribou	Extinct (GX)
Gulo gulo vancouverensis	Wolverine, vancouverensis subspecies	Possibly Extirpated (SH)
Lepus townsendii	White-tailed Jackrabbit	Possibly Extirpated (SH)
VASCULAR PLANTS; n = 22		
Downingia elegans	common downingia	Presumed Extirpated (SX)
Epilobium torreyi	brook spike-primrose	Presumed Extirpated (SX)
Lepidium oxycarpum	sharp-pod peppergrass	Presumed Extirpated (SX)
Lupinus oreganus var. kincaidii	Kincaid's lupine	Presumed Extirpated (SX)
Atriplex alaskensis	Alaskan orache	Possibly Extirpated (SH)
Elymus virginicus var. submuticus	beardless wildrye	Possibly Extirpated (SH)

APPENDIX 4 (CONTINUED): BRITISH COLUMBIA'S CASUALTY LIST

SCIENTIFIC NAME	ENGLISH COMMON NAME	STATUS IN B.C.
Epilobium pygmaeum	smooth spike-primrose	Possibly Extirpated (SH)
Ericameria bloomeri	rabbitbrush goldenweed	Possibly Extirpated (SH)
Eriogonum pauciflorum var. pauciflorum	few-flowered buckwheat	Possibly Extirpated (SH)
Gilia sinuata	shy gilia	Possibly Extirpated (SH)
Leucanthemum arcticum	arctic daisy	Possibly Extirpated (SH)
Lupinus arbustus ssp. neolaxiflorus	spurred lupine	Possibly Extirpated (SH)
Parrya nudicaulis	northern parrya	Possibly Extirpated (SH)
Piptatherum canadense	Canada Ryegrass	Possibly Extirpated (SH)
Pleuricospora fimbriolata	fringed pinesap	Possibly Extirpated (SH)
Poa laxa ssp. banffiana	Banff bluegrass	Possibly Extirpated (SH)
Poa nervosa	coastal bluegrass	Possibly Extirpated (SH)
Polypodium sibiricum	Siberian polypody	Possibly Extirpated (SH)
Prenanthes racemosa ssp. multiflora	purple rattlesnake-root	Possibly Extirpated (SH)
Ranunculus lobbii	Lobb's water-buttercup	Possibly Extirpated (SH)
Senecio hydrophilus	alkali-marsh butterweed	Possibly Extirpated (SH)
Senecio integerrimus var. ochroleucus	white western groundsel	Possibly Extirpated (SH)

NOTE 1 – See Table 1 for a definition of each conservation status rank. NatureServe reports range ranks (e.g., S1S2) when there is uncertainty about the conservation status of a particular species. In this report range ranks were rounded to the higher rank (i.e., S1 in the example) or averaged (S2S4 to S3). The original range rank for each species can be obtained at http://www.natureserve.org

NOTE 2– The list of extinct and extirpated species does not include species and subspecies in the following categories: populations, marine species, non-vascular plants, accidentals, exotics or introduced species, and species listed as no status by the B.C. Conservation Data Centre. A full list of species excluded in the analysis is given in Appendix 2.

NOTE 3– Extinct species (GX) no longer exist anywhere on the planet. Conversely, species that are presumed extirpated (SX) or possibly extirpated (SH) in B.C. are no longer are found in the province, but may be found in other jurisdictions within their global range.

APPENDIX 5

Species at risk endemic to B.C. (39 species and subspecies)

