

Spotted Owl Survival and Recovery in British Columbia: Expert Report



Prepared for: Wilderness Committee
Requested by: Ecojustice

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Preface

Wilderness Committee (WC) is formally requesting the federal Minister of Environment and Climate Change (the “Minister”) fulfill her obligation to publish an Action Plan for the northern spotted owl (*Strix occidentalis caurina*) (“spotted owl”) as required in the *Species at Risk Act* (the “Petition”). If the Minister fails to accede to this demand within an acceptable timeline, WC may file an application for judicial review with the Federal Court seeking to compel the Minister to do so (the “Lawsuit”).

This report provides an expert opinion for use in the Petition and Lawsuit. In the preparation of this report I have responded to questions with independence and objectivity and in a manner that does not advocate for any position taken by the WC despite being retained by that organization.

1. Name, address and area of expertise

My full name is Jared Hobbs; I am the director of J Hobbs Ecological Consulting Ltd. (Pender Island, British Columbia (BC)). My area of professional expertise is wildlife biology with a specialized focus on management of species at risk. I have over 25 years of relevant species at risk experience conducting ecological assessments to inform conservation and management and have worked professionally on spotted owl conservation and management throughout the duration of my professional career.

2. Qualifications, employment, and educational experience in my area of expertise

My first formal work experience with spotted owls began in May 1997. I was retained by the BC Provincial Government as a field technician tasked with conducting acoustic lure (i.e., call-playback) surveys for northern spotted owl. This initial work marked the beginning of a 15-year term of employment with the BC Provincial Government. In addition to my work in government, I continued to study and work on spotted owls independently in the United States (US) and Mexico in pursuit of content for a book I published on the northern spotted owl (Hobbs, J. and R.J. Cannings, 2007). During this period my proficiency in finding spotted owls and their nests, and my understanding of the ecology, conservation and management of spotted owls (range-wide) grew rapidly.

During this period (1997-2002) I was employed by the Provincial government as a full-time species-at-risk biologist; tasked as the provincial lead for field implementation of the Identified Wildlife Management Strategy (IWMS). My bailiwick included implementation of conservation and management for 82 species (including spotted owl). In this position my role was to identify occurrences of rare species in BC to promote legal designation of Wildlife Habitat Areas (WHAs).

To fulfill program objectives for spotted owl, between 2002 and 2006, I led a field survey program conducting spotted owl inventory within the Cascades, Chilliwack and Sea-to-Sky Natural Resource District (NRD) and provided scientific advice to the Canadian Spotted Owl Recovery Team (CSORT). In this capacity I played a strong role in the development of the BC Recovery Strategy for the Northern Spotted Owl (Chutter et al. 2004), and in the development of a companion document: Guidance and Some Components of Action Planning for the Northern spotted owl in BC (Chutter et al. 2007). Both

documents were produced to inform and guide spotted owl action plan development by the Provincial Government.

To further inform development of the BC spotted owl recovery strategy I also revised and improved a new habitat suitability model to more accurately identify spotted owl habitat within the species' range in BC¹. This revised model was adopted by CSORT as a more accurate and more appropriate model to be used by Cortex Consulting for predictive Spatially Explicit Landscape Event Simulation (SELES) modelling. The SELES model, using the new habitat suitability model I had developed, was used to define recovery planning objectives, in particular habitat management objectives, for spotted owl in BC. In addition, in 2005, I co-authored new Provincial spotted owl survey standards (endorsed and published by the Resource Inventory Standards Committee (RISC)) to ensure more specific guidance to spotted owl survey efforts and to incorporate a hierarchical ruleset for determination of spotted owl occupancy and productivity at newly detected active sites.

Finally, after a prolonged (phased) process commencing 2006 and continuing into 2009 (with the release of Best Management Practices for Managing Spotted owl Habitat (Blackburn et al 2009)) SARCO released the BC spotted owl recovery action plan to provide guidance for spotted owl habitat management in BC within revised SOMP1 spatially designated areas called Special Resource Management Zones (SRMZs). These SRMZs were eventually legally designated, under IWMS, in 2011 (Chilliwack NRD) and 2013 (Sea-to-Sky NRD) as Wildlife Habitat Areas (WHAs). I was assigned a role on the Spotted Owl Habitat Management Team to support development of SOMP2. In this capacity I shifted my focus towards providing support during development of a second (new) spotted owl (habitat) management plan (SOMP2) that was eventually formalized in 2006 (Cascades NRD), 2011 (Chilliwack NRD) and 2013 (Sea-to-Sky NRD) with prescriptive guidance for forestry presented as Best Management Practices by Blackburn et al (2009).

In 2013, I resigned from the Provincial government but retained an academic interest in spotted owl recovery in BC and continued to lead spotted owl field inventory for several clients as a consultant. For further details of my experience and expertise managing species at risk please see my CV (attached).

¹ the former 1996 BC spotted owl model (developed and applied, by I. Blackburn during development of the first iteration of the Spotted Owl Management Plan (SOMP1) adopted values for habitat attributes relevant to US literature; this failed to recognize and incorporate refinement of values more relevant in the BC/Canada portion of the species' range.

Recent Publications and Reports (Chronological)

- Nagorsen, D., Lausen, C., Brigham, M., and Hobbs, J. 2019. Field Guide to Bats of BC. Manuscript in prep.
- Hobbs, J., C.C. Helbing, C. Goldberg, I. Adams. 2018. Ecology and Distribution of Rocky Mountain tailed frog using eDNA methods in Eastern BC. PlosOne. Manuscript in Prep.
- Hobbs, J., J. M. Round, C.C. Helbing. 2018. Expansion of the known distribution of the coastal tailed frog, *Ascaphus truei*, in British Columbia, Canada using robust eDNA detection methods. PlosOne. Manuscript in Prep.
- Veldhoen, N., Hobbs, J., Ikonomidou, G., Hii, M., Lesperance, M., and Helbing, C.C. 2016. Implementation of novel design features for qPCR-based eDNA assessment.
- Hobbs, J. and C. Goldberg. 2016. Standard Operating Procedure. Environmental DNA Protocol for Freshwater Aquatic Ecosystems. V2.0. Prepared for B.C. Ministry of Environment. 1-25.
- Livezey, K.B, M.F. Elderkin, P. A Cott, J. Hobbs and J. P. Hudson. 2008. Barred owls eating worms and slugs: the advantage in not being picky eaters. *Northwestern Naturalist*. 89: 185-190.
- Smith, J., G.D. Sutherland, D.T. O'Brien, F.L. Waterhouse, J.B. Buchanan; J. Hobbs and A.S. Harestad. 2008. Relationships between Elevation and Slope at Barred Owl Sites in Southwestern British Columbia. Research Section, Coast Forest Region, BC Ministry of Forests and Range. Nanaimo, BC. Technical Report TR-040.
- Hobbs, J., 2007, "Thermal Ecology of the Northern Pacific Rattlesnake." Masters of Science Thesis: Simon Fraser and Royal Roads University
- Hobbs, J. and Cannings, 2007, "The Spotted Owl – Shadows in an Old Growth Forest" (Book), Douglas and McIntyre. ISBN: ISBN 978-1-55365241-0.

3. WC has asked me to provide an opinion, based on my qualifications, on the following questions:

1. What is the history, population trend, and current status of the Spotted Owl in Canada?
2. What are the key threats to survival and recovery of the Spotted Owl?
3. What are the ecological requirements for the Spotted Owl, and which of these are key to their recovery in British Columbia?
4. How should ecological requirements influence recovery actions?
5. How has British Columbia managed for Spotted Owl survival and recovery? Please provide a chronology.

6. In reference to the BC Habitat Management Practices document and any other relevant materials you are aware of, how has British Columbia managed and protected Spotted Owl habitat since the release of the Recovery Strategy?
7. How has British Columbia's management and protection of habitat affected the survival or recovery of the Spotted Owl?
8. How has British Columbia managed key threats to Spotted Owl habitat?
9. How has British Columbia's management of key threats to the habitat affected the survival or recovery of Spotted Owl?
10. How has British Columbia managed key threats, other than to habitat, of the Spotted Owl?
11. How has British Columbia's management of these key threats affected the survival or recovery of the Spotted Owl?
12. In reference to the BC Habitat Model, how has British Columbia defined and described Spotted Owl habitat?
13. Does the BC Habitat Model identify and define Spotted Owl critical habitat as required by the SARA (that is, "habitat that is necessary for the survival or recovery of [the Spotted Owl]" identified "to the extent possible, based on the best available information") ("Critical Habitat")?
14. If you answered "no" to question 13, what is the Critical Habitat for the Spotted Owl as required by the SARA?
15. How is the Critical Habitat you define and describe different and similar to the BC Habitat Model?
16. How should the threats to Critical Habitat be managed to maximize the likelihood the Spotted Owl will survive and recover?
17. Can Critical Habitat be logged so as to enhance or not jeopardize the Spotted Owl's survival and recovery?
18. What are the key activities (such as habitat enhancement, predator control, prey augmentation, etc.) which should and should not accompany management and protection of Critical Habitat to maximize the likelihood the Spotted Owl will survive and recover?
19. The authors of the Recovery Strategy determined that the survival and recovery of the Spotted Owl was at the time technically and biologically feasible. Is the survival and recovery of the Spotted Owl in British Columbia still technically and biologically feasible?
20. Attached is a document prepared by the Canadian Spotted Owl Recovery Team ("CSORT") that we refer to as the Action Plan Guidance. What is your understanding of the nature of this document?

21. The CSORT states in the Action Plan Guidance that it was drafted to “identify reasonable actions required to protect and recover the Northern Spotted Owl in Canada” (at page v). How does BC’s current approach to protecting and recovering the Spotted Owl exceed, meet, or fall short of these actions?

4. Acronyms, Abbreviations, and Definitions

Acronym/Abbreviation/Term	Definition
AAC	Annual Allowable Cut
Age Class	Assignment used by BC Government to denote the age of forest cover. Forests are assigned an age class (1-9) based on estimated age, since origin, of the forest.
Allee Effect	Negative relationship between population density and population growth rate: illustrated by negative effects on juvenile recruitment
ASL	Above Sea Level
BACI	Before/After-Control/Impact
BEC Zone	Broad Ecosystem Classification Zone
BGC Unit	Bio-geoclimatic Unit
BCCF	BC Conservation Foundation
BCTS	BC Timber Sales
BMP	Best Management Practice
Capable Habitat	Used to refer to habitat that is forested, or capable of becoming forested, through maturation (or succession). Generally young forests (below 120 years, or age class 7) are regarded as capable, but not currently suitable, for use by spotted owl (as breeding or foraging habitat).
Cat-I (Category-Information)	Used to identify proposed cut-blocks being advanced, as “information”, to the BCMFLNRORD district manager for approval to harvest. Once approved a Cat-I block becomes a Cat-A (approved) block and is advanced for commercial forest harvest.
CDF	Coastal Douglas-Fir
CH	Critical Habitat
Class A (spotted owl) habitat	Habitat rated as suitable for breeding/nesting use by northern spotted owl in BC.
Congeneric	Belonging to the same genus
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSORT	Canadian Spotted Owl Recovery Team
CWD	Course Woody Debris
CWH	Coastal Western Hemlock
DBH	Diameter at Breast Height
ECCC	Environment and Climate Change Canada
FMA	Forest Management Area
FRPA	Forest and Range Practices Act

GWM	General Wildlife Measure
GVRD	Greater Vancouver Regional District
HCA	Habitat Conservation Area
HEP	Habitat Enhancement Procedure
HSI	Habitat Suitability Index
HVR	Heavy Volume Removal
HWR	Harvest with Retention
IDF	Interior Douglas-Fir
IWMS	Identified Wildlife Management Strategy
LRMP	Land and Resource Management Plan
LTAC	Long-term Owl Activity Centre
LTOHA	Long-term Owl Habitat Area
LVR	Light Volume Removal
MFHA	Managed Future Habitat Area
MS	Montane Spruce
MOU	Memorandum of Understanding
NRD	Natural Resource District
NSOBP	Northern Spotted Owl Breeding Program
NWFMP	Northwest Forest Management Plan
Old Growth (forest)	In reference to late seral, or mature forest; generally greater than age class 8 (141-250 years of age) and often greater than age class 9 (>251 years of age).
PP	Ponderosa Pine
RISC	Resource Inventory Standards Committee
SARA	Species at Risk Act
SARCO	Species at Risk Coordination Office
SELES	Spatially Explicit Landscape Event Simulation
Stochastic	Randomly determined
SOHA	Spotted Owl Habitat Area
SOMIT	Spotted Owl Management Interagency Team
SOMP1	1997 – 2007 Spotted Owl Management Plan (original)
SOMP2	2009-2019 Spotted Owl Management Plan (revised)
Suitable Habitat	In reference to estimated or perceived foraging and nesting habitat for spotted owl based on consideration of several habitat attributes including BGC Zone, age-class, stand height, and crown (or canopy) closure.
SRMZ	Special Resource Management Zone
Sympatric	Co-occurring, existing in the same geographic area
THLB	Timber Harvesting Land Base
VRI	Vegetation Resource Inventory
WC	Wilderness Committee
WHA	Wildlife Habitat Area

5. Detailed Responses to Questions 1-21

1. What is the history, population trend, and current status of the Spotted Owl in Canada?

Synopsis: Pre-European contact the population of northern spotted owl in BC is estimated at 500 pairs. The owl's historic distribution in BC (or Canada) extends from the international border east to Manning Park and north along the Cascades to Lillooet, and along the Coastal ranges to Bute Inlet. The first written recorded spotted owl detection in BC is from 1903. Between 1909 and 1965 spotted owls were recorded at 18 additional locations within their range. No trend data exists prior to 1991; however, monitoring efforts between 1991 and 2002 demonstrated an annual population decline of up to 10.4% per year. Surveys between 2002 and 2018 suggest an even more rapid rate of population decline. As of 2018, the remaining extant population of spotted owl in BC is restricted to three single owls in the Chilliwack NRD.

Distribution in BC:

The historic distribution of spotted owl in BC is from the international border, from Vancouver continuing east to Manning Park (east gate and Lightning Lake (Campbell 2014)) and continuing north along the Cascades and Coastal ranges north to Carpenter Lake, northwest of Lillooet. The first written records of spotted owl detected in BC was recorded in 1903 by Delbert Grovnor Boyd Ryder at Mount Lehman; this was closely followed by a specimen from Chilliwack in 1909 (Campbell 2014). Between 1909 and 1965, spotted owls were reliably recorded at 18 additional locations (including four nest records) between Bute Inlet and Powell River along the west coast and as far east as Lightning Lake in Manning Park in the Cascades. There are no confirmed records on Vancouver Island; however, Clark reported repeated observations of spotted owl south of Courtenay in 1910 (as described in Campbell et al. 2014). The western extent of the species' range in BC was never well defined as no formal survey has ever been conducted within large portions of the species' former range within the Sunshine Coast NRD despite several confirmed records (near Bute Inlet) as documented by W. Campbell (Campbell 2014). The current 2018 extant population is restricted to only three sites near Boston Bar (Dulc 2018).

Appearance and Taxonomy:**Northern Spotted Owl****California Spotted Owl****Mexican Spotted Owl**

The northern spotted owl is a mid-sized brown owl with no ear-tufts and brown eyes. Individuals weigh between 600-800 grams, with a body length of 55cm and a wingspan of 150 cm. Within North America, there are three recognized subspecies: the northern spotted owl (*S. o. caurina*), the California spotted owl (n nominate subspecies) (*S. o. occidentalis*), and the Mexican spotted owl (*S. o. lucida*). Only the northern spotted owl is found in British Columbia (BC); this subspecies is the focus of this report; it is referred to hereafter simply as “spotted owl”.

Conservation Status:

By the mid 1980’s, concern over noted declines within the US, and suspected in BC, motivated increased attention in Canada. In 1984, protection for the species was recommended to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Campbell 2014) and by 2000 the owl’s status was confirmed as Endangered based on an updated report by Kirk (1999) (as cited in Campbell 2014). The spotted owl was first designated as Endangered in Canada by COSEWIC in 1986 (Chutter et al. 2004). This status was reconfirmed in 1999 and again in 2002. Spotted owl was listed on Schedule One of the federal *Species at Risk Act* in 2004. In BC, spotted owl is red-listed by the Conservation Data Center, and is recognized as a “Priority 1” under Goal 3 of the BC Conservation Framework (to maintain the diversity of native species and ecosystems). Spotted owl is also identified by the BC Ministry of Environment in the Category of Species at Risk and as a priority species for conservation and management under the Government Actions Regulation component of the Forest and Range Practices Act (Blackburn and Godwin 2004). As such, sites detected on Crown land are entitled to consideration for protection through the designation of Wildlife Habitat Areas (WHAs) to conserve and maintain habitat values.

Status of the Captive Breeding Population:

A captive breeding program was initiated in 2006 with the goal of releasing 20 young per year between 2006 and 2026 (I. Blackburn pers. com.) with an originally projected 2019 goal of 240 owls bred and released. To date the program has produced eight young (one of which was blind and incapable of flight); the same program has removed ten spotted owls from the wild population in the same time period to augment breeding stock (including at least one that died within 24-hours of capture from blunt force trauma). Release goals are not publicly available and are not currently anticipated in 2019; to date no captive bred spotted owls have been released in BC. There are currently 21 owls in captivity (including eight captive bred juveniles, ten adults removed from the wild in BC, and four owls brought in from rescue centres in the United States (US)).

Population Trend in BC:

- **Long-term Trend (1903-1991):** Trend data is not available prior to 1991. Historic population estimates (pre-European contact) estimated as many as 500 pairs of northern spotted owl in BC (Blackburn et al. 2002). Large declines from historic population levels have occurred in BC over the past 50-100 years.
- **Short-term Trend (1991-2002):** Evaluation of short-term trends between 1992 and 2001 confirmed at least 64 occupied sites in British Columbia within the Sea-to-Sky, Chilliwack, and Cascades NRD. Analysis of the occupancy of owls at 40 of these sites in the Chilliwack and Sea-to-Sky forest districts between 1992 and 2001 confirmed a population decline of about 49% at an average annual rate of 7.2% (Blackburn et al. 2002). In 2002, Chutter et al. (2004) suggested a similar sharp population decline in BC (35%) resulting in an overall decline of 67% between 1992 and 2002 at an average rate of 10.4% per year (Chutter et al. 2004).
- **Overall Trend (1903-2018):** Regardless of subtle differences in reported rates of population decline, based on the historic population estimate of about 500 potential breeding pairs of owls (Blackburn et al. 2002), the current population estimate suggests that the population may have declined by as much as 99% since European settlement (**Figure 1**).

Population trends were not monitored using consistent monitoring protocols after 2002 - instead, more widespread surveys were conducted to document new occurrences on the landscape and to determine productivity and survivorship of juvenile spotted owls (Hobbs 2004a, 2004b, Hausleitner 2005, Hausleitner 2006). As such, a graph of known occupied sites per year between 2002 and 2018 shows a fluctuating trend, however, this fluctuation is a reflection of allocation of effort rather than a fluctuation in number of owls (**Figure 2**). Survey information collected between 2002 and 2018 suggests that the rate of population decline likely increased after 2002 (Hobbs 2004, 2005, Hausleitner 2007, Gillis 2016a, Gillis 2016b, Dulc 2018 (unpublished monitoring data provided by I. Blackburn 2017)).

Despite measures to control barred owl and extensive efforts from the BC spotted owl captive breeding program, the BC population of spotted owl has now declined to a current population of three single (non-paired) owls in 2018. Few areas of large contiguous old-growth forest habitat remain on the landscape in BC in a condition suitable for occupancy by spotted owls (Chutter et al. 2004).

Continued population decline and current status indicate that spotted owls are critically imperiled in BC. There are currently no remaining known extant spotted owl sites in the Cascades Natural Resource

District (NRD) and the Sea-to-Sky NRD²; in the Chilliwack NRD there are only three remaining single owls (no pairs). The remaining extant sites in BC are all restricted to the Fraser sub-population (J. Gillis, pers. comm., 2018 as cited in Dulc 2018).

Figure 1: Estimated number of occupied survey areas (n=40) from 1992-2002 (from Blackburn and Godwin 2003, as cited in Chutter et al. 2004).

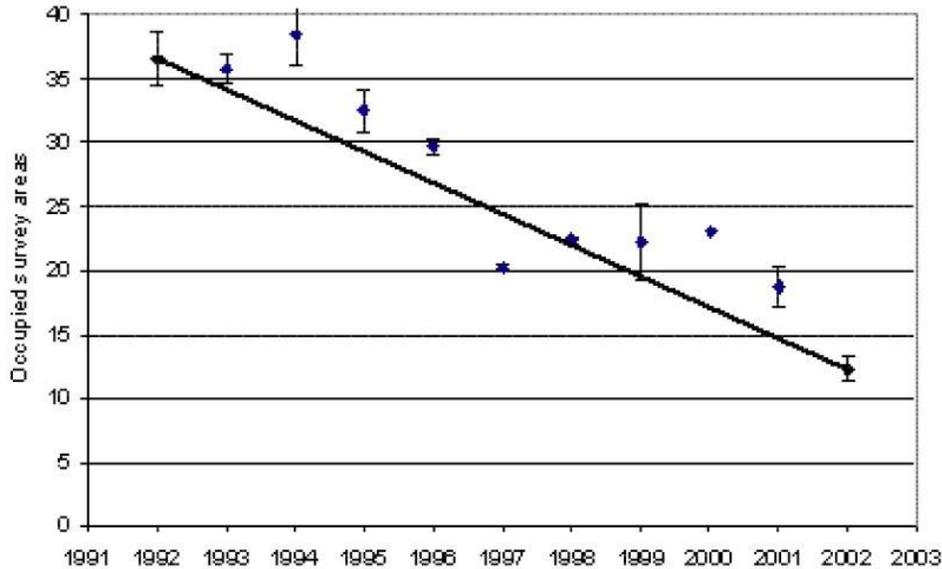
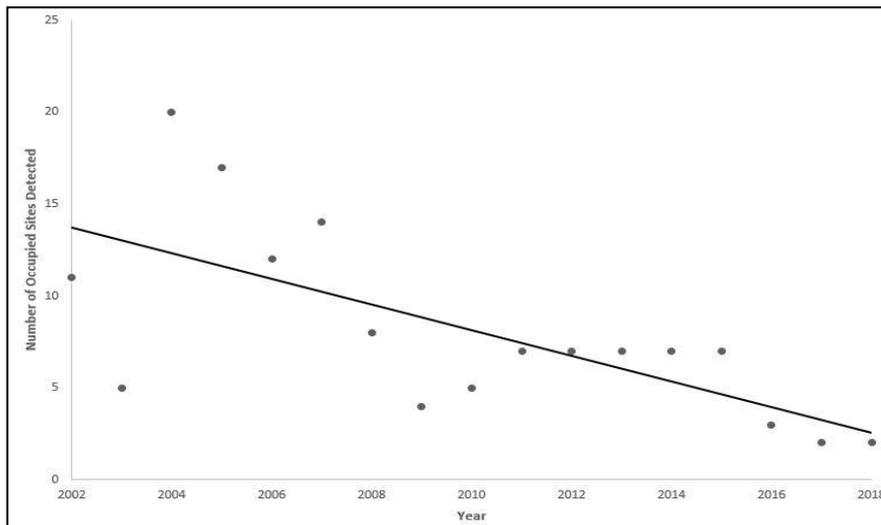


Figure 2: Estimated number of occupied sites from 2002-2017 (unpublished monitoring data provided by I. Blackburn 2017).



² Within the Lillooet and Squamish sub-populations, inventory efforts since 2004 have documented a 100% decrease in occurrences; no spotted owls were detected in this sub-population in 2016 or 2017 surveys (Dulc 2018).

2. What are the key threats to survival and recovery of the Spotted Owl?

Synopsis: Key threats to spotted owl survival and recovery include further loss and fragmentation of old-growth habitat, competition from barred owls, predation, climate change, disease, and negative effects from environmental and genetic factors. Of these, the primary threat is loss of habitat. Spotted owl prey abundance and availability is influenced by available suitable forested habitat; spotted owl reproduction and survival are directly influenced by habitat loss. Commercial forest management practices create fragmented landscapes and exacerbate a secondary threat in the form of barred owl competition and depredation, and a tertiary threat of depredation by great horned owl and northern goshawk. Natural environmental disturbances are considered quaternary threats but are still significant given the small population size of spotted owls.

In the treatment of “Threats to the Species” (P.12) of the spotted owl Recovery Strategy the authors distinguished primary factors from secondary factors based on the duration of the effect and assigned threat priority as follows: *“The original population decline is believed due to the loss and fragmentation of old-growth habitat to urban and rural development, and forestry activities. This loss of habitat resulted in diminished quantity and quality of habitat, reduced connectivity of owl sites across the landscape, increased isolation from the larger population in the United States, and likely heightened negative effects of stochastic events associated with very small populations. Current known and potential threats include further loss and fragmentation of habitat, competition from barred owls, predation, climate change, disease and negative effects from environmental and genetic factors.”* (From Chutter et al. (2007)). I agree with the classification and assignment of priority as described in the recovery strategy; however, I also considered guidance from the Canadian Environmental Assessment Agency (2013) to describe significance of each threat by examining magnitude, extent, duration, reversibility and frequency. I have followed this more fulsome approach in the summaries of each threat presented below.

Primary Threat: Loss of Habitat:

High magnitude (i.e., severe influence), large extent (i.e., range-wide), prolonged duration (i.e., not readily reversible) and frequent (i.e., occurs commonly).

Spotted owls are specialists – they persist by foraging on two key species that they hunt within the canopy of a mature forest. The northern spotted owl occupies large home ranges (2,800 – 3,400 ha) within suitable forested habitats (**Figure 3**). Reproduction and survival are strongly affected by fluctuations in prey abundance and availability; both attributes are negatively affected by loss of old-growth forest habitat (**Figure 4**). Commercial forest harvest is most commonly identified as the primary threat to spotted owl (Chutter et al. 2004), as clear-cut practices result in removal of large areas of coniferous forest. Conventional commercial forestry practices typically result in large areas of complete forest removal (i.e., clear-cuts) with an obvious direct effect upon the amount, distribution (i.e.,

fragmentation) and abundance of available suitable spotted owl habitat. This directly impacts spotted owl abundance at the landscape level³.



Figure 3: Spotted owl territory within Stein Provincial Park. This illustrates ideal spotted owl habitat conditions in BC.



Figure 4: Upper Pitt watershed illustrating typical landscape conditions on the THLB within the owl's range in BC.

³ In the past, urban encroachment within the Lower Mainland region likely displaced spotted owls but the influence of urban encroachment is no longer proximal to any active owl territories.

Secondary Threat: Competition from Barred Owls:

High magnitude (i.e., severe influence), large extent (i.e., range-wide), prolonged duration (i.e., not readily reversible) and frequent (i.e., occurs commonly).

In addition to direct loss of habitat, forest harvest promotes and exacerbates a more recent secondary threat; competition, and to a lesser extent, depredation, from the northern barred owl (*Strix varia varia*) (hereafter referred to as barred owl) (**Figure 5**). Unlike spotted owls, barred owls forage along the edge of a forest, hunting prey in forest openings. Barred owls are referred to as a “generalist” species in ecology (i.e., a species with general foraging requirements that can capitalize on a wider variety of prey) (Livezey et al. 2008). By converse, spotted owls are referred to as a “specialist” species (i.e., a species with specific foraging requirements that specialize on feeding on a relatively limited number of key prey items). As forest harvest increases the area of ‘edge’ habitat, relative to the area of available interior forested habitat⁴, foraging conditions are optimized for barred owl. These distinct ecologies are apparent when considering diet, home range size, fecundity, and survivorship in response to environmental perturbation.

Available literature from Oregon and California suggests that barred owl prey diversity is up to three times greater than spotted owl (Diller et al. 2016,). As such, barred owls persist within relatively smaller home ranges (600 ha) and exploit a more diverse prey base. Suitable prey for barred owl includes amphibians, other birds, and a diversity of small mammals (i.e. mice, voles, tree squirrels (including flying squirrel (*Glaucomys sabrinus*)) and bushy-tailed woodrat (*Neotoma cinereus*)) whereas spotted owls tend to specialize, feeding almost exclusively on woodrats and flying squirrels. The barred owl’s less restrictive diet allows it to forage within a range of forest types including younger forests and mixed species stands. Barred owls can select for alternate prey species when their populations of their preferred prey decline or fluctuate giving barred owls a competitive advantage over spotted owls when they co-occur in suitable forested habitat (Livezey and Flemming 2009).

Forested landscapes with a mosaic of forest age-classes are created by commercial forest harvest practices (**Figure 3**). Under the current fragmented age class structure in BC the barred owl has a competitive advantage (Livezey and Flemming 2009, Weins et al. 2014 as cited in Gillis 2016a). Barred owls have been observed displacing spotted owls from habitats (Diller et al. 2016); barred owls have also been recorded depredating both juvenile and adult spotted owls (Dark et al. 1998, Leskiw and Gutierrez 1998 as cited in Gillis 2016a). Fecundity and survivorship of adult spotted owls are both negatively affected by barred owls when they co-occur within 0.8 km of territory centres (Gillis 2016a). Recruitment and survivorship of juvenile spotted owls is also affected in areas where barred owls are established (Diller et al. 2016). In a long term (1985-1996) study that sampled 386 marked juvenile spotted owls 26.2% of the 386 marked juvenile spotted owls died from starvation (Forsman et al. 2002). Starvation induced mortality is undoubtedly exacerbated by barred owls (Diller et al. 2016).

⁴ Edge-effect is an ecological term used to describe the influence of increased edge-to-interior ratios in mature (primary, or old growth) forests. As mature forest is harvested and replaced by cleared openings the ratio of interior to edge habitat is reduced.

In summary, as barred owl abundance increases there is a concomitant increased level of competition for prey and security habitat. The more aggressive barred owl tends to displace both resident and non-resident (dispersing) spotted owls. In response, spotted owls will move to avoid barred owl thus subjecting themselves to increased thermo-energetic costs as they disperse from high-value foraging habitats (Diller et al. 2016) to sub-optimal habitats with fewer resources. This often results in mortality from starvation in dispersing juvenile spotted owls (**Figure 6**).



Figure 5: Barred owl in mixed age forest.



Figure 6: Emaciated (dead) juvenile spotted owl.

Tertiary Threat: Increased Predation Risk

High magnitude (i.e., severe influence), large extent (i.e., range-wide), prolonged duration (i.e., not readily reversible) but low frequency (i.e., occurs irregularly)

Fragmented forest landscapes (i.e., forests with a mosaic of age classes as created by commercial forest harvest practices) may also favor (for reasons similar to those described above for barred owl) great horned owl (*Bubo virginianus*) and northern goshawk (*Accipiter gentilis*) population abundance. As forest harvest increases edge-to-interior forest ratios more favourable habitat conditions for great horned owls are created. This not only affects competition for limited prey resources, but also affects predation rates. Avian predation on spotted owls is largely attributed to great horned owl and northern goshawk (Forsman et al. 2002). This is further exacerbated for dispersing spotted owls as increased movement, during dispersal, places spotted owls at greater risk of depredation by great horned owls. In a long term

(1985-1996) study that sampled 386 marked juvenile spotted owls 68% died from predation; 67 of 83 (81%) of the depredated owls were attributed to avian predators (Forsman et al. 2002).

Quaternary threats: Random Stochastic Events (including fire)

High magnitude (i.e., severe influence), low extent (i.e., localized), short duration (i.e., temporary) and infrequent (i.e., occurs irregularly).

Natural stochastic events also affect owl survival and recovery. Typically, these include natural environmental disturbances including fire, landslides, and unusual weather patterns as a result of climate change (Dulc 2018). These threats become more serious, and more likely to result in extirpation, when population sizes are small as these populations have reduced resilience to cope with change.

Unfortunately, decades of fire suppression have altered the tree species composition, structure and spatial distribution of conifer forests in at the drier (Cascades) and transition (Sea-to-Sky) NRD. Literatures from Washington suggests increased canopy cover and fuel loading on the forest floor has continued to intensify and expand risk from catastrophic wildfire events (Buchanan 2016). As a consequence, fires in these altered conditions are more intense and often remove substantial areas of forest resulting in landscape conditions that are unsuitable (or less suitable) for use by spotted owls. In summary, fire suppression has served to create spotted owl habitat in some areas but has altered forest attributes towards an unsustainable condition; in these modified forests large fires and impacts of insects and disease are more likely to degrade or destroy portions of these forests (Buchanan 2016). The U.S. Fish and Wildlife Service acknowledged the need to address this risk by proactively managing dry forest landscapes (Buchanan 2016).

3. What are the ecological requirements for the Spotted Owl, and which of these are key to their recovery in British Columbia?

Synopsis: Key ecological requirements include protection from predators; access to nesting and roosting habitat features; and access to suitable foraging habitat that features high prey availability and accessibility (i.e., open stands to allow flight within and beneath the forest canopy). These attributes are typically associated with old-growth forests (generally no less than 120-140 years old in the CWH and IDF bio-geoclimatic zones). As such, conservation of suitable spotted owl habitat is fundamental to species recovery.

Ecological Requirements:

Spotted owls are upper trophic level avian specialists that rely on forest characteristics typically associated with old-growth forests. Forest age class is an important attribute; however, several other forest attributes are also required. These include appropriate stand (tree) height, appropriate canopy closure, low stem density (approximately 240 stems/hectare (ha)), vertical structural heterogeneity, healthy understory component and presence of coarse woody debris. These structural attributes provide security habitat (i.e., protection from predators and the environment (e.g., inclement weather)), nesting and roosting structures; relatively high prey availability and accessibility; and suitable foraging conditions that permit flight within and beneath the forest canopy. The specific structural attributes that influence habitat quality varies between ecosystems and topography but, generally speaking, suitable spotted owl foraging habitat is comprised of mature forest at \geq age class 6 (least 100 - 120 years old) and below 1,200m elevation. Spotted owl nesting habitat is typically associated with old growth forested habitat \geq age class 8 (141-250 years of age) or age class 9 (>251 years of age)

In the northern part of their range spotted owls “*consistently select nest stands surrounded by a greater proportion of old or mature forest than are randomly available in the landscape*” (Manley et al. 2003). Although there is some variation across the range of the species, northern spotted owl habitat is described by consensus in the literature as late-seral (i.e., old-growth) coniferous forests with uneven aged trees that create a multilayered canopy and an average stem density of approximately 200 – 240 stems per hectare (Chutter et al. 2004, Blackburn et al. 2009). At a general level, habitat suitability includes consideration of (horizontal and vertical) structural complexity, tree species, canopy closure, stand (stem) density and stand height. The response to Question 12 provides additional detail regarding specific measurements of key forest habitat attributes used by CSORT to define and identify spotted owl habitat in BC.

As secondary cavity nesters, spotted owls are dependent on tree deformities that are most abundant in old-growth forests. Spotted owls’ nest in large natural cavities (broken limbs resulting in a cavity that creates access into the bole), broken topped trees with a hollow top into the core of the tree (referred to as chimney nests) or platforms created by mistletoe clusters and abandoned northern goshawk nest structures. As medium-sized owls, spotted owls require relatively large tree deformities for nesting and roosting, these typically occur in large diameter trees (>75 cm Diameter at Breast Height (DBH)) (Forsman et al. 1984, Thomas et al. 1990, Buchanan et al. 1993). In Washington and Oregon, mean

diameter of nest trees varied from 59-141 cm DBH with smaller trees used more frequently in drier ecosystems (Manley et al. 2003). In BC, spotted owl nests have been reported in two bio-geoclimatic (BGC) zones: the wetter ecosystem is referred to as the Coastal Western Hemlock (CWH) BEC zone and the drier ecosystems are referred to as the Interior Douglas-fir (IDF) BEC zone at elevations of 368-1,120 m above sea level.



Broken-top (or Chimney) nests occur in trees with a large bole; with an average age of 700 year. Once cut, these trees can't be quickly replaced.



In drier portions of the owl's range large diameter trees are scarce; abandoned platform nests may be used if available.

Forest structure is also critical to ensure that spotted owls have sufficient access to prey. Spotted owls need particular forest characteristics to locate and capture their prey, and as specialists (feeding predominantly on flying squirrel and bushy-tailed woodrat), they require a high abundance of prey species (see response to Question 11). Flying squirrel and bushy-tailed woodrat occur in higher densities in forested areas with diverse shrub cover, coarse woody debris, or nearby rocky talus (Gutierrez 1995) (see Question 11-3). As such, mature forested areas with these characteristics are required for persistence of spotted owls on the landscape.

Spotted owl persistence and survival requires breeding, foraging and dispersal habitats that are generally recognized to occur within large contiguous areas of old-growth forest in the CWH and IDF biogeoclimatic zone. Conservation of old-growth forested habitat within the known historic range of the species is essential to spotted owl recovery as these habitats provide nesting and roosting habitat and access to prey items with appropriate forage conditions. Spotted owl habitat has been described consistently in the BC Recovery Strategy (Chutter et al. 2004) and in the COSEWIC spotted owl species account (2008), as follows:

General Habitat:

The Canadian Spotted Owl Recovery Team (Chutter et al. 2007) identified three habitat types based on ecological subregions: maritime, sub-maritime and continental. High-quality habitat is characterized as mixed coniferous forests >200 years old, at elevations below 1,200 m with abundant large diameter and tall trees (Chutter et al. 2007). These forests feature uneven-aged, multi-layered canopies, and include numerous large trees with broken tops, deformed limbs, and large natural cavities in the bole of veteran trees. Snags are typically abundant, as is downed woody debris. These habitat characteristics are found naturally in old-growth forests in the maritime and sub-maritime areas. In interior areas spotted owls have been observed using younger forest stands where structural components typical of old-growth forests have been created by disturbances such as fire, wind or selective logging (COSEWIC 2008).

Breeding Habitat:

Old-growth trees are used for nesting, either in contiguous old-growth stands or in remnant old-growth patches (Thomas et al. 1990; Forsman and Giese 1997; Ripple et al. 1997 as cited in COSEWIC 2008). Nest sites are typically located in dense, multi-layered, older forests with 85-90% canopy closure (Gutiérrez et al. 1995). Spotted owl exhibit high philopatry (fidelity) to breeding areas (territory cores); re-using the same nest grove for their entire life, and often over successive generations.