SCIENTIFIC NAME	ENGLISH COMMON NAME	STATUS IN B.C.
BIRDS N=6		
Aegolius acadicus brooksi	Northern Saw-whet Owl, brooksi subspecies	Imperiled (S2)
Cyanocitta stelleri carlottae	Steller's Jay, carlottae subspecies	Vulnerable (S3)
Glaucidium gnoma swarthi	Northern Pygmy-Owl, swarthi subspecies	Vulnerable (S3)
Lagopus leucura saxatilis	White-tailed Ptarmigan, saxatilis subspecies	Vulnerable (S3)
Picoides villosus picoideus	Hairy Woodpecker, picoideus subspecies	Vulnerable (S3)
Pinicola enucleator carlottae	Pine Grosbeak, carlottae subspecies	Vulnerable (S3)
BUTTERFLIES; n = 1		
Plebejus saepiolus insulanus	Greenish Blue, insulanus subspecies	Possibly Extirpated (SH)
FRESHWATER FISH; n = 16		
Coregonus sp. 1	Dragon Lake Whitefish	Presumed Extirpated (SX)
Cottus sp. 2	Cultus Pygmy Sculpin	Critically Imperiled (S1)
Gasterosteus aculeatus ssp.	Charlotte Unarmoured Stickleback	Imperiled (S2)
Gasterosteus sp. 1	Giant Black Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 12	Hadley Lake Limnetic Stickleback	Presumed Extirpated (SX)
Gasterosteus sp. 13	Hadley Lake Benthic Stickleback	Presumed Extirpated (SX)
Gasterosteus sp. 16	Vananda Creek Limnetic Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 17	Vananda Creek Benthic Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 18	Misty Lake "Lake" Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 19	Misty Lake "Stream" Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 2	Enos Lake Limnetic Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 3	Enos Lake Benthic Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 4	Paxton Lake Limnetic Stickleback	Critically Imperiled (S1)
Gasterosteus sp. 5	Paxton Lake Benthic Stickleback	Critically Imperiled (S1)
Lampetra macrostoma	Cowichan Lake Lamprey	Critically Imperiled (S1)
Spirinchus sp. 1	Pygmy Longfin Smelt	Critically Imperiled (S1)
FRESHWATER AND TERRESTRIAL MOLLUSCS; n = 1		
Physella wrighti	Hotwater Physa	Critically Imperiled (S1)
TERRESTRIAL MAMMALS; n = 9		
Gulo gulo vancouverensis	Wolverine, vancouverensis subspecies	Possibly Extirpated (SH)
Marmota vancouverensis	Vancouver Island Marmot	Critically Imperiled (S1)
Microtus townsendii cowani	Townsend's Vole, cowani subspecies	Critically Imperiled (S1)
Mustela erminea anguinae	Ermine, anguinae subspecies	Vulnerable (S3)
Mustela erminea haidarum	Ermine, haidarum subspecies	Imperiled (S2)
Neotamias minimus selkirki	Least Chipmunk, selkirki subspecies	Critically Imperiled (S1)
Ochotona princeps septentrionalis	Common Pika, septentrionalis subspecies	Imperiled (S2)
Rangifer tarandus dawsoni	Dawson Caribou	Presumed Extirpated (SX)
Sorex palustris brooksi	American Water Shrew, brooksi subspecies	Imperiled (S2)

APPENDIX 5 (CONTINUED): SPECIES AT RISK ENDEMIC TO B.C.

SCIENTIFIC NAME	ENGLISH COMMON NAME	STATUS IN B.C.
Thomomys talpoides segregatus	Northern Pocket Gopher, segregatus subspecies	Imperiled (S2)
VASCULAR PLANTS; n = 6		
Lloydia serotina var. flava	Alpine lily	Vulnerable (S3)
Trillium ovatum var. hibbersonii	Dwarf trillium	Critically Imperiled (S1)
Enemion savilei	Queen Charlotte false rue-anemone	Vulnerable (S3)
Geum schofieldii	Queen Charlotte avens	Imperiled (S2)
Saxifraga taylori	Taylor's saxifrage	Vulnerable (S3)
Viola biflora ssp. carlottae	Queen Charlotte twinflower violet	Vulnerable (S3)

NOTE 1 – See Table 1 for a definition of each conservation status rank. NatureServe reports range ranks (e.g., S1S2) when there is uncertainty about the conservation status of a particular species. In this report range ranks were rounded to the higher rank (i.e., S1 in the example) or averaged (S2S4 to S3). The original range rank for each species can be obtained at http://www.natureserve.org

NOTE 2 – The list of species at risk that are endemic to British Columbia does not include species and subspecies in the following categories: populations, marine species, non-vascular plants, accidentals, exotics or introduced species, and species listed as no status by the B.C. Conservation Data Centre. A full list of species excluded in the analysis is given in Appendix 2.

NOTE 3 – Endemic species that are presumed extirpated (SX) or possibly extirpated (SH) in B.C. are extinct globally (i.e., a global status of GX or GH, respectively).

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4 Includes all native and regular occurring terrestrial and freshwater species and subspecies. Does not include marine species, whose protection is the federal government's responsibility.
5 See Appendix 4
6 65 species are considered "Identified Wildlife" under the *Forest and Range Practices Act;* 3 species are legally listed under the *Wildlife Act.*
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23 *The Constitution Act*, 1867 (U.K.) 30 & 31 Victoria, c.3.
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British Columbia is blessed with biodiversity that is on par with some of the great wilderness areas on the planet, such as the Amazon, the Boreal and the Great Barrier Reef. More than 3,600 species and subspecies call B.C. home. Unfortunately, B.C. has already lost dozens of species to local extinction, and hundreds more risk being eliminated from the province.

Rich Wildlife, Poor Protection investigates 3,672 native and regularly occurring terrestrial and freshwater species and subspecies in B.C. This is the first Canadian study to report endangerment below the species level.

The report concludes that in order to safeguard the province's unusually abundant biodiversity, the B.C. government must set in place a stronger set of policies to protect species and their habitat, as well as introduce a robust provincial *Endangered Species Act*.

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