Nest tree in breeding habitat at Sockeye Creek; nested in broken top tree for at least two years in 2004 and 2005.

Foraging Habitat:

Northern spotted owl foraging habitat occurs in forests with high canopy closure and complex structure (Gutierrez et al. 1995). Owls primarily forage in old-growth or mixed-aged stands (with mature and old-growth trees) and use a wider variety of habitat for foraging than for nesting or roosting (Thomas et al. 1990 as cited in COSEWIC 2008). Telemetry studies in BC, Oregon and Washington suggest that old-growth forests provide superior foraging habitat relative to maturing stands, young stands provided marginal habitat and clear-cuts were totally unsuitable for use as foraging habitat by spotted owl (Thomas et al. 1990; Forsman et al. 1984; Carey et al. 1990; Carey et al. 1992 as cited in COSEWIC 2008).

Dispersal Habitat:

Juvenile owls undergo natal dispersal in the fall. To be successful, dispersing owls require protection from predators and security habitat for shelter during inclement weather. They also need abundant and available prey to meet high thermo-energetic demands experienced during dispersal. Old-growth (and mature) forests are thought to provide ideal conditions for dispersal; however, dispersing owls may use a fragmented mosaic of various-aged forests, clear-cuts, roads, and non-forested areas (likely by necessity, and to their detriment, as these habitats are encountered) (Forsman et al. 2002, Hobbs 2004, Hobbs 2005).

Breeding-age owls also occasionally disperse, especially young unpaired females, to find new territories or to move between alternate territories (Forsman et al. 2002). The quality (stand structure, degree of fragmentation, topography) of dispersal habitat is likely an important factor in survival of dispersing birds (Forsman et al. 2004). Large non-forested valleys and large water bodies are known barriers to dispersal (Forsman et al. 2002a).

In BC, I used radio-telemetry to track seven dispersing juvenile spotted owls between 2003-2006. I confirmed use, by dispersing juvenile owls, of old-growth forested habitats (Hobbs 2004, 2005). I demonstrated that although dispersing juveniles were able to move through suboptimal habitats (including early seral forest, severely burned areas, and across large waterbodies (Hobbs 2005)) the effects on survivorship were negative. None of the owls I tracked, during dispersal, survived to reach adulthood. Starvation was the main cause of mortality (n=6) followed by predation (n=1). Similar studies in the US, with larger sample size, confirmed decreased survival with increased use of fragmented forest during dispersal (Forsman et al. 2004).

4. How should ecological requirements influence recovery actions?

Synopsis: As a species whose ecological requirements are determined by the availability and distribution of old-growth forest habitat, any measure of recovery action demands the protection of suitable habitat in sufficient quantity. Secondary actions such as captive breeding and control of barred owl populations should be undertaken once sufficient habitat conservation has been achieved.

Recovery actions, and associated effort and cost, should, ideally, be proportionately allocated in accordance with the sensitivity of the species to key threats (see Question 2). Compromising actions or effort allocated towards conservation or protection of habitat in favour of maintaining forest harvest targets (set by Annual Allowable Cut (AAC)) on the timber harvesting land base (THLB)) is counter-productive when attempting to recover a species whose persistence is directly linked to old-growth forest habitat availability and distribution on the landscape. This principle is stated and supported by a consensus in the scientific understanding in guidance provided to SARCO by the CSORT in 2004 (refer to Chutter et al. 2004-Appendix 1C (P.62))



Logging truck loaded with former owl habitat on route to the mill on the Harrison FSR.



Clear-cuts in former spotted owl habitat near Lillooet, BC.

It is also prudent to consider secondary threats (competition from barred owl) in addition to conservation of suitable habitat in sufficient quantity to ensure recovery. Augmenting natural populations of spotted owls (through captive breeding and release, or diet supplement), and controlling the effects of barred owls on spotted owls at occupied sites, are logical next-steps. Augmentation of spotted owl populations through captive breeding, and control of barred owls at occupied sites, is not sufficient to ensure recovery of spotted owls in BC in the absence of adequate habitat protection.

Triage management requires that recovery of any wild population of a species will be restricted by the most limiting factor. For spotted owl effective recovery requires sufficient attention is afforded to all key threats.

5. How has British Columbia managed for Spotted Owl survival and recovery? Please provide a chronology.

Synopsis: The following bullet points outline the chronology of Spotted Owl survival and recovery management in BC:

- 1990: Canadian Spotted Owl Recovery Team (CSORT) was established to develop a national recovery plan in response to 1986 COSEWIC designation. In 1991 the Province initiated surveys to assess population trend, and in 1995 accepted a management option with the lowest associated socio-economic impact.
- 1997: Initial implementation of Spotted Owl Management Plan (SOMP1), carried out between 1997-2007. In 1997 CSORT was replaced by the Spotted Owl Management Interagency Team (SOMIT) as a result of CSORT's refusal of SOMP1 based on its shortcomings (predicted 60% probability of halting decline).
- 2002: Review of SOMP1 (leading to SOMP2) begins with re-establishment of CSORT; primary challenge of SOMP1 recognized as the area based 'cap' to mitigate impact to forest sector at no greater than 4.5% to the THLB. This cap was carried forward and applied during development of SOMP2.
- 2006-2009: Development of SOMP2, with initial focus on captive breeding of spotted owl and barred owl control. In 2006 the Province released a Recovery Action Plan recommending revised habitat management guidance.
- 2009: SRMZ boundary revisions completed. Best Management Practices released by the Province. There was a net change in managed habitat under SOMP1 (363,000 ha) versus SOMP2 (396,247ha); however, of the 396,247 ha purportedly being *managed* for spotted owl 208,025 ha (52.5%) is co-located within Parks, conservancies, eco-reserves, protected areas and already protected watersheds within the Greater Vancouver Regional District (GVRD). The remaining 188,222 ha being managed by the Province is comprised of a large proportion of previously logged former spotted owl habitat – only 95,117 ha (51 %) is currently suitable – and within that commercial logging of suitable owl habitat is permitted in 28,198 ha as these habitats occur within MFHAs.
- 2011: WHAs designated in the Chilliwack NRD to provide legal management directive for forest management to support spotted owl recovery in BC.
- 2013: WHAs designated in the Sea-to-Sky NRD to provide legal management directive for forest management to support spotted owl recovery in BC.
- 2009-current: Under SOMP2 the BC population continues to decline to three remaining owls in 2018.

In 1990 the first Canadian Spotted Owl Recovery Team (CSORT) was established to develop a national recovery plan. Formal surveys were initiated, by government, in 1991 to better understand the population trend of spotted owls in BC. Concern for potential for socioeconomic impacts quickly arose and began to influence development of management options. The Province insisted on development of management options that ranged from maximum to minimum habitat protection for spotted owls in BC. A report entitled Management Options for the Northern Spotted Owl in British Columbia presented six

management options (each adjusted to varying degrees to cater to socio-economic considerations). In 1995, after a provincial cabinet level decision, the premier's office announced adoption of the least precautionary (i.e., lowest socio-economic impact) plan to manage spotted owls using existing and new protected areas and enhanced forest conservation measures to promote recovery. This initial attempt at spotted owl recovery and management was implemented by the Province in 1997 as the first iteration of the Spotted Owl Management Plan (referred to as SOMP1) and was implemented informally, by the Province, between 1997-2007. When released in 1997, SOMP1 afforded management to 363,000 ha of suitable and capable forested habitat within Parks and on Crown THLB lands. At the time, only about half of that total area was currently suitable, with recruitment and enhancement of second growth stands required to increase this amount in areas with only capable habitat (Chutter et al. 2004). When SOMP1 was released, SOMIT (1997a) suggested that the amount of suitable habitat would not begin to increase for several decades, after which it was hoped that numbers of spotted owls would also begin to recover. The transpiring reality did not follow these projections.

By 2002, it was clear that spotted owls were (still) declining precipitously in BC under SOMP1 management. In October 2002, in recognition of the dramatic spotted owl population decline under SOMP1, a new CSORT was initiated to review the existing SOMP1 and, in 2004, to develop a recovery plan to meet the requirements of the federal *Species at Risk Act*.

Chilliwack and Sea-to-Sky NRD:

In 2006, development of a revised Spotted Owl Management Plan (referred to as SOMP2) was instigated by the Province within the Chilliwack and Sea-to-Sky NRDs (but not in the Cascades NRD). Initial recovery efforts outlined by the Province focused on augmentation (captive breeding of spotted owls) and on barred owl control (through translocation and lethal removal). The habitat component of SOMP2 was not fully implemented until much later in 2009.

During the 2006 recovery planning process it was again raised that the fragmented condition of remaining spotted owl habitat, and sparse distribution of potential breeding owls, as well as other biological limitations and threats, resulted in continued dramatic population decline (Chutter et al. 2004, Chutter et al. 2007). The population continued to decline precipitously under SOMP2 and is now facing imminent extirpation. SOMP2 is still in place today (2019) and currently provides management, by the Province, to afford (partial) protection to spotted owl habitat in the interest of spotted owl recovery in BC. The specific management attributes of SOMP1 and SOMP2 are detailed below.

SOMP1: The first Spotted Owl Management Plan (SOMP1) was released in 1997. As noted, the SORT did not endorse SOMP1 as it predicted only a 60% probability of halting the decline of the spotted owl in BC (Chutter et al. 2004); as such, the SORT disbanded shortly after the release of SOMP1. Regardless of the lack of scientific support, SOMP1 was implemented by the Province to provide a 60% probability that BC's spotted owl population would stabilize, and then recover, predicated on the requirement that there must be no significant impacts to timber supply and forestry employment (Chutter et al. 2004). After disbanding in 1997, the SORT was replaced by the Spotted Owl Management Interagency Team (SOMIT) (comprised of representatives from BC's ministries of Environment and Forests) to develop and implement SOMP1 in May 1997. SOMP1 was predicated on an area-based 'cap' to mitigate impact to the forest sector and was set to not result in an impact greater than 4.5% to the THLB.

Within the Sea-to-Sky and Chilliwack NRD, 21 Special Resource Management Zones (SRMZs) were established (two were later rescinded) that included 159,000 ha of protected areas and 204,000 ha of Crown forest land to be legally established as Resource Management Zones under the *Forest Practices Code of British Columbia Act*. It was originally intended to legally establish SOMP1 as a Higher-Level Plan but this did not take place. Nonetheless, SOMP1 was voluntarily implemented by forest companies between 1997-2007 before prescriptive measures under SOMP1 were replaced by Best Management Practices under SOMP2 in 2009 (Blackburn et al. 2009). Under SOMP1, the objective, within each SRMZ, was to maintain 67% of the gross forested area as suitable spotted owl habitat. Unfortunately, many of the SRMZs had less than the targeted 67% suitable habitat at the time of their establishment; this posed a recognized challenge with SOMP1. The Cascades NRD (formerly the Lillooet FD) was not included in SOMP1; as such, there was no protection afforded to spotted owl in the Cascades NRD until 2006 as the Cascades NRD was considered to be extra-limital based on a restricted scope of inventory. In 2014, R.W. Campbell presented evidence that the range of spotted owls in BC also likely included the Sunshine Coast NRD on the west coast (Campbell 2014); to date there have been no formal surveys conducted and no management afforded to spotted owl in this portion of their former range in BC.

By 2002, a precipitous population decline (10.4% per year) was noted in trend monitoring data (Chutter et al. 2007). In 2002, I conducted a complete inventory within the Cascades NRD. My inventory results demonstrated that the population of spotted owls within the Cascades NRD was indeed extant and was, at the time, the most robust population of spotted owl remaining in the Province despite exclusion of management consideration under SOMP1⁵.

In a final attempt to halt the decline a renewed (second) Canadian Spotted Owl Recovery Team (CSORT) was re-established in 2002 with the intent of developing a recovery strategy to identify additional actions required to prevent extirpation. The second attempt was released as SOMP2 by the Province. The intent was to recover spotted owl in BC. Although SOMP2 was announced in 2006, habitat protection measures were not completed until much later.

SOMP2: In 2006, under direction from the BC MOE/MFLNRO and with oversight from the Species at Risk Coordination Office (SARCO) the Province released its Recovery Action Plan for spotted owl habitat management. These actions were implemented with the purported intent of preventing extirpation of spotted owls from BC. The SARCO spotted owl recovery action plan included considerations for captive breeding of spotted owls, barred owl control and partial inclusion (under SOMP2) of habitat management actions recommended by CSORT⁶.

SARCO released the BC spotted owl recovery action plan to provide guidance for spotted owl habitat management in BC within revised SOMP1 spatially designated areas called Special Resource Management Zones (SRMZs). The SRMZ boundary revisions and associated Best Management Practices

⁵ In 2006, additional consideration was afforded to spotted owl habitat conservation to accommodate new survey results in the Cascades NRD (J. Hobbs pers obs). This was achieved through designation of three new Wildlife Habitat Areas (WHAs) as enabled under the Government Actions Regulation (GAR).

⁶ CSORT recommendations were clearly presented and rationalized in the 2004 BC Spotted Owl Recovery Strategy document (Chutter et al 2004) and the 2007 Guidance and Action Planning document (Chutter et al 2007).

(BMPs) for forest harvest activities were not completed until three years later (2009). All SRMZs were subsequently legally designated in 2011 (Chilliwack NRD) and 2013 (Sea-to-Sky NRD) as Wildlife Habitat Areas (WHAs)⁷.

The habitat management guidance of the Provincial Recovery Action Plan is summarized by Blackburn et al. (2009) to include “*Evaluating and revising SOMP 1 (SRMZ boundaries) to ensure better protection for Spotted Owls and their habitat, within existing timber supply impacts*”. There was a net change in managed habitat under SOMP1 (363,000 ha) versus SOMP2 (396,247ha). Of the 396,247 ha purportedly being *managed* for spotted owl (within WHAs) 208,025 ha (52.5%) is located within Parks, conservancies, eco-reserves, protected areas and already protected watersheds within the Greater Vancouver Regional District (GVRD). The remaining 188,222 ha being *managed* for spotted owl is largely comprised of previously logged former spotted owl habitat – only 95,117 ha (51 %) is currently suitable – and within that logging is permitted in 28,198 ha of MFHA areas (a designation that permits intensive forest harvest).

This intricate and complicated management, including new prescriptive guidance for commercial forest harvest of spotted owl habitat within these areas, was authored by the Province (Blackburn et al. 2009) and is now referred to as SOMP2⁸. This initiative represents the Province’s Recovery Action Plan component, under SOMP2, to address conservation of spotted owl habitat in BC.

Cascades NRD:

In addition to revisions to SRMZ boundaries from SOMP1 to SOMP2 in the Chilliwack and Sea-to-Sky NRD the Provincial Recovery Action Plan for habitat conservation also included separate management, under the Identified Wildlife Management Strategy, for the Cascades NRD. This had an even more restrictive 1% ‘cap’ on impacts to the THLB. The Province stated an intention to Protect “*the known (2005) Spotted Owl locations by establishing nine Wildlife Habitat Areas (WHAs; approximately 23,000 ha) to protect 100% of the forests found within each WHA*” (as quoted from Blackburn et al. 2009) yet only 45% of the area within WHAs was actually suitable for spotted owl – the remaining area had been previously logged. In addition, and despite the Province’s stated intent, several extant sites documented between 2002 and 2005 were not afforded protection; they were disregarded from consideration for WHA designation by the Province (SARCO) without transparent criteria or justification. This point was contested internally by M. Chutter and myself, but our concerns were never addressed by SARCO or the Province. By the time the legal designations were accepted in 2009 (Cascades NRD) only six WHAs were established for spotted owl in the Cascades NRD, including three in 2006 (before SOMP2) was released (Copper, Bounder and Enterprise Creek); and three in 2012 (Mowhokam, Nesikep and Lost Valley). This falls short of the Province’s commitment to establish nine WHAs in the Cascades NRD when SARCO announced SOMP2.

⁷ WHAs were designated, by the Province, in 2006 (Cascades NRD), 2011 (Chilliwack NRD) and 2013 (Sea-to-Sky NRD).

⁸ Management guidance under SOMP2 was later formally legalized as General Wildlife Measures (GWMs) (prescriptive management requirements applied within WHAs as mandated under the *Forest and Range Practices Act*) for application within WHAs.

Sunshine Coast NRD:

The historic and current distribution of spotted owl in the Sunshine Coast NRD is unconfirmed as no formal surveys, for spotted owl, have ever been conducted despite verified and documented (published) accounts of spotted owl in this district (Campbell 2014). To date, no management consideration has been afforded to the Sunshine Coast NRD.

6. In reference to the BC Habitat Best Management Practices document (Blackburn et al. 2009) and any other relevant materials you are aware of, how has British Columbia managed and protected Spotted Owl habitat since the release of the Recovery Strategy (2006)?

Synopsis: SOMP2 was predicated on a principle of no-net loss to timber revenue relative to SOMP1 despite the obvious indication, as evidenced by the owl's decline, that the level of protection afforded to suitable habitat was insufficient to stabilize or reverse the declining population trend. SOMP1 was openly rejected by SORT; SOMP2 was also internally criticized at the time of its announcement in 2006. I (and others) openly raised concern when SOMP2 was announced but the Province was unwavering in their commitment to maintain timber harvest levels consistent with levels allowed under SOMP1.

The release of the 2006 Recovery Strategy resulted in a prolonged three-year process of revisions to SOMP1 SRMZ habitat management areas in the Chilliwack and Sea-to-Sky NRD. In 2009, the Province released a document recommending Best Management Practices (BMP) to provide voluntary compliance with prescriptive guidance for licensees harvesting within spotted owl management areas. The Province also approved three more WHAs in the Cascades NRD, in addition to three WHAs I submitted (approved in 2006) as part of an independent planning process.

Two years later (in 2011), within the Chilliwack NRD, the Province converted SOMP2 SRMZs to WHAs to afford legal management under the Forest and Range Practices Act. In 2013, this conversion was completed for SOMP2 SRMZs in the Sea-to-Sky NRD. Within managed areas, two management designations were recognized:

- 1) Managed Future Habitat Areas (MFHAs): the primary purpose of the MFHA is to provide timber harvesting opportunities by allowing Harvest with Retention (clear cuts with retention patches); and,
- 2) Long-term Owl Habitat Areas (LTOHAs): The primary purpose of the LTOHA is to recover and sustain the Spotted Owl population to prevent extirpation of the species. Harvest is permitted in these areas with the objective of enhancing habitat.

In describing the areas being managed for spotted owl habitat, under SOMP2, the Province is circumspect regarding the distinction between capable (i.e., disturbed (i.e., previously harvested) areas of immature forest that are not currently suitable for spotted owl but, with the passage of decades, have potential to mature into suitable habitat) and suitable habitat (old-growth forest currently suitable for use by spotted owl). An independent analysis of currently suitable habitat available within SOMP2 designations revealed that only 51% of the SOMP2 managed areas are considered currently suitable for use by spotted owl. In addition, these management areas represent only 31% of the available spotted owl Class A (breeding and nesting) habitat remaining on THLB today.

When SARCO announced the Province's Recovery Action Plan in 2006 the initial focus (until 2009) was limited to efforts afforded to spotted owl population augmentation and implementation of barred owl control measures. Barred owl control measures were purportedly focused on areas anticipated to be targeted for eventual release of captive-bred spotted owls (no captive bred spotted owls have been released to date). Barred owl control measures were also purportedly focused on extant spotted owl territories with intent to increase recruitment of breeding pairs and to improve nesting success of active breeding pairs. The habitat protection component of SOMP2 (as announced in 2006) was completed three years later.

In describing current management, the Province reports that *"As part of the Provincial Government's Spotted Owl Recovery Action Plan, the Province of British Columbia has protected 305,000 ha of forest for the spotted owl"* (Gillis 2016a) (**Figure 7**). The derivation of this estimate is uncertain as there was no supporting reference provided. As such, Wilderness Committee (WC) completed an independent GIS based analysis at my request. This analysis demonstrates that a total area of 396,247 ha is currently mapped within "managed areas" (under SOMP2 and under the Identified Wildlife Management Strategy⁹ (IWMS)) by the Province. At a glance this effort appears laudable; however, closer analysis shows that these designations include 208,025 ha (52.5%) of mapped areas that occur within already existing conservation designations (e.g., Provincial Parks and municipal watersheds). In terms of actual forested area, on the THLB, that was set-aside for management the conservation gain, for spotted owl, is significantly lower. Only 188,222 ha of harvestable forested area (i.e., crown land on the Timber Harvesting Land Base (THLB)) was designated for spotted owl habitat management under SOMP2. This figure is eroded even further when I considered management prescriptions within the 188,222 ha of designated management areas on the THLB, as 64,238 ha (34%) occurs within Managed Future Habitat Areas (MFHAs) whose *"primary purpose is to provide for timber harvesting opportunities"* (Blackburn et al 2009). In this context this is **very** misleading accounting – whilst the province claims 396,247 ha is being managed for spotted owl only the areas inside LTOHAs and WHAs, on the THLB, were actually protected for spotted owl habitat conservation and these areas only amount to 123,984 ha (or 31%) of the area purportedly afforded focused (special) management for spotted owl by the Province under SOMP2.

Taken further, the WC also analyzed the amount of habitat that is currently suitable for breeding use (Class A habitat) within the SOMP2 areas; this results in an even more disheartening statistic (**Table 1 and Figure 7**). There are two SOMP2 two management designations within SOMP2 spotted owl WHAs in the Chilliwack and Sea-to-Sky NRD; these are described and summarized below.

1. **Managed Future Habitat Areas (MFHAs) (total area = 64,238 ha):** Only 28,198 (44%) of the total area of MFHAs remains as suitable habitat for use by spotted owl. The remaining 56% has been

⁹ The IWMS is a component of the Forest and Range Practices Act (FRPA) that allows focused habitat management to species listed on the Category of Species at Risk through the designation of Wildlife Habitat Areas (WHAs). WHAs can be legally designated, as orders under FRPA, where recognized habitat features occur on Provincial Crown land.

previously harvested and affords no current benefit to the owl. Commercial forest harvest of remaining spotted owl habitat is encouraged within these (MFHA) areas.

2. Long-Term Owl Habitat Areas (LTOHAs) (total area = 103,823 ha): Only 57,851 ha (56%) of the total area of spotted owl WHAs remains as suitable habitat for use by spotted owl. The Province states that *“The primary purpose of the LTOHA is to recover and sustain the Spotted Owl population to prevent extirpation of the species”* (Blackburn et al. 2009) yet 44% of these areas have been previously disturbed and thus afford no current benefit to the owl.

Within the Cascades NRD there was an initial commitment to designate nine WHAs, in addition to the 31 SRMZs (converted to WHAs) under SOMP2 in the Chilliwack and Sea-to-Sky NRD. This commitment was never met – only six WHAs (total area = 20,161 ha) were designated within the Cascades NRD. Within these WHAs only 9,068 ha (45%) is currently comprised of suitable habitat for use by spotted owl (**Table 1 and Figure 8**).

In total, there were 31 SRMZs (later converted to WHAs in 2011 (Chilliwack NRD) and 2013 (Sea-to-Sky NRD) established under SOMP2 (**Table 1**) and six WHAs in the Cascades NRD. The Province’s inclusion of habitats that were already protected within existing conservation designations (e.g., Provincial Parks) or within lands managed by the Greater Vancouver Regional District (GVRD)¹⁰ provides a misleading measure of conservation commitment, by the Province, towards spotted owl recovery. Similarly, the Province’s quantification of habitat being managed for spotted owl is also misleading; the data in **Table 1** illustrates that in reality only 51% of the habitat being managed under SOMP2 (including the Cascades NRD) is actually currently suitable for use by spotted owls and only 66,919 ha (16.8%) of Class A habitat protected on the THLB by SOMP2 is actually suitable for use by spotted owl today.

Restrictive habitat conservation measures are a legacy that undermined both SOMP1 and SOMP2. Under SOMP1 the Province imposed an area-based ‘cap’ to ensure that the impact of habitat management measures did not to exceed 4.5% of the THLB harvest allocation in the Chilliwack and Sea-to-Sky NRD. The same limit used for SOMP1 was also applied during delineation of habitat management designations for SOMP2 and is referred to as the ‘no net loss’ policy. This was recognized by SORT (for SOMP1) and by CSORT (for SOMP2) as a fundamental challenge to recovery. Regardless of this recognition, implementation of SOMP2 proceeded and these restrictions are reflected in current habitat management by the Province.

¹⁰ It is challenging to resolve the discrepancy in the Provinces reported estimate of forest managed for spotted owl (305,000 ha) with the actual area within mapped management units.

Table 1: Summary of SRMZs and WHAs including the area of each SRMZ or WHA designation and the percentage of currently suitable spotted owl habitat that remains within each designated area.

SRMZ Name	Designation	WHA ID	Prescription	Area (ha)	% Suitable
Liumchen Creek	LTOHA A	2-497	Harvest to Enhance	983	24%
Elk Creek	LTOHA A	2-501	Harvest to Enhance	2,590	45%
Stokke Creek	LTOHA A	2-505	Harvest to Enhance	3,261	56%
Speyum Creek	LTOHA A	2-507	Harvest to Enhance	3,240	52%
Mowhokam Creek	LTOHA A	2-508	Harvest to Enhance	1,725	64%
Tantalus	LTOHA A	2-517	Harvest to Enhance	198	9%
Manning/Sumallo	LTOHA B	2-494	Harvest to Enhance	4,355	57%
Hornet/Clear	LTOHA B	2-503	Harvest to Enhance	3,150	54%
Spuzzum/Urquhart	LTOHA B	2-506	Harvest to Enhance	3,672	60%
Douglas	LTOHA B	2-518	Harvest to Enhance	3,878	68%
Chilliwack Lake/Depot Creek	LTOHA C	2-495	Harvest to Enhance	3,031	40%
Coquihalla/Sowaqua	LTOHA C	2-498	Harvest to Enhance	9,608	60%
Ure Creek	LTOHA C	2-520	Harvest to Enhance	1,959	58%
Birkenhead	LTOHA C	2-523	Harvest to Enhance	9,124	46%
Nahatlatch River	LTOHA D	2-509	Harvest to Enhance	8,349	53%
Glacier/Tuwasus	LTOHA D	2-519	Harvest to Enhance	5,247	78%
Twin One/Twin Two	LTOHA D	2-521	Harvest to Enhance	4,543	55%
Silverhope Creek	LTOHA E	2-496	Harvest to Enhance	7,064	56%
Tincup Creek	LTOHA E	2-510	Harvest to Enhance	3,254	64%
Anderson/Utzlius	LTOHA G	2-502	Harvest to Enhance	21,379	55%
Lillooet River	LTOHA A	2-522	Harvest to Enhance	3,215	50%
	TOTAL LTOHA			103,823	56%
Sasquatch	MFHA A	2-499	Harvest with Retention	2,465	8%
Hornet/Clear	MFHA A	2-503	Harvest with Retention	3,255	38%
Ure Creek	MFHA A	2-520	Harvest with Retention	3,926	50%
Liumchen Creek	MFHA B	2-497	Harvest with Retention	512	0%
Trethewey Creek	MFHA B	2-504	Harvest with Retention	10,971	52%
Douglas	MFHA B	2-518	Harvest with Retention	672	74%
Birkenhead	MFHA B	2-523	Harvest with Retention	4,822	38%
Chehalis	MFHA C	2-500	Harvest with Retention	11,949	42%
Tantalus	MFHA C	2-517	Harvest with Retention	4,899	31%
Twin One/Twin Two	MFHA D	2-521	Harvest with Retention	1,816	39%
Glacier/Tuwasus	MFHA F	2-519	Harvest with Retention	5,934	58%
Cheakamus	MFHA X	2-524	Harvest with Retention	6,338	51%
Wedgemount/Green	MFHA X	2-525	Harvest with Retention	6,679	42%
	TOTAL MFHA			64,238	44%
Boulder West	WHA	3-034	No future harvest	3,955	44%
Copper Creek	WHA	3-035	No future harvest	3,239	48%
Enterprise Creek	WHA	3-036	No future harvest	3,398	42%
Mowhokam	WHA	3-158	No future harvest	2,614	42%
Nesikep	WHA	3-159	No future harvest	2,997	54%
Lost Valley - Anderson	WHA	3-160	No future harvest	3,958	41%
	TOTAL WHA			20,161	45%

In summary, in the Province's estimate of area of habitat being *managed* for spotted owl there is no distinction between **capable** (i.e., previously harvested areas that, with time, may acquire suitable habitat attributes) and currently **suitable** habitat. This distinction is critical to recovery as areas comprised of early seral forest that are merely *capable* of becoming suitable habitat with the passage of time does not favour spotted owl recovery in the short-term. This issue is exemplified in **Figure 7**. It is readily apparent that the WHA boundary (red and blue shaded areas) depicting the managed area for spotted owl) contains little currently suitable Class A forested habitat for spotted owls (as indicated in green).

The WC GIS analysis of currently suitable Class A habitat within all THLB areas managed for spotted owl under SOMP2 (188,222 ha) demonstrates that only 95,117 hectares (51 %) represents currently suitable Class A habitat (**Table 2**).

This GIS analysis was next extended to determine the area of Class A suitable habitat for spotted owl that currently occurs on the THLB within the defined range of the species. In total there is 314,959 ha of suitable spotted owl habitat remaining on the THLB in BC. Less than 31% of available spotted owl Class A habitat on the THLB (within the defined range) is currently being managed¹¹ for spotted owl recovery within Provincially designated spotted owl habitat management afforded to only three (of four) NRDs that historically supported spotted owl in BC.

¹¹ Even within managed areas under SOMP2 WHA designation harvest is still permitted, with 64,328 ha of the total 188,222 occurring with MFHAs whose stated primary purpose is to provide timber harvesting opportunities to commercial operators for economic gain.

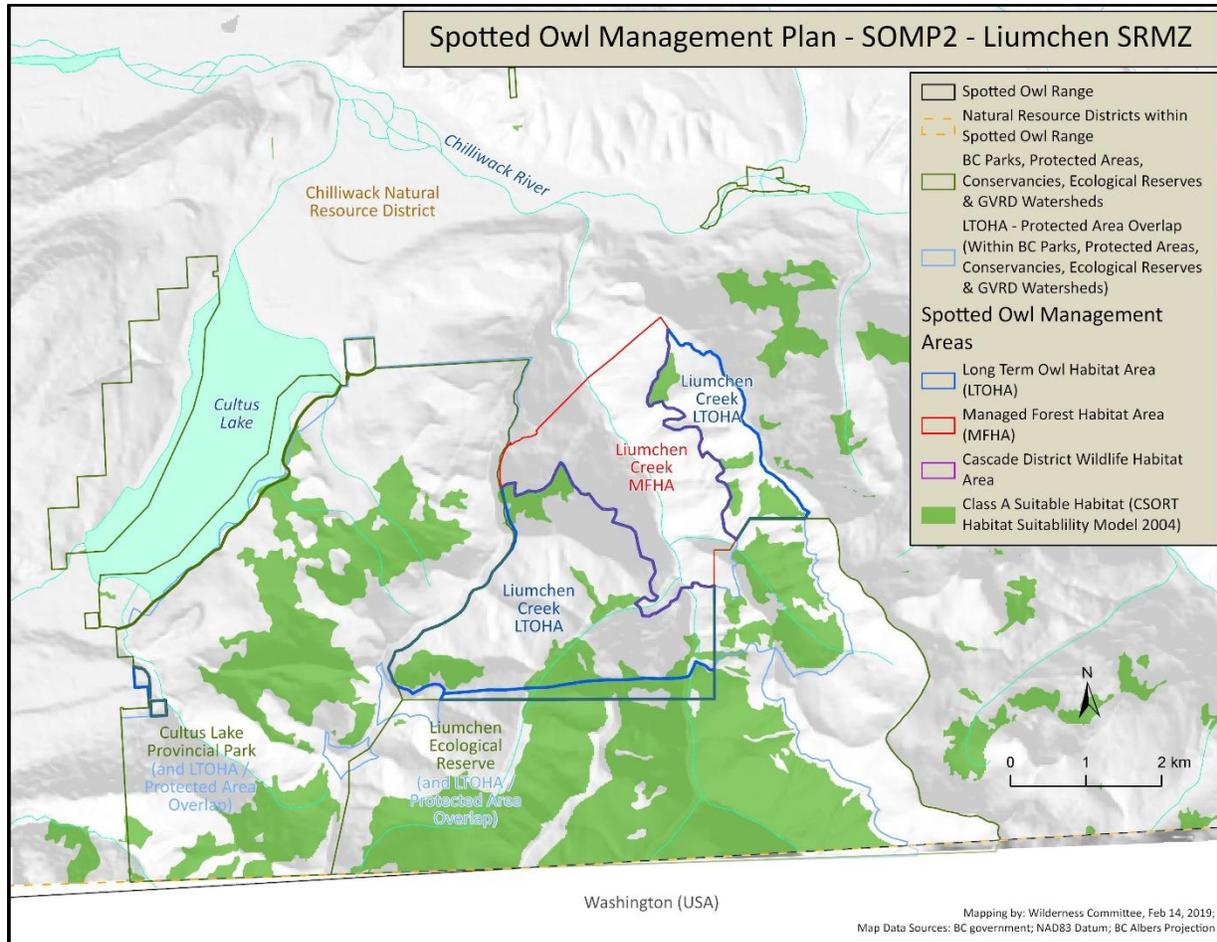


Figure 7: An example of misleading accounting is evident in the map depicting current remaining Class A suitable spotted owl habitat (239 ha) within the Liumchen Creek WHA (total area: 1,485 ha). Less than 16 percent of the area reported by the Province as “managed for spotted owl” contains currently suitable spotted owl habitat¹². This habitat condition is characteristic within all spotted owl WHAs (to varying degrees) and is consistent under SOMP1, and now under SOMP2.

¹² Each LTOHA is purported to achieve (in the distant future) suitable spotted owl habitat within the entire SRMZ area (i.e., 100% of the SRMZ area). Achievement of the management goal is purportedly to occur through conservation of existing spotted owl habitats and creation of additional spotted owl habitats using Habitat Enhancement Practices (HEPs). In my opinion (and as iterated by D’Anjou et al. 2015) this practice is unlikely to result in benefit to existing spotted owl habitat when applied to old growth or suitable forested habitat).

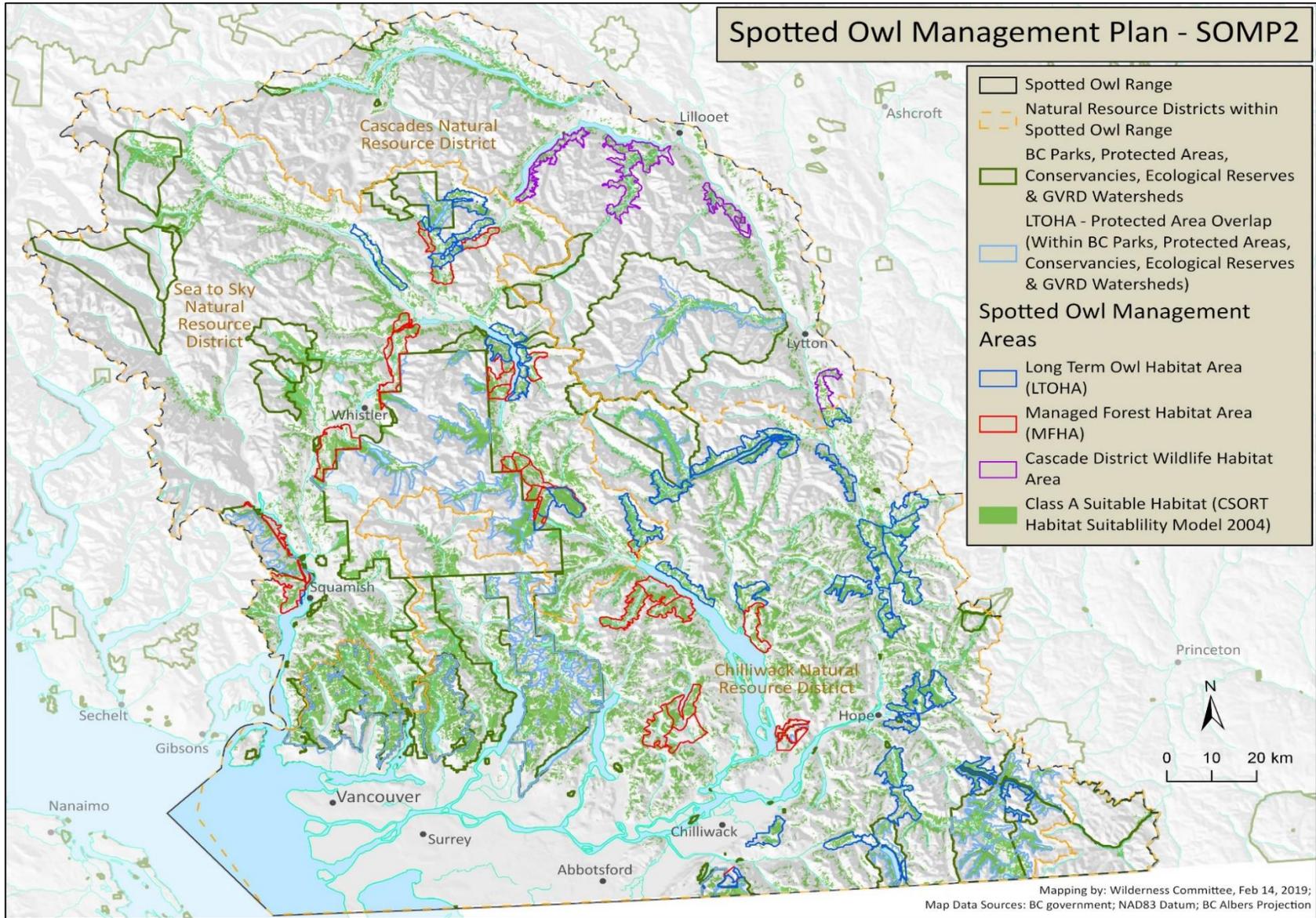


Figure 8: Spotted owl management in BC, under SOMP2 and IWMS.

7. How has British Columbia's management and protection of habitat affected the survival or recovery of the Spotted Owl?

Synopsis: Precise quantification of direct effects of habitat loss, from timber harvest, are unattainable as there are no requirements, in BC, to survey for spotted owls prior to commercial harvest of suitable habitat. Instead, effects must be inferred based on logical assessment of direct effects from habitat loss in accordance with literature-based consensus documenting the effects of commercial forestry on spotted owl from the US.

Forest resource management continues to impose a deleterious competing interest (i.e., revenue generation from forest harvest) upon available remaining suitable spotted owl habitat. Previous and continued harvest of old growth forest has resulted in dramatically diminished availability of suitable habitat on the landscape, with remaining suitable habitat becoming increasingly rare and fragmented rendering remaining small 'patches' of habitat un-usable. This has a concomitant and directly proportionate negative effect on recovery and survival of spotted owl.

SOMP2 was predicated on a principle of no-net loss to timber revenue relative to SOMP1 despite the obvious indication, as evidenced by the owl's decline, that the level of protection afforded to suitable habitat was insufficient to stabilize or reverse the declining population trend. SOMP1 was openly rejected by SORT; SOMP2 was also internally criticized at the time of its announcement in 2006. I (and others) openly raised concern when SOMP2 was announced but the Province was unwavering in their commitment to maintain timber harvest levels consistent with levels allowed under SOMP1.

By failing to distinguish between capable and suitable habitat the Province's estimates, when describing the area of managed forest, convey a misleading characterization of habitat conservation. The continued loss of suitable old growth forested habitat continues to jeopardize the ability of the species to persist, or recover, in BC.

Spotted owl recovery is directly affected by loss of habitat. The Provincial Recovery Strategy (Chutter et al. 2004) identified ongoing habitat loss as a primary threat to continued spotted owl population persistence. This position is repeatedly re-iterated in published literature. The effect of habitat loss upon recovery is both immediate (measured area of mature forested habitat harvested) and long-term (effects on natal dispersal, recruitment, competition as a result of edge-effect, and availability and abundance of prey). As such, areas in the Cascades NRD were only relatively recently surveyed in 2002-2004 despite suspected occurrence in the Cascades NRD dating back to 1997. Although management was extended to the Cascades NRD in 2006 in response to my survey results, management (and survey) has never been afforded to the Sunshine Coast NRD. In that context it is inappropriate to provide a quantitative estimate of 'loss' or 'impact' to the resident BC spotted owl population throughout the entire historic range as there is simply no information available.

For the Cascades, Sea-to-Sky and Chilliwack NRD this question was addressed (by Sutherland et al. 2007) using desktop GIS-based predictive (assumption based) multivariate analysis using a Spatially Explicit

Landscape Event Simulation ((SELES) GIS model. The SELES model was last run in 2007; re-analysis with the SELES model using current habitat conditions could be conducted to further examine this question.

For reasons stated above a quantitative analysis of the effects of BC’s forest management is not feasible with existing data. I therefor requested that the Wilderness Committee (WC) analyzed the rate of depletion of mature forested habitat (as an acceptable proxy for suitable spotted owl habitat) that has resulted from commercial forest harvest from 2002 to 2018. This analysis was completed for both NRDs included in SOMP2 (Sea-to-Sky and Chilliwack), and in the Cascades NRD (managed under the Identified Wildlife Management Strategy (IWMS)). These results are summarized on an annual basis, since 2002, and presented in **Table 2**.

Table 2: Rate of potential spotted owl habitat loss, under pre-SOMP2 and post-SOMP2 management regimes, as a result of commercial harvest of old-growth forest within the Chilliwack and Sea-to-Sky NRD.

Year	Hectares of old-growth forest harvested	
2000	3,215	
2001	2,218	
2002	2,536	
2003	2,023	
2004	3,011	
2005	1,783	
2006	2,148	
2007	2,131	
2008	946	
2009	1,008	
2010	1,001	
2011	1,501	
2012	1,410	
2013	1,561	
2014	1,403	
2015	1,144	
2016	870	
Total	29,909	This image was taken near Anderson Creek, inside an SRMZ within a formerly occupied spotted owl activity center (breeding and roosting location).

This analysis, and insights from US literature and the SELES model in BC (Sutherland et al. 2007) afford insight into the Province’s management of spotted owl habitat in the Chilliwack and Sea-to-Sky NRD. This approach allows quantitative assessment of the effects of the Province’s approach to habitat management practices on the BC population of spotted owl. In total, the Province has approved harvest of 29,909 ha of mature forest habitat since 2000. This may seem insignificant but it represents 31% of the total area of Type A nesting habitat (95,117 ha) that the province is currently managing for spotted owl. In more tangible terms, this represents about 10 spotted owl territories that have been logged since 2000 despite elevated concern for the plight of the species and full awareness of the

interdependence of spotted owl persistence (and recovery) and the amount and distribution of suitable habitat on the landscape.

In that context it is logical to conclude that habitat loss has had, and continues to have, a negative effect on spotted owl recovery potential in BC. Habitat loss, as a result of government proposed and approved commercial forest harvest, continues today.

8. How has British Columbia managed key threats to Spotted Owl habitat?

Synopsis: In summary, the history of spotted owl habitat management, by the Province, is convoluted and undermined by its own complexity. In practical terms, habitat loss, the key threat to spotted owl population viability and recovery, has resulted in substantial reduction in available owl habitat. Pre-European contact, there was an estimated 939,800 ha of spotted owl habitat (Chutter et al. 2004) within the Chilliwack and Sea-to-Sky NRD's. Of this, 477,300 ha (51%) is considered as “contributing” to the Timber Harvesting Land Base (THLB) (upon which timber resource extractions may occur). Today the amount of currently suitable spotted owl habitat is further reduced, mostly existing as isolated patches within Provincial Parks and within GVRD lands. Commercial forest harvest practices, as managed by the Province, have resulted in a patchily distributed mosaic of forest age classes on the landscape; these conditions favor barred owls (competitors) and great horned owls (predators), disfavour spotted owl survival and recruitment and have contributed to the species practical extirpation from BC by 2018.

The following text provides clarification of spotted owl habitat management afforded by the Province under both SOMP1 and SOMP2.

- **SOMP1:** habitat was managed within Special Resource Management Zones (SRMZs) that encompassed 363,000 ha of suitable and capable habitat. Two forest management regimes were prescribed under SOMP1:
 1. Light Volume Removal (LVR) was applied within Long-term Owl Activity Centres (LTACs).
 2. Heavy Volume Removal (i.e., clear-cutting) (HVR) was applied within Forest Management Areas (FMAs) that were designated as Matrix areas.
- **SOMP2:** Habitat management provided under SOMP1 and SOMP2 is applicable within only the Chilliwack and Sea-to-Sky NRD. Habitat in the Cascades NRD is managed under IWMS and there is no management afforded to spotted owl habitat within the Sunshine Coast NRD. A total of 396,247 ha is purportedly being managed within WHA boundaries (under SOMP2 and IWMS) although this includes 208,025 ha that was already afforded protection within existing conservation designations. As such, only 188,222 ha of THLB area is afforded management under SOMP2 and IWMS and only 51% of that represents currently suitable Class A habitat for spotted owl.

After 2011, SRMZs were legally designated as WHAs and are now managed under the IWMS; the same forest management practices developed for SRMZs were applied, through GWMs within WHAs. Within WHAs in the Sea-to-Sky and Chilliwack NRD there are two spatial designations with

different prescriptive guidance for each designation as described in response to Question 6. The WHAs under SOMP2 (in the Chilliwack and Sea-to-Sky NRDs) include Long-term Owl Habitat Areas (LTOHAs) and Managed Future Habitat Areas (MFHAs). MFHA's are intended to provide replacement habitat in the event of catastrophic loss (i.e., fire) within a LTOHA, yet the explicitly stated primary purpose of the MFHA is *"to provide for timber harvesting opportunities while maintaining future options for all or portions of the MFHA to become Spotted Owl habitat, if necessary."* (Blackburn et al. 2009). It is not clear how the Province will achieve these competing objectives, nor how it will determine when it might be necessary to protect the small areas of remaining spotted owl habitat within MFHAs. Regardless of these issues the overarching intent of SOMP2 was to create a more 'natural' canopy gap and forest structure relative to SOMP1 following two prescriptive forestry methods:

1. Habitat Enhancement Practices (HEPs) are to be applied within LTOHAs (replaced Light Volume Removal (LVR) applied under SOMP1 within SRMZs). HEP prescriptions are now set within LTOHAs to promote recruitment of spotted owl habitat until 100%¹³ of the forested area can mature to become suitable for use by spotted owls. These prescriptions are intended to *"retain stand integrity and enhance stand structure through accelerated development of stand attributes associated with owl habitat."* (D'Anjou et al. 2015).
2. Harvest with Retention (HWR): This harvest method replaced the HVR (i.e., clear-cutting) prescription under SOMP1 by prescribing retention of 'seed tree' patches within clear-cut harvest areas. HWR is permitted within Managed Future Habitat Areas (MFHAs) and theoretically allows for retention of 'green (live)' trees, Course Woody Debris (CWD) and wildlife (veteran) trees to create structural diversity for spotted owl and their prey.

A GIS analysis was also completed to calculate the area of currently suitable (Class A) habitat within the spotted owl's defined range in BC within the Chilliwack, Sea-to-Sky and Cascades NRD (**Table 3**).

Table 3: Area of currently suitable Class A habitat with the defined range of the species in BC.

Total area of suitable Class A habitat in the defined range of the species.	533,306 ha (100%)
Total area of protected suitable Class A habitat within all Parks and GVRD lands	151,428 ha (28.5%)
Total area of protected suitable Class A habitat under SOMP2 (i.e., including WHAs within the Cascades, Chilliwack and the Sea-to-Sky NRD but excluding MFHAs as that habitat is not protected from harvest).	66,919 ha (12.5%)
Total area of unprotected suitable Class A habitat on THLB. Commercial forest harvest is permitted without survey, or without regard, for spotted owl recovery.	314,959 ha (59%)

This quantitative GIS analysis show that there is currently 314,959 ha of Class A suitable spotted owl habitat located on crown land within the THLB in BC. This habitat is not afforded any conservation or

¹³ Note: Many of the SRMZs were well below this designation target when they were mapped under SOMP1 and SOMP2.

management for spotted owl and is treated as productive forest land within the Timber Harvesting Land Base (THLB). As such, 314,959 ha of Class A spotted owl habitat can be clear-cut without any requirement to survey to determine current use by spotted owl or to offset habitat loss that may impact spotted owl recovery potential. This is a fundamental challenge to spotted owl recovery in BC. For context SOMP2 only afforded protection to 66,919 ha of spotted owl Class A habitat on the THLB; this represents only 12.5% of the total available Class A spotted owl habitat within the defined range of the species in BC.

Table 4: Clarification of Terms:

SOMP1 (SRMZs and Matrix areas)	SOMP2 (WHAs)
SRMZ (67% habitat retention in LTACs with adjacent matrix areas where harvest was permitted)	LTOHA (100% habitat retention) (managed primarily for conservation and creation of owl habitat)
FMA (Forest Management Areas) were designated within Matrix Areas	MFHA (Managed Future Habitat Area) (managed primarily for timber harvesting)
LVR (Light Volume Removal) (thinning in SRMZ LTAC) was allowed as long as 67% of the SRMZ remained as owl habitat (under SOMP1 habitat model which was overly optimistic).	HEP (Habitat Enhancement Practices) are permitted within LTOHAs and replace the HWR rules from SOMP1 (intended for 60-140 year-old stands).
HVR (Heavy Volume Removal) (clear-cutting) allowed within matrix areas and SRMZs where >67% was deemed suitable (under old HSI model).	HWR (Harvest with Retention) (only allowed in MFHA).

D’Anjou et al. (2015) provided a simple comparative analysis of forest management under SOMP 1 (from 1997-2009) and SOMP2. Under SOMP1 *“Spotted Owl habitat was managed on a stand-level basis within Spotted Owl Resource Management Zones, where operational guidelines for two forest-management approaches (light volume removal and heavy volume removal) were used. Under SOMP2, Spotted Owl habitat is managed as Long-Term Owl Habitat Areas or as Managed Future Habitat Areas”* within SRMZs (now designated as WHAs). Under SOMP2, Habitat enhancement practices are prescribed within the Long-Term Owl Habitat Areas; these replaced light volume removal as prescribed under SOMP1. Harvest with retention (clear-cuts with seed tree patches) replaced SOMP1 heavy volume removal (i.e., clear-cuts) and is applied within the Managed Future Habitat Area (D’Anjou et al. 2015).

D’Anjou et al. (2015) concluded that the changes under SOMP2, relative to SOMP1, are effectively insubstantial – I agree. In more practical terms management activities that will be permitted under SOMP2 are very subtle and may be critically viewed as assigning new names to the same detrimental forestry practices. For example, “Harvest with Retention” (HWR) is essentially clear-cut harvest with retention of a seed patch – this prescription was already in place under SOMP1 (it was called HVR). The resulting effect of HVR or HWR is identical from a biological perspective; both practices result in loss of spotted owl habitat.

In practice these prescriptions have disconcerting implications for spotted owls. To illustrate this concern; the Province’s BC Timber Sales (BCTS) program has applied for HEP in a LTOHA in the Spuzzum

SRMZ; at the outset this application is in violation of the terms of SOMP2 as the harvest will occur within habitat reasonably identified as a “critical roost zone or nest area” yet the proposed (Category I) cut-blocks are still under consideration and review by the Province.

Based on analysis of harvest changes between 1997 and 2011 D’Anjou et al. (2015) concluded:

“Overall, this comparative review indicated that the transition from SOMP1 to SOMP2 has produced (subtle) changes and refinements to...habitat management objectives, forest management approaches, and operational practices and targets.... Of interest is whether these differences in management and eventual outcomes will create significant differences in enhancement and recruitment of stand attributes associated with superior owl habitat, and whether SOMP2 will result in more and better-quality (spotted owl) habitat.” The conclusion reached by D’Anjou et al. (2015) is that the difference between SOMP1 and SOMP2 is subtle; the authors have also questioned eventual outcomes to spotted owl recovery under SOMP2. I share the author’s concerns.



This juvenile spotted owl was fledged by the nesting pair I found at Sockeye Creek in 2003. It died near Lillooet in 2004, after dispersing a cumulative total distance of 133.9 km. This large dispersal distance, and fate, was shared by all of the spotted owls I tracked (over several years) and is indicative of fragmented forest condition on the landscape.

9. How has British Columbia's management of (other) key threats to the habitat affected the survival or recovery of Spotted Owl?

Synopsis: Management of key threats to habitat, other than commercial forest harvest, is considered to have a relatively minimal effect on spotted owl recovery.

Relative to commercial forest harvest each of these effects are suspected to be minimal. With specific reference to key threats to spotted owl habitat other than commercial forest harvest, these threats include:

- fire and post-fire management (i.e., salvage logging),
- management for mountain pine beetle (*Dendroctonus ponderosae*) (i.e., salvage harvest in response to beetle-kill); and,
- long-term effects of climate change.

Salvage harvesting is typically permitted within the mapped 'boundary' of the fire. The Province (BC MFLNRORD) predictively maps wildfire boundaries in a remote desktop-based GIS mapping process that extrapolates the extent of the burnt area as the fire is advancing on the landscape. In many cases boundaries are mapped well beyond the final or actual 'footprint' of the fire which creates an incentive to harvest within unburnt suitable spotted owl habitat, under the guise of salvage logging, as commercial harvest within these areas is not subject to stumpage fees that are charged by the Government during non-Salvage logging operations.

I'm aware of at least one instance where salvage harvest was conducted in response to fire within unburnt suitable occupied spotted owl nesting habitat (e.g., Enterprise Creek "salvage harvest" by Ainsworth Lumber).



Commercial harvest within areas mapped as beetle-killed or burnt is often conducted beyond the actual impacted area.

10. How has British Columbia managed key threats, other than to habitat, of the Spotted Owl?

Synopsis: Beyond the primary threat resulting from habitat loss there are several ecological attributes that threaten spotted owl survival and recovery. The next most pronounced deleterious effect is decreasing population density (typically as a direct result of habitat loss). Population density adversely affects juvenile survivorship and recruitment into the adult breeding population. The Allee effect (a biological theory) posits that the probability of encountering a mate diminishes as a population declines. For spotted owl settlement behaviour is promoted by the presence of conspecifics (i.e., another spotted owl). Juvenile spotted owls continue to disperse on the landscape until they encounter another spotted owl, or until they die of starvation (exacerbated by competition for prey from barred owls) or from depredation (exacerbated by increasing density of great horned owl as a positive response to increased forest fragmentation). BC is attempting to manage this threat by attempting to breed spotted owls in captivity with the eventual intent (if successful) to release spotted owls back into the wild.

Competition with barred owl and depredation from great horned owl are secondary threats. Initial recovery efforts under SOMP2 from 2006-2009 emphasized captive breeding of spotted owls, and barred owl control, with priority and urgency afforded to these threats instead of habitat conservation and management. After an unsuccessful spotted owl translocation effort in 2002, and attempted supplemental feeding programs from 2003-2004, a 12-year long effort to manage juvenile recruitment via captive breeding resulted in a net-negative impact to BC's wild spotted owl population. The captive breeding program is ongoing despite no net benefit and very limited success. The barred owl control program is also ongoing and has been purported to have resulted in some (potential/unmeasurable) benefit to spotted owls at previously known occupied sites but moral and logistical considerations warrant attention. To date there have been no known attempts at control of great horned owl by the Province.

Threats external to considerations regarding habitat include, primarily, the Allee effect (1) and secondarily competition from barred owl (2) and depredation from great horned owl (3).

1. **Allee Effect:** BC is currently attempting to address the Allee effect (negative effects on juvenile recruitment) by breeding spotted owls in captivity (see response to Question 11, point 6, for a definition of the Allee Effect). The forecasted commitment (in 2006) was to release 20 captive bred spotted owls back into the wild (annually) to promote settlement and recruitment. To date, 12 years later, eight captive owls have been bred. To achieve this at least ten owls have been removed from BC's wild population resulting in a net-negative impact to BC's wild spotted owl population after 12 years of focused captive breeding efforts. Actions preceding current captive breeding efforts included translocation (following overwintering of a captured wild-bred spotted owl) and supplemental feeding of dispersing juvenile spotted owls between 2003 and 2004. This effort is summarized below:

- I. In 2002, the BC government attempted translocation of a single juvenile spotted owl captured near Enterprise Creek, overwintered and released at Sumallo Grove (Skagit Park) near Hope, BC. Unfortunately, this attempt was poorly researched and implementation of the release strategy was compromised by an inaccurate interpretation of field survey results conducted for the Province by Keystone Consulting. The translocated juvenile owl was released into an active paired site in late winter (a particularly inhospitable period for raptors in BC). I surveyed the site after the release occurred and determined it was already occupied by a pair of breeding spotted owls. I had also raised concern, prior to release, that the habitat at Sumallo Grove (CWH BEC Zone) differed from the habitat at the capture site near Lillooet (IDF BEC Zone). The wetter/colder climate at the release site (at the time of release) created challenging conditions for a wild-born owl that had just spent six months penned in a very small enclosure. On that point, I had requested that the owl be fed, whilst in captivity, a natural diet to include bushy-tailed woodrat and northern flying squirrel; my request was not followed – the captive owl was instead fed domesticated mice. Finally, I also advocated that the owl be “hacked” (soft-release from an in-situ enclosure with food) but this recommendation was also not implemented. Instead the Province (I. Blackburn) proposed that the field crew (led by Keystone) would monitor the owl daily, post-release, using telemetry to ensure adequate supplemental feeding immediately post-release. This approach was also not successful as the technician was unable to track and follow the owl as he judged that the owl had moved too far from the road (~2km) and deemed the effort required unwarranted. The owl was found ~11 days post-release in a severely emaciated condition. It was found and delivered (by a road-work crew) to the South Okanagan Rehabilitation Centre for Owls (run by Sherri Klein) where it was used to pose for several media publicity ‘shoots’ for fundraising purposes (for the rehabilitation centre). This was contrary to explicitly stated permit stipulations. No charges were laid by the Province for this permit violation - the owl died after a few days in the rehabilitation facility.
- II. In 2003, after the Province’s failed attempt at over-wintering and translocating a captured wild owl the government ceased, at my insistence, a second and third attempt at translocation in 2003 and 2004. Instead I successfully implemented an experimental supplemental feeding program. In the post-fledging period, continuing through the winter and spring of the year following natal dispersal, I monitored and tracked juvenile spotted owls and provided food, on a 6-10 day rotation, to seven dispersing juvenile spotted owls I had found in 2004 and 2005 (n=7 (Hobbs 2004, Hobbs 2005)). I believe supplemental feeding positively influenced juvenile survival, but efforts were insufficient to ensure survival to recruitment into the adult resident breeding population. This program did however garner insight into dispersal movements, including documentation of natural survival rates and natural movement/connectivity corridors. This information was used to inform reserve design in subsequent habitat protections. This effort led to the eventual successful legal designation of six WHAs in

the Cascades NRD. These legal designations are today the only protective habitat measures afforded to spotted owl in the Cascades NRD¹⁴.

- III. In 2006, SARCO released the BC Recovery Action Plan. The release announcement claimed consistency with, and adherence to, the 2006 CSORT management strategy (released as guidance to government to inform development of the SARCO led action plan). The 2006 Action Plan detailed a commitment to implement a captive breeding program with a much-delayed implementation of habitat conservation measures.

2) Barred owl: Secondary threats include competition, by barred owls, for resources (food/habitat). The main predation risk to spotted owls is from great-horned owls and, to a lesser degree, northern goshawk. To address this secondary threat the Province initiated a barred owl control program in 2006. The barred owl control program has, to date, removed 189 barred owls (138 captured and relocated; 51 shot). There has been purported benefit to resident spotted owls at removal sites (Gillis 2016a); however, the sustainability of these efforts is questionable in the context of effort, moral values, and counter-effects from natural recruitment rates of barred owls within the range of spotted owl in BC. Based on productivity and sympatric population estimates, anticipated recruitment rates for barred owl are approximated at 5,400 new barred owls fledged within the spotted owl's range in BC annually.

3) Great horned owl: The third order key threat (other than threats to habitat) is depredation by great horned owl. To date there have been no (publicly disclosed) attempts at control of great horned owl by the Province.



A barred owl perches, vigilant, waiting for prey. Their generalist ecology gives them a competitive edge over spotted owls where they co-occur



Great horned owls are much larger than spotted owls, and are a formidable predator.

¹⁴ During the consultation process an MOU was signed by government and Ainsworth Logging (Lillooet) with a commitment to not harvest owl habitat within the nest grove or core activity center at any active spotted owl sites. Despite the MOU (November 25, 2003) Ainsworth Lumber harvested within the nest grove / activity centre at two proposed WHAs (Enterprise and Nesikep). WC protested, and a media article (Vancouver Sun: Larry Pynn) was released to bring attention to this contravention. The WHAs were eventually designated but the territory cores were, by then, already compromised at both sites.

11. How has British Columbia's management of these key threats affected the survival or recovery of the Spotted Owl?

Synopsis: Understanding the effect of BC's management upon all key threats affecting spotted owl recovery requires consideration of six key life-history attributes that influence spotted owl survival. These key ecological attributes, exacerbated by the species' specialist behavior, include: habitat dilution (loss of suitable forested habitat (primarily from commercial forest harvest), reduced prey accessibility (due to an increase in stem density during post-harvest forest succession), reduced prey abundance (due to reduction in prey abundance in post-harvest landscapes), increased competition for diminishing prey resources (as a result of an increasing barred owl population), increased predation risk (particularly upon dispersing juvenile spotted owls), and the Allee effect (decline of population below a critical population persistence threshold). The Province's management of these threats has been outlined in response to Questions 7 to 11. Continued loss of suitable old growth forested habitat continues to compromise survival and recovery of spotted owls in BC as it negatively influences productivity and survivorship via each of these ecological stressors.

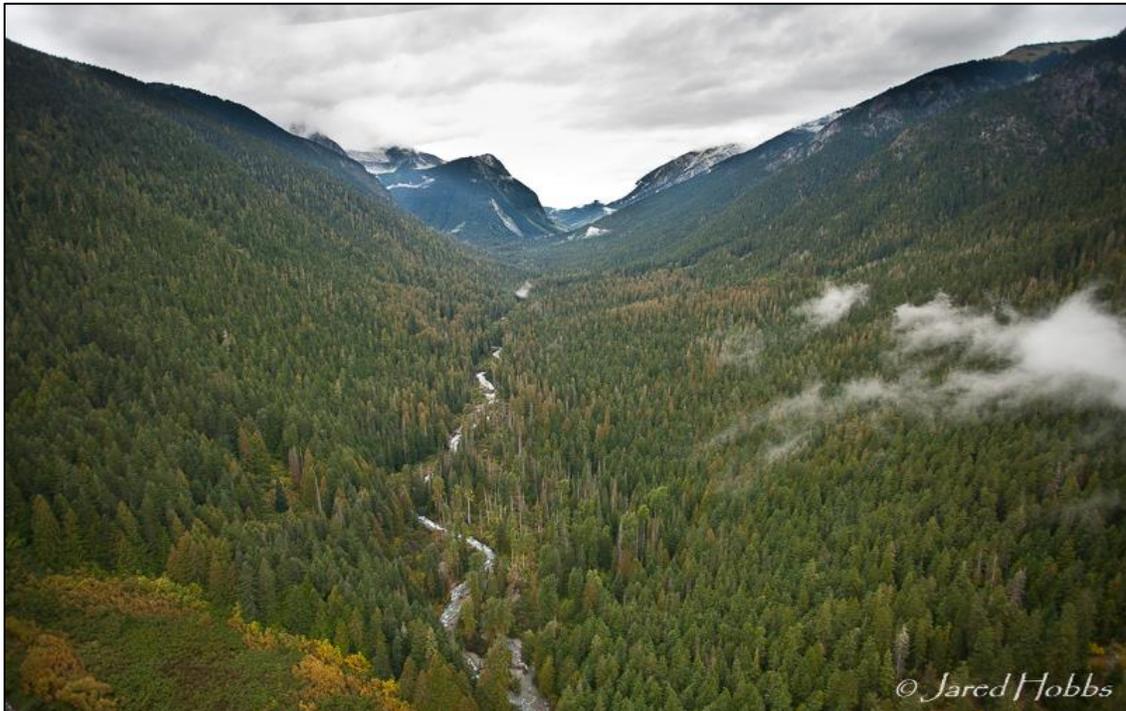
In responding to this question, I have assumed inclusive consideration of all previously discussed threats and responded by assessing the Province's management of all the described threats to survival and recovery of spotted owl in BC. The preceding questions are re-presented below for clarity:

- Question 7: *"How has British Columbia's management and protection of habitat affected the survival or recovery of the Spotted Owl?"*
- Question 8 *"How has British Columbia managed key threats to spotted owl habitat?"*
- Question 9: *"How has British Columbia's management of (other) key threats to the habitat affected the survival or recovery of Spotted Owl?"*; and,
- Question 10: *"How has British Columbia managed key threats, other than to habitat, of the spotted owl?"*

As explained in my response to Question 7 this question cannot be answered quantitatively when assessing impact of forest harvest, using existing data, as the Province does not require survey prior to harvest of spotted owl habitat. Without a "Before/After-Control/Impact" (BACI) experimental design it is impossible to accurately quantify effects from realized threats. Instead, I have responded based on consideration of peer-reviewed published articles to afford an in-depth and thorough understanding of spotted owl ecology, and thus spotted owl population response. My response evaluates the effect of the Province's management (of *all* key threats) upon spotted owl recovery. I posit a qualitative assessment of the influence of habitat loss (post-European contact) by discussing six key life-history attributes that influence spotted owl survival in a modern landscape.

- 1) Habitat Dilution: Spotted owls are a 'resident' species – they occupy (and defend) a large (2,800-3,400 ha) territory year-round. The quality of forested habitat within their territory dictates their survival, or persistence, on the landscape as this directly influences their ability to secure (catch) their prey. Spotted owls are interior forest hunters (i.e., they hunt under the closed canopy of mature forest). As such, they depend on open, evenly spaced forests with low "stem-densities"

(see Question 3 or refer to Chutter et al. (2004): (37-185 stems/ha for coastal (wetter) ecosystems, 173-247 stems/ha for interior (drier) ecosystems)). These stem densities are characteristic of late succession old growth forested ecosystems in the Pacific Northwest. When mature forest is harvested it is converted to clear-cut areas (often with variable retention of small stands of seed-trees). These young age-class forests have to develop over 100-200 years through age classes 1-7 before attaining characteristics that create suitable foraging habitat for spotted owls. As suitable habitats disappear on the landscape, spotted owls are increasingly challenged to find sufficient habitat to maintain and occupy a viable territory year-round. In ecology this is termed 'habitat dilution effect'. When any organism is forced to expand its home range (area) in search of prey, economic theory dictates that the thermo-energetic cost of moving further must not exceed the reward (improved food supply); if it does the organism cannot persist. Under these conditions spotted owls must either abandon their territory (and disperse on landscape to settle elsewhere, with an associated risk and cost) or face starvation. BC's forest management practices have resulted in a highly fragmented mosaic of younger age-class forest in areas once dominated by old-growth coniferous forest throughout the species' range in BC. Loss of spotted owl habitat, range-wide, is repeatedly cited in the literature as the most dominant influential (causal) factor in spotted owl population declines; BC is no exception (Chutter et al. 2004). The current population and noted declines from trend monitoring (Blackburn et al. 2002) are most reasonably attributed to habitat loss (and thus habitat dilution) at the landscape scale (Chutter et al. 2004).



A pair of spotted owls once occupied this territory at Billygoat Creek – this illustrates ideal non-fragmented Class A habitat that is today only available within Provincial Park boundaries.

- 2) Prey accessibility: During forest succession from disturbance (clear-cut or natural loss) there is a dramatic increase in stem density (up to or exceeding 2,000 stems/ha); in maturing early seral forests spotted owls are unable to catch their prey as they can't forage (or fly) efficiently in dense forests. Their prey, even when present, is no longer 'available' to them. This has an obvious effect on survivorship. In response a resident owl may either abandon the territory or expand their movements to compensate for reduction in the area of mature (old-growth) forest in which they can more effectively forage.
- 3) Prey abundance: The literature also presents a second prevailing effect of forest harvest on spotted owl survival – prey abundance. The spotted owl is an upper trophic level carnivore that evolved along the west coast of North America (and Mexico). Before European contact their ecosystem was relatively stable and dominated by old-growth forested habitat. Evolutionary theory dictates that stable environments favor natural selection of specialist species (species with narrow niches and a specialized ecology). Specialist species evolved successfully by outcompeting other generalist species (i.e., species with a broad and adaptive niche ecology). Over millennia spotted owl and barred owl diverged from a common ancestor (likely the fulvous owl (*Strix fulvescens*), from Guatemala and Mexico). Barred owls occupied the east coast of North America (within patchy forested ecosystems with high edge-interior ratios) while spotted owls occupied mature contiguous areas of coniferous forests along the west coast of North America. In these stable mature forested habitats, with low edge-to-interior ratios 64.6% of the diet of the Northern spotted owl is comprised of tree squirrels (of this northern flying squirrel contributed 41.2% (Horoupiian et al. 2004)). Bushy tailed woodrat contributed 27.8% of the diet (Horoupiian et al. 2004). By converse, barred owls occupied forests along the east coast that featured a patchier age class with a mosaic of successional stages. In this environment of higher edge-to-interior ratios the barred owl learnt to be a generalist, preying on a greater diversity of prey items including: small mammals (e.g., mice, voles, flying squirrel and bushy-tailed woodrat), amphibians, birds, bats and large insects (e.g., noctuid moths) (Livezey et al. 2007). The advent of commercial forestry in coniferous forests along the west coast of North America rapidly altered the conditions spotted owls had evolved in and put them at a disadvantage due to their specialized ecology.
- 4) Competition: The effect of competition for limited resources (i.e., prey) by a generalist species (i.e., barred owl) upon a specialist species (i.e., spotted owl) is self-evident when demographic parameters (survivorship and fecundity) are examined. Both species weigh approximately 600-800 grams, and both species require ~56 grams of prey/day to persist yet barred owl populations have flourished while spotted owl populations crashed (Forsman et al. 2004). In a post-European landscape, commercial forest harvest of old growth forested areas results in a reduction in abundance of the spotted owl's primary prey items as both flying squirrel and bushy-tailed woodrat also depend on mature forest conditions. When the abundance of spotted owl prey diminishes survival is negatively affected as spotted owls lack the ecological plasticity to switch to prey items that fare better in a mosaic of successional stages (Livezey et al. 2007). Barred owls, by converse, flourish by capitalizing on a far more diverse prey base. A study by Diller et al. (2016) demonstrated that the continued decline in spotted owl abundance may be at least partially attributed to the presence of the congeneric invasive barred owl. Commercial

forest harvest has likely improved conditions for barred owl. Regardless of the cause barred owls have recently colonized the entire range of spotted owls in BC.

- 5) **Predation:** Since 2006 the Province has focused considerable efforts on removing barred owls from active spotted owl territories. No attention has been afforded to controlling the influence of the most common avian predators (including great horned owls and northern goshawk).
- 6) **Allee Effect:** For many species low population density (numbers) appears to strongly limit population growth. The Allee effect is pronounced, to varying degrees, in species with positive density dependence and is evidenced by a positive correlation between absolute average individual fitness (survivorship and productivity) and population density. This positive correlation may (but does not necessarily) give rise to a critical population size below which the population cannot persist (i.e., a minimum viable population size). In a long-term study (1987-1998) Lahaye et al. (2001) studied natal dispersal patterns in an insular population of spotted owl in Southern California; with a particular focus on territory acquisition rate in juvenile spotted owls. The authors concluded that the presence of conspecifics plays a key role in the settlement process for spotted owl; 78% of dispersing owls settled in occupied territories, 16% settled adjacent to occupied sites and only 6% settled at sites of unknown occupancy. No owls settled at sites that were unoccupied or not adjacent to occupied sites (Lahaye 2001). This finding demonstrates that spotted owl settlement, and ultimately recruitment in the breeding population, is strongly influenced by density dependence (the Allee Effect). At some point post-European contact commercial forestry activities (through habitat dilution) very plausibly diminished spotted owl population densities (within the species' range in BC) below a critical threshold resulting in sharp range-wide population decline. Spotted owl persistence (survival and recovery) in BC will continue to be challenged by the Allee effect.



A spotted owl swoops down on its prey – note the large wingspan. Prey is not as accessible to spotted owls in densely forested habitat.



Bushy-tailed woodrat are an important key prey item in BC.

12. In reference to the BC Habitat Model, how has British Columbia defined and described Spotted Owl habitat?

Synopsis: The Province has used Geographic Information Systems (GIS) desk-top based habitat modelling to define and describe spotted owl habitat quality. GIS based Habitat Suitability Index (HSI) models were used to delineate habitat reserves during development of both SOMP1 and SOMP2. HSI modelling methods consider attributes generally accepted to efficiently characterize habitat for the focal taxa. For spotted owl these attributes include BEC variant, stand age, stand height and elevation.

Input values to identify suitable habitat during development of SOMP1 grossly overestimated suitable spotted owl habitat within SRMZs as the elevational inputs were inaccurate for use in BC. This error allowed a subsequent reduction, through over-harvest of lower elevation suitable habitats, in the amount of actual available spotted owl habitat within SOMP1 reserve areas. As a result of this error remaining spotted owl habitat, inside SOMP1 conservation areas, was reduced well below threshold targets set by area-based SOMP1 planning objectives.

This oversight revealed the importance of accuracy, confirmed by field-verification, when using HSI models to define, describe and spatially map spotted owl habitat. I redeveloped the model used for SOMP1, creating a new more accurate model to delineate habitat reserves to inform the SOMP2 habitat reserve design process. My model was accepted by the Province, and by COSEWIC, as an accurate method to map available suitable habitat and was used, by Coretex Consulting, to evaluate population response to various habitat management scenarios during the CSORT led recovery planning process.

In defining and mapping suitable habitat, for many species, Habitat Suitability Index (HSI) modelling is commonly used in wildlife conservation planning. HSI modelling provides an accurate spatial depiction of the amount and distribution of suitable habitat based on input of attributes known to be used by the focal taxa. HSI models are developed in a desktop environment using Geographic Information Systems (GIS) software. GIS-based HSI modeling was used to map the distribution and abundance of spotted owl foraging and breeding habitat throughout the species range in BC, both by SOMIT (for SOMP1) and by the Province (for SOMP2). Habitat attributes used to model spotted owl habitat include: BEC variant, stand age, stand height; and, elevation. These input attributes are queried against Vegetation Resource Inventory (VRI) mapping data to generate maps depicting Type A (nesting) and Type B (foraging) habitat for spotted owl.

SOMP1: The first (early) HSI model used by SOMIT to map spatial boundaries of the SRMZs for SOMP1 was overly optimistic in its characterization of suitable spotted owl habitat. This (early) model was based on characteristics derived from literature and studies from the United States (I. Blackburn pers. com.). In consequence, this (early) model over-predicted suitable habitat to occur at elevations up to 1,370 – 1,500 m ASL (depending on BEC zone) (D’Anjou et al. 2006). This is well above the documented elevation breeding limit of spotted owl in BC (1,194 m ASL) and resulted in a gross overestimate of suitable

spotted owl habitat within SRMZs designated and managed under SOMP1 guidelines. This overestimate had a pronounced effect on habitat conservation (resulting primarily from habitat loss as a result of commercial forest activities). Lower elevation habitats continued to be harvested (under SOMP1 management) while upper elevation habitats (thought to be suitable based on this early model) were not harvested to maintain or meet the 67% retention target. When this inaccuracy was addressed and corrected in 2004, with a new model I developed (based on actual data collected from trend-analysis surveys, and telemetric monitoring collected 1991-2002) it was apparent that previous logging within lower elevation areas of each SRMZ, under SOMP1, had reduced the amount of actual spotted owl habitat, range wide, even further below SOMP1 habitat retention objectives. This was identified and recommended for correction by myself in 2004, and supported again by D'Anjou et al. (2006), but by then the loss of spotted owl habitat had already occurred.

SOMP2: In 2004, I developed a new (revised) BC habitat suitability model that was quickly adopted by CSORT and Coretex Consulting (for the purpose of SELES modelling¹⁵). My model was applied for recovery planning in the delineation of revised SRMZ boundaries for SOMP2. This (2004) model has been used consistently, since 2004, to define and describe spotted owl habitat in BC. The attributes used in this model were field verified, accepted and used by CSORT (Chutter et al. 2004), by Coretex (Sutherland et al. (2007)) and by COSEWIC (COSEWIC 2008). The parameters used to develop the 2004 model (used to inform development of SOMP2 SRMZ boundaries) are summarized consistently in Sutherland et al. (2007) and in Chutter et al. (2004) and presented in **Table 5**. These attributes are also described more fully in **Table 6**.

A third model is being developed currently (2019), by I. Blackburn for future planning but the necessity of additional model development should be rationalized and the attributes used should be examined to ensure accuracy and relevance if this model is proposed as a replacement to the model used by CSORT, COSEWIC and Coretex to delineate owl habitat in BC since 2004. Preliminary investigation of a draft version of the model showed poor alignment with actual owl habitat used based on reconciliation against field data (~1,463 survey observations, 33 nest records and 94 telemetry observations).

¹⁵ Used by Coretex Consulting to inform analysis of potential (predicted) spotted owl territories on the landscape, to assess landscape connectivity and to project spotted owl population response to various predicted habitat management scenarios during recovery planning.

Table 5. Description of habitat parameters for maritime, sub-maritime and continental ecosystems.

Parameter	Maritime		Sub- Maritime		Continental	
	Type A (Nesting)	Type B (Forage)	Type A (Nesting)	Type B (Forage)	Type A (Nesting)	Type B (Forage)
BEC variant	CWHvm1 CWHvm2 CWHdm CWHxm1 CDFmm*	CWHvm1 CWHvm2 CWHdm CWHxm1 CDFmm*	CWHds1 CWHms1 IDFww	CWHds1 CWHms1 IDFww	IDFun IDFdk IDFdk1-4 IDFhx1 IDFhx2 IDFxm IDFwx	IDFun IDFdk IDFdk1-4 IDFhx1 IDFhx2 IDFxm IDFwx MSdm2 MSxk PPxh2
Maximum Elevation	< =900	< =1000 m	< =1000 m	< =1100 m	< =1100m	< =1200m
Slope	all	all	all	all	all	all
Aspect	all	all	all	all	all	all
Minimum Stand Age	>=140 years	>=80 years	>=110 years	>=80 years	> =110 years	> =80 years
Minimum Stand Height	>= 28 m	>= 28 m	>= 28 m	>=26 m	> =26 m	>=23 m

*Although CDF listed little area actually falls in the owl range, and it all occurs in developed regions of Vancouver.

**Forest cover height classes: 3 = 19.5-28.4; 4 = 28.5 - 36.4, 5+ ≥36.5

Table 6: Descriptive summary of spotted owl habitat characteristics in wet and dry habitat types as taken from Chutter et al. 2007.

Table 5: Spotted owl habitat attributes (taken from Chutter et al. 2009. P. 7)

Habitat Type	Superior Habitat (nest, roost, forage, and dispersal)	Moderate Habitat (roost, forage, and dispersal)
Wetter ecosystems: Maritime Coastal Western Hemlock and Mountain Hemlock Biogeoclimatic Zones		
Natural Disturbances: Rare to infrequent stand-initiating events.		
Suitable habitat characteristics	<ul style="list-style-type: none"> • Three or more canopy layers, multi-species canopy dominated by large (>75 cm dbh) overstorey trees (typically 37–185 stems/ha) • Moderate to high (60–80%) canopy closure. • Five or more large (>50 cm dbh) trees/ha with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections). • Five or more large (>75 cm dbh) snags/ha. • Accumulations ($\geq 268 \text{ m}^3/\text{ha}$) of fallen trees and other coarse woody debris on the ground. 	<ul style="list-style-type: none"> • Two or more canopy layers, multi-species canopy dominated by large (>50 cm dbh) overstorey trees (typically 247–457 stems/ha, although densities as low as 86 stems/ha are possible where large diameter trees are present). • Moderate to high (60–80%) canopy closure. • Five or more large trees/ha (>50 cm dbh) with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections). • Five or more large (>50 cm dbh) snags/ha. • Accumulations ($\geq 100 \text{ m}^3/\text{ha}$) of fallen trees and other coarse woody debris on the ground.
Dryer ecosystems: Sub-maritime Coastal Western Hemlock and Mountain Hemlock, and Interior Douglas-fir and Engelmann Spruce–Sub–Alpine Fir Biogeoclimatic Zone		
Natural Disturbances: Infrequent stand-initiating events to frequent stand-maintaining fires; however, fire suppression has increased the frequency of stand-initiating events.		
Suitable habitat characteristics	<ul style="list-style-type: none"> • Three or more canopy layers, multi-species canopy dominated by large (>50 cm dbh) overstorey trees (typically 173–247 stems/ha, although densities as low as 86 stems/ha are possible where large diameter trees are present). • Moderate to high (60–85%) canopy closure. • Five or more large trees/ha (>30 cm dbh) with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections). • Seven or more large (>50 cm dbh) snags/ha. • Accumulations ($\geq 268 \text{ m}^3/\text{ha}$) of fallen trees and other coarse woody debris on the ground. 	<ul style="list-style-type: none"> • Two or more canopy layers, multi-species canopy dominated by large (>30 cm dbh) overstorey trees (typically >247 stems/ha). • Stands must contain 20% Fd and/or Hw in the overstorey. • Greater than 50% canopy closure. • Five or more large trees/ha (>30 cm dbh) with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections). • Five or more large (>30 cm dbh) snags/ha. • Accumulations ($\geq 100 \text{ m}^3/\text{ha}$) of fallen trees and other coarse woody debris on the ground.

13. Does the BC Habitat Model identify and define Spotted Owl critical habitat as required by the SARA (that is, “habitat that is necessary for the survival or recovery of [the Spotted Owl]” identified “to the extent possible, based on the best available information”) (“Critical Habitat”)?

Synopsis: No; the BC Habitat Model (i.e. the habitat modeling used in SOMP2) does not identify critical habitat as required by the SARA. Habitat conservation measures as defined by SOMP2 were constrained by socio-economic considerations. The SARCO imposed a constraint on the impact allowed during recovery planning to accommodate competing interests from revenue generation from commercial forestry activities.

Under the SARA, ecological considerations should not be influenced by socio-economic consideration when designating CH. An appropriate process for mapping CH requires a more fulsome suite of considerations that accommodates all ecological needs of the species and recognizes and protects breeding, foraging and dispersal habitats required for effective species recovery throughout the species’ entire (former) range.

Habitat Suitability Index modelling (i.e., the BC habitat model) is not an equivalent proxy for identification of Critical Habitat (CH) in isolation of consideration of patch size, connectivity, edge-effect and reserve design. The BC Habitat model simply identifies where suitable spotted owl habitats occur on the BC landscape (i.e., spatially depicts the amount and distribution based on selection of desired habitat attributes (as described in the response to Question 12)). The BC habitat model (circa 2004) does not identify and define CH; it is instead an informational tool that was intended to support mapping of CH. For clarity, I will assume that the wording “BC Habitat Model” as used in the question is analogous to the BC Habitat (Management) Model, or framework, referred to by the Province and in this document as SOMP2.

On that assumption, literature regarding effective reserve design suggests design must allow for management of habitat to provide ‘clusters’ of occupied territories spaced evenly on the landscape to facilitate natal and adult dispersal (Lamberson et al. 2003). In assessing the habitat protection component of SOMP2 in response to Question 13 the answer is “No” for the following reasons:

1. Design of SOMP2 was influenced by socio-economic considerations: The BC Habitat model (circa 2004) was used to inform reserve design for revisions made to SOMP1 SRMZ boundaries for the purpose of spatial mapping of SOMP2 boundaries. Although reserve design principles outlined by Lamberson (2002) were followed during this process (i.e., territory clusters, with spacing consideration afforded to ensure maintenance of connectivity habitat for dispersing owls), SOMP2 habitat management (as defined and announced in 2009) was constrained, in its design, by imposition of socio-economic considerations. The SARCO imposed a ‘cap’ on habitat protection afforded to spotted owls under SOMP2 by carrying forward the same 4.5% limit on impact to timber revenue within the Sea-to-Sky and Chilliwack NRD as used for SOMP1. The effect of this constraint warrants consideration as SOMP1 had already been demonstrated as

ineffective at halting or reversing the rapid spotted owl population decline in BC. Under the SARA, socio-economic concerns are not supposed to fetter designation of CH as CH designation is strictly a biological process¹⁶. On these grounds alone SOMP2 provisions do not meet the intent and requirement of CH designation under the SARA.

2. Critical Habitat identification not yet in place: SARA (S.2(1)) defines "CH" as *"the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species"*. The Province is required to post a proposed strategy to the SARA public registry within 1 year¹⁷ of listing for an endangered species. Furthermore, section 41(1)(c) SARA states that *"a recovery strategy must include an identification of the species' CH, to the extent possible, based on the best available information..."* Spotted owl was listed under SARA in 2004; as of the time of writing of this report (2019) CH for spotted owl has still not been defined and identified by the Province in a Recovery Strategy or in an Action Plan. Identification of CH for spotted owl is now 15 years overdue.
3. Delayed effective legal protection: Management of spotted owl habitat, as constrained by SOMP2, was not defined until 2009. In 2009, it was defined only informally by non-legal recommendations outlined by Provincial BMPs (Blackburn et al. 2009). This concern was partially addressed when SRMZ boundaries were finally converted to WHAs in 2011 and 2013 for the Chilliwack and Sea-to-Sky NRD. GWMs now afford legal guidance to habitat management within WHA boundaries; however, point 1 still presides and there is still no intent to afford protection to 314,959 ha of suitable Class A unprotected spotted owl habitat that currently occurs on the THLB within the owl's defined range.
4. Protection afforded to spotted owl habitat does not adhere to current scientific understanding of habitat management for spotted owl: Management outlined in Blackburn et al. (2009) is not in the best interest of spotted owl conservation. The BMPs promote harvest with retention (HWR) (within MFHAs) and logging to enhance owl habitat (HEPs) (within LTOHAs). Available literature and previous application of these methods in BC provide compelling evidence that neither of these prescriptions effectively benefit preservation of required attributes for spotted owl habitat (see response to Question 8).
5. Demonstrated non-compliance with habitat management practices: The Province's BCTS program continues to promote harvest within several WHAs (including one of the last three extant spotted owl territories near Spuzzum Creek) in a manner contrary to the guidance afforded by SOMP2. Category-Information (Cat-I) blocks is the term used to denote areas of forested habitat that have been advanced for approval to harvest. There are currently several Cat-I blocks within occupied spotted owl critical roosting and nesting habitat.

¹⁶ From Critical habitat identification toolbox: *Species at Risk Act* guidance: *"...socio-economic considerations are excluded from this stage of recovery planning. CH boundaries should be identified based on the best available information (ecological and biological relevance), not socio-economic orientation (for example, deliberately truncated to align with particular land parcel boundaries or land designations), such that activities likely to destroy CH and identified CH boundaries are mutually relevant."*

¹⁷ SARA (2002): the competent minister must include a proposed recovery strategy in the public registry within one year after the wildlife species is listed

In summary, an appropriate process for mapping CH requires a more fulsome consideration of ecological value and recognizes and protects breeding, foraging and dispersal habitats required for effective species recovery throughout the species' entire (former) range. This work has already been completed for spotted owl recovery by Sutherland et al. (2007) (i.e., the Coretex SELES model). The SELES model could have been used over a decade ago to identify CH throughout the owl's defined range in BC. It is very likely that a more fulsome consideration of recovery habitat requirements (i.e., for the purpose of mapping CH necessary for the survival and recovery of the spotted owl in BC) would differ markedly from the reserve design and habitat management afforded by SOMP2 as it would likely include much, or all, of the remaining 314,959 ha of unprotected Class A spotted owl habitat (on the THLB) within the owl's defined range in BC. This is self-evident as SOMP2 resulted in a net *reduction* in total area of habitat managed for spotted owl in BC relative to an already failed SOMP1. SOMP2 also failed to protect all active sites, all previously known active sites and all available currently suitable spotted owl habitat on the THLB by instead allowing continued harvest of suitable spotted owl habitat despite scientific guidance, in 2004, that suggested more habitat protection should be the primary recovery action (Chutter et al. 2004 – Appendix 1 – request for interim measures).

14. If you answered “no” to question 13, what is the Critical Habitat for the Spotted Owl as required by the SARA?

Synopsis: SARA suggests that CH must effectively and legally protect sufficient suitable (and if required, capable) habitat, within the known range of the species to accommodate recovery. Critical Habitat should define nesting, roosting, foraging, and dispersal habitat to accommodate future species recovery. Effective habitat conservation for spotted owl must also ensure maintenance of connectivity (at the landscape scale) and work towards reducing habitat fragmentation by preventing further loss of suitable habitat by preventing further loss of old growth forests range-wide.

Reserves should include aggregates of clustered potential spotted owl territories (34,000 – 68,000 ha) connected by corridors of low elevation dispersal habitat comprised of mature forests. Where these conditions are not met CH designation should ensure no further attrition (as a result of commercial forest harvest) within CH reserves. Within areas maintained for connectivity recruitment of suitable forest attributes could be accelerated by forests prescriptions that prioritize spotted owl management over revenue generation from extracted timber.

Spotted owl CH should be comprised of an adequate amount of survival and recovery habitats throughout the species' (former) natural range in support of scientifically defensible recovery goals (Chutter et al. 2004). The 2004 CSORT stated recovery goal was to provide sufficient “*suitable habitat, spatially distributed in a way that it can support and sustain a minimum of 250 mature owls*” in BC. Recovery habitat was identified by CSORT, in 2004, to include both existing occupied habitats, and all suitable habitat into which the species could recolonize. CSORT also identified inclusion of dispersal habitat as necessary to enable successful dispersal and establishment of new territories. These are valid biological principles that should be applied in defining CH.

Identification of the total amount and distribution of CH needed to meet the recovery goal was identified as one of the highest priorities by the CSORT in 2007. Theoretically, assuming 3,200 ha per

breeding territory, and assuming that 250 mature owls equated to 125 breeding pairs, about 400,000 ha of currently suitable habitat would be required (Chutter et al. 2004). SOMIT (1997) claimed that SOMP1 afforded management to 363,000 ha of **capable** (but not suitable) spotted owl habitat and yet the species declined precipitously. The Province's presentation of SOMP1 was a misleading oversimplification as capable habitat includes a spectrum of immature young seral forested habitat that is inhospitable to spotted owls. This should not have been attributed as beneficial towards spotted owl recovery. The same misleading oversimplification was again perpetuated by the Province when describing current management in a 2016 report. In the report the Province reported that "*As part of the Provincial Government's Spotted Owl Recovery Action Plan, the Province of British Columbia has protected 305,000 ha of forest for the spotted owl*" (Gillis 2016a). This is not equivalent to protection of 305,000 ha of suitable spotted owl habitat - this distinction may be lost on an uninformed audience – in reality only 66,919 ha (12.5 % of total available currently suitable spotted owl habitat) was afforded protection under SOMP2.

In addition, the amount of habitat required for recovery cannot be simply summarized as a total number of hectares of currently suitable spotted owl habitat protected, but must address the issues of connectivity, fragmentation, and elevational constraints across species' range. Spotted owl population health may be influenced by habitat composition and quality as available in the landscape. Fortunately, as described in the spotted owl Action Plan Guidance document (Chutter et al. 2007) much of the work required to define CH for spotted owl has already been completed. Chutter et al. (2007) list the following actions as Completed (in 2004) – this provides a framework to appropriately designate CH: Steps already completed towards appropriate identification of CH (taken from Chutter et al. 2007):

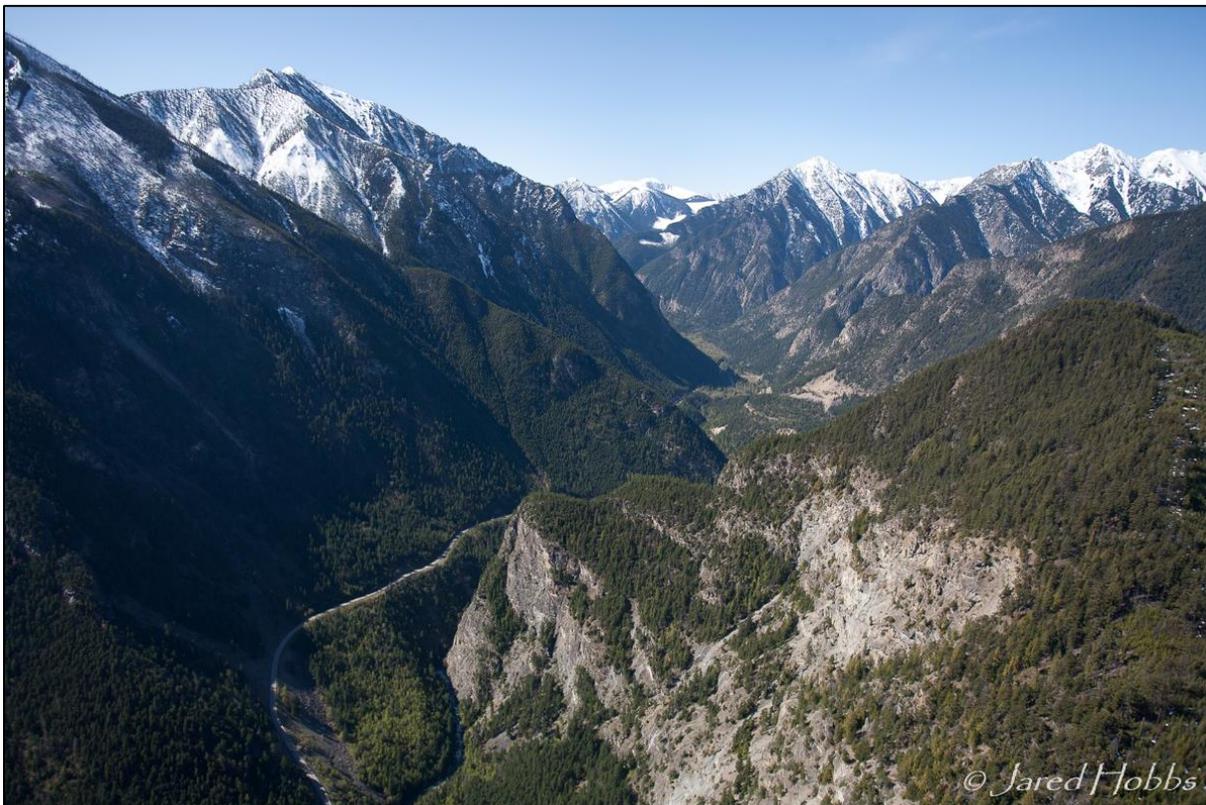
- ✓ Based on surveys and GIS work, create a base map of known sites and potential new sites.
- ✓ Define nesting, roosting, foraging and dispersal habitat.
- ✓ Develop a spatially explicit habitat supply model for the spotted owl based on the best science available.
- ✓ Refine the model and test its assumptions.
- ✓ Use the model to test assumptions about the effects of different habitat, territory and population characteristics, as well as threats on a potential stand-alone provincial population versus the need for connectivity to the United States populations.
- ✓ Apply the model to help create a map of all potentially suitable habitat.
- ✓ Apply the model to help define attributes necessary to define and delineate Critical Habitat in BC. This should incorporate survival habitat, and individual, population and landscape level requirements.
- ✓ Use the model to assess the existing spotted owl management plan (SOMP1).
- ✓ Establish spotted owl objectives under the Forest and Range Practices Act.
- ✓ Develop comprehensive guidelines to create, enhance and maintain critical habitat and reduce threats (author's note: this was noted as ongoing in 2004 and subsequently completed by Blackburn et al. in the 2009 BMP document; however, suggested management prescriptions that should be examined for scientific merit in the context of available published literature. This retro-active examination was anticipated by CSORT as adaptive management principles were recommended (in 2004) to evaluate the effectiveness of created or enhanced habitat to provide for the life requisites of the Spotted Owl or its prey populations).
- ✓ Implement a map-based spotted owl habitat management plan that conserves critical habitat and meets recovery goals and objectives (author's note: SOMP2 was completed in 2009)

however it failed to identify and protect CH for reasons outlined in the response to Question 13).

- ✓ Assess and monitor the effectiveness of the habitat management plan and revise and adapt the habitat management plan as necessary (author's note: *there is currently no effectiveness monitoring in place to evaluate SOMP2 habitat protection*).

The final step noted in the 2007 Action Plan Guidance document (Chutter et al. 2007) was adopted by SARCO, on behalf of the Province, and was described as the next required step (in 2007): “Provide a map of potentially suitable habitat along with a description of critical habitat in the recovery action plan” (Chutter et al. 2007). This final step has still not been completed by the Province in 2019 although the means to do so was completed by Coretex Consulting in 2007 using a comprehensive SELES model (Sutherland et al. 2007). The information required to map CH in a scientifically defensible manner has been available to the Province for over a decade.

The 2016 ECCC CH Identification “Toolbox” was provided by ECCC recovery practitioners to inform development of recovery documents where CH identification is required (ECCC 2016). The Toolbox could be used immediately, by the Province, to identify CH using the results from the 2007 SELES modelling already completed by Coretex Consulting (Sutherland et al. 2007). This action should be completed in a timely fashion - it is more than a decade overdue.



This spotted owl territory at Enterprise Creek was the most productive territory ever recorded in BC. I confirmed breeding at this site for five consecutive years before the female was taken from the wild to support the breeding program. All remaining suitable habitat could readily be mapped as CH.

15. How is the Critical Habitat you define and describe different and similar to the BC Habitat Model?

Synopsis: While the current BC Habitat Model under SOMP2 identifies suitable spotted owl habitats, it does not define or manage Critical Habitat reserves as required by the SARA. The fundamental difference between an appropriate spatial definition of CH, and the reserves mapped by SOMP2, is that SARA demands a process unfettered by socio-economic considerations.

In accordance with the SARA all habitat that is essential to the species' recovery should be afforded effective legal protection. In principle, SOMP2 is aligned with conventional wisdom for spotted owl reserve design (i.e., delineate large reserves spaced evenly on the landscape) but the size of the reserves are smaller than that recommended in the literature, and the omission of protection afforded to 59% of available remaining suitable habitat, suggests that CH defined in compliance with the SARA would be markedly different.

A Spatially Explicit Landscape Event Simulator (SELES) model was developed prior to development of SOMP2; this model should be used to allow more effective reserve design to better accommodate spotted owl recovery in BC.

As clarified in Question 13, the BC Habitat model simply identifies where suitable spotted owl habitats occur on the BC landscape (i.e., spatially depicts the amount and distribution based on selection of desired habitat attributes (as described in the response to Question 12)). The BC habitat (suitability) model (circa 2004) does not identify and define CH; it is instead an informational tool that was intended to support mapping of CH. For clarity, I will again assume that the wording "BC Habitat Model" (as used in question 15) is analogous to the BC Habitat (Management) Model, or framework, referred to by the Province and in this document as SOMP2.

On that assumption, literature regarding effective reserve design suggests successful reserve design must allow for management of habitat to provide 'clusters' of occupied territories spaced evenly on the landscape to facilitate natal and adult dispersal (Lamberson et al. 2003). The habitat protection component of SOMP2 applied this principle but did not define reserves as Critical Habitat; it simply refers to the reserves as WHAs with LTOHA and MFHA designations within each of 31 WHAs in the Sea-to-Sky and Chilliwack NRDs. The province has made no pretense of defining CH for spotted owl. The reserves, or WHAs, presented by the Province as SOMP2 (referred to as the "BC Habitat Model" in this question) would not meet the expectations, under SARA, of CH for reasons outlined in Question 13.

I recommend an unfettered process for CH designation that considers the species' needs and utilizes a reserve design that promotes large aggregations of suitable owl habitat and considers the likelihood of persistence and survivorship (during all requisite life history stages) and attempts to maximize fecundity by creating conditions favorable for survival and recruitment of adult and juvenile spotted owls. An early study by Lamberson et al. (1994) examined reserve design; the primary conclusion was that the level of occupancy (i.e., spotted owl persistence) is positively correlated with reserve size and that this relationship is less pronounced once reserve size is sufficient to accommodate at least 20 pairs (i.e.,

51,000 - 68,000 ha (allowing between 25 – 0 % overlap, respectively)). An analysis of reserve size under SOMP2 illustrates reserve size varies from 983 to 21,379 ha (with an average size of 4,944 ha) for LTOHAs and from 512 to 11,949 ha (with an average size of 4,941 ha) for MFHAs.

In the US two reserve designs were examined, using demographic models, by Anderson and Mahato (1995) and are summarized as follows:

- 1) The first design (Spotted Owl Habitat Area (SOHA)) uses smaller aggregates of one to three functional spotted owl territories (3400-10,200 ha). Reserve size closely follows that employed under SOMP1 and SOMP2.
- 2) The second design (Habitat Conservation Areas (HCA)) uses larger aggregates of 10-20 functional spotted owl territories (34,000 (10 territories) up to 68,000 ha (20 territories)).

The authors concluded that the HCA strategy always led to longer persistence times than the SOHA strategy (Anderson and Mahato 1995). The difference was attributed to the probability of colonization of an empty or vacated territory by a new owl. The authors recommended the HCA strategy for reserve design in proposed (at the time) conservation and management for the California spotted owl (Anderson and Mahato 1995). This approach was followed in the US management for northern spotted owl under the NWFMP throughout the species range in Washington, Oregon and California.

Designations for CH should be incorporated into future revision of spotted owl management in BC. Development of a revised SOMP (i.e., SOMP3) was beyond the scope of the contract but designation of CH by the Province is long overdue. When designating CH, a preliminary recommendation includes closer consideration of patch size consistent with recommendations from Lamberson et al. (2003), as larger patches (reserves) appear to more effectively support spotted owl survival, reproduction and recruitment relative to the smaller reserves implemented under SOMP1 and SOMP2. Any revised future management (SOMP3) should include a spatial definition of CH using the wealth of pre-existing HSI and SELES based models developed by CSORT (2004-2007) to identify existing suitable spotted owl habitat. CH designation should also identify capable spotted owl habitat for long-term habitat recruitment as this will be necessary for recovery. The CH objectives should stipulate retention and recruitment of attributes (discussed in response to Question 12) favourable for spotted owl persistence and recovery. CH designation processes should follow guidance from ECCC (ECCC 2016) and should, as stipulated under the SARA, *not* be fettered by continued consideration for socio-economic considerations. A GIS based analysis of remaining suitable Class A habitat within the defined range of the spotted owl in BC suggest there is currently 533,306 ha of suitable habitat currently remaining. Only 66,919 ha (12.5 %) is protected in areas designated by SOMP2; 151,428 ha (28 %) is afforded protection within Provincial Parks, Protected Areas, ecological reserves, conservancies and municipal watersheds. The remaining 314,959 ha (59 %) is located on the THLB and is currently available for commercial forest harvest.

Finally, future spotted owl management in BC may also consider broader application to areas of former spotted owl occurrence within the Sunshine Coast NRD, as supported by reliable observations presented by Campbell (2014). These areas have not ever been formally surveyed by the Province so occupancy status is unknown but, given the trend within the surveyed population, the probability of discovery of any currently extant spotted owl territories in these areas at the periphery of the species' range in BC is low.

16. How should the threats to Critical Habitat be managed to maximize the likelihood the Spotted Owl will survive and recover?

Synopsis: Management prescriptions within WHAs, LTOHAs and MFHAs continue to detriment spotted owl survival and recovery through commercial harvest of old-growth forest habitat. Critical Habitat needs first to be explicitly spatially defined and protected from future harvesting to maximize the likelihood of future spotted owl recovery.

In general, suitable habitat will continue to be lost or degraded through human activities such as logging, mining, other resource development, urban and rural development, and development of transportation and utility transmission corridors. Habitat loss, or conversion to early seral stands, is also caused by natural disturbances including major forest fires and insect outbreaks with each of these stochastic events exacerbated by climate change. However, in more practical terms, I believe commercial forest harvest continues to be the main stressor, and the predominant cause, of continued depletion of spotted owl habitat in BC. Many areas of old-growth forested habitats occur outside any management reserve boundary - continued harvest of these habitats is currently permitted by the Province's BCTS Program.

Viewed pragmatically the disproportionate threat from a single regulated activity should theoretically facilitate efficient threat management as improved conservation of spotted owl habitat can be efficiently addressed by focus on a single issue. At this over-simplified level further habitat loss could be prevented by a complete cessation of any further commercial harvest of old-growth forest habitat within the (former) range of spotted owl in BC.

The Province's current approach affords management to 31 spatially mapped areas with each area containing varying degrees of remaining unharvested suitable spotted owl habitat; however, as outlined in the response to Question 6, there are large areas of immature forest (unsuitable for use by spotted owl) also included within reserve areas that do nothing to contribute to recovery of spotted owl at the current time. Furthermore, harvest of old-growth forested habitat is also permitted within Provincial spotted owl management areas under two prescriptions:

1. Within LTOHAs commercial harvest of forested habitat is permitted if the intention is purported to improve habitat conditions (euphemistically phrased "Harvest to Enhance (HEP)" in the SOMPS2 management guidance (Blackburn et al. 2007)). The intent of HEP prescriptions is sound but only if HEP is permitted within maturing forests – HEP applications within late seral mature or old-growth forest is contrary to scientific understanding (see response to Question 17).
2. Within MFHAs harvest of suitable habitat is permitted using variable (partial) retention of a subset of required habitat attributes deemed to be favourable to be retained as patches of suitable habitat. The Province states that "*the primary purpose of the MFHA is to provide for timber harvesting opportunities.*"

Both management prescriptions would be detrimental if applied to areas of suitable spotted owl habitat. Management guidance prescribed by Blackburn et al. (2009) is not in the best interest of spotted owl conservation when applied to existing suitable spotted owl habitat.

17. Can Critical Habitat be logged so as to enhance or not jeopardize the Spotted Owl's survival and recovery?

Synopsis: Available information suggests that commercial forest practices cannot be reasonably or prudently applied to mature or old-growth forest, in a practicable manner, to improve spotted owl habitat suitability. If Critical Habitat is defined to include old-growth or mature forested habitats then commercial thinning (i.e. HEP procedures under SOMP2) should not be permitted in old-growth forested habitats.

This question has been afforded thorough treatment in D'Anjou et al. (2006); four points of consideration were presented (and logically supported by scientific understanding) and is summarized as follows:

- 1) It is challenging to isolate, during forest manipulation, those attributes that are essential to spotted owl use from the suite of characteristic attributes of old-growth forests. To effectively identify habitat attributes the harvest prescription should be completed by an expert with extensive experience recognizing spotted owl habitat values.
- 2) There is a paucity of information regarding the temporal requirements, post-treatment, for recruiting and enhancing habitat. Extensive work on maturing second growth stands in Oregon (>150 years of age) by Franklin and Spies (1991, as cited in D'Anjou et al. 2006) suggest that even 200 years post-harvest these managed stands still lack the habitat attributes fundamental for use by spotted owl (e.g., large trees with broken tops, or Douglas-fir with spreading crowns). Wilk et al. (2018) described 1,717 nest trees in 16 tree species in Washington and Oregon; many of the nest trees in their study were estimated to be at least 700 years old. They concluded that managing for the retention of such trees, and for their replacement, is a significant challenge for land managers.
- 3) Available data is insufficient to allow accurate or reliable prediction of prey response by key prey items (including bushy-tailed woodrat and flying squirrel) to both short and long-term treatments. D'Anjou et al. (2006) cited telemetry data in Oregon that indicated spotted owls avoided partially cut mature conifer stands with 40-59% canopy closure. Another study demonstrated that commercial thinning (i.e., logging to enhance owl habitat) within the nest area may have caused a resident male owl to move from its breeding range and appeared to result in an overall increase in the home range size. Finally, D'Anjou et al. (2006) also cited Carey (2000) – Carey reported flying squirrels moved further and were found at lower densities in managed thinned stands. This data suggests any manipulation of mature and old-growth forested habitats (such as thinning as prescribed by SOMP2 HEP procedures) are likely detrimental to spotted owl survival on both the short and long term.
- 4) The final consideration in D'Anjou et al. (2006) raised concern over the operational feasibility of HEP procedures. Stand-level management is costly to implement; those costs, in most cases, will quickly exceed the value of the extracted resource (timber) making HEP procedures (if completed in compliance with their stated intent) cost prohibitive. This sentiment was

repeatedly raised during discussions with forestry proponents during the recovery planning process and cited by M. Chutter and myself in preparation of a draft report for Ministry review in April 2002 (*“since the release of SOMP, increased stumpage rates caused harvest costs to exceed profit margins, thereby preventing forest companies from improving habitat conditions for Spotted Owls by performing these treatments”*).

Speaking specifically to partial harvesting (i.e., HEP procedures) in older forests, management prescriptions are *“untested hypothetical constructs”* until validated by scientifically valid observations (D’Anjou et al. (2006) quoting Franklin (2005)). There are few well documented experiments to analyze. Results of future experimentation would be uncertain at best and are deemed unlikely to succeed. Negative effects from HEP will likely include (based on partial harvest practices already completed) residual tree damage, windthrow, mortality and conversion of the stand from desired tree type (Douglas-fir) to more shade-tolerant (less desirable) tree species.

Available information suggests that commercial forest practices cannot be reasonably or prudently applied to mature or old-growth forest, in a practicable manner, to improve spotted owl habitat suitability. If Critical Habitat is defined to include old-growth or mature forested habitats then commercial thinning (i.e. HEP procedures under SOMP2) should not be permitted in old-growth forested habitats. More research is required to determine if HEP procedures should or could be applied effectively within maturing (early to mid-seral) forested stands but conclusions from existing published literature on effects upon old-growth forested habitats caution this approach.

18. What are the key activities (such as habitat enhancement, predator control, prey augmentation, etc.) which should and should not accompany management and protection of Critical Habitat to maximize the likelihood the Spotted Owl will survive and recover?

Synopsis: Any activities to manage other key threats should be undertaken in conjunction with efforts to effectively address the primary threat of habitat loss. These activities include population augmentation (i.e., captive breeding), barred owl control (within active spotted owl territories and by experienced personnel), prey augmentation (for wild breeding owls and juvenile owls during natal dispersal), and inventory of unsurveyed habitats. Habitat enhancement prescriptions should not be permitted in any remaining mature and old-growth forest within the owl’s range.

Anthropogenic changes to spotted owl habitat has created favourable ecological conditions (increased edge effect) and, to an undefinable degree, promoted invasion of the more aggressive, prolific and adaptable barred owl. Similarly, these changes have also likely promoted an increase in population abundance and density of great horned owl with a concomitant increased predation effect on spotted owls.

To promote recovery the Provincial Government has largely focused its attention, effort and resources on controlling negative effects of the more aggressive barred owl, including call suppression (in spotted

owl) and competition for resources (prey) resulting in territory abandonment and reduced recruitment of juvenile spotted owls. Attention to these aspects of spotted owl recovery is not misguided as without spotted owl population augmentation (release of captive bred owls), and with no attempt to ameliorate secondary (barred owl) and tertiary (great horned owl) order threats (see Question 2 for discussion of threats) recovery will be hindered. The challenge is with the magnitude and sequence of effort applied to all threats. Prevention of further habitat loss should have been afforded the highest order of attention for recovery, followed by recruitment of habitat in younger forested habitats to advance succession towards late seral stand characteristics. When the primary threat (habitat loss and connectivity within remaining habitats) has been fully addressed efforts should logically shift towards control of secondary threats (barred owl competition) with focused efforts afforded to active spotted owl territories (note: this has been the approach followed for addressing barred owl but these efforts have been applied before the primary threat (habitat loss) has been fully addressed).

Captive Breeding Program: At this point the owls placed in captivity would likely be dis-advantaged if released into the wild; survival and recruitment would be heavily compromised. The captive-breeding program should continue in hopes that it will one day result in a net positive benefit.

Barred Owl Control Program: Control measures to ameliorate the effects of barred owl should only continue within active spotted owl territories. To enable this, continued inventory for spotted owl is required to locate new spotted owls that may immigrate from the Washington population. If lethal control methods are continued only experienced personnel should be tasked with removal of barred owls. In the U.S. there have been at least two reported incidents where a spotted owl was inadvertently shot due to mistaken identification.

Prey Augmentation: During my tenure as the field lead for spotted owl inventory and telemetric monitoring I had attempted to augment the diet of adults (during the nesting/brood rearing phase) and juveniles (during natal dispersal) phase. I believe these efforts resulted in a positive benefit. As evidence the resident pair of spotted owls at Enterprise Creek bred for five consecutive years. This level of productivity was unheard of in the literature, or in any field programs in the U.S. (Eric Forsman, pers. comm. 2005). Insufficient sample size (too few owls remaining in BC) prevented a controlled experiment to assess efficacy, but available evidence suggests that prey augmentation may be an effective means to improve productivity for wild breeding owls and recruitment/survivorship of juvenile owls during natal dispersal.

Inventory: The merit of inventory within the Sunshine Coast NRD, and within unsurveyed habitats at Lightning Lake, should be investigated in light of more recent disclosure of reliable reports of spotted owl detections in these areas. In the context of the current trend future inventory is unlikely to reveal any additional new (i.e., undetected) territories but if extensive areas of unprotected suitable habitat remain, particularly in the Sunshine Coast NRD, additional inventory may be warranted.

Habitat Enhancement: HEP and HWR prescriptions would likely be detrimental if conducted within mature and old-growth forest habitats. These procedures should be restricted to early seral forests only when attempting to promote recruitment of spotted owl habitat.

19. The authors of the Recovery Strategy determined that the survival and recovery of the Spotted Owl was at the time technically and biologically feasible. Is the survival and recovery of the Spotted Owl in British Columbia still technically and biologically feasible?

Synopsis: To determine feasibility I assessed available information from 2018 against Environment Canada’s set of criteria from 2005, with revisions made to consideration of SOMP2 habitat management limitations as well as actual captive breeding outcomes. Given the amount and distribution of available suitable habitat (Sutherland et al. 2007) recovery is still technically and biologically feasible. This assessment suggests spotted owl recovery in BC, while logistically challenging, remains ecologically and technically feasible. The presence and connectivity of Spotted Owl populations on both sides of the international border also allows increased recovery potential in BC.

In the 2004 spotted owl recovery strategy CSORT concluded that recovery was ecologically and technically feasible. In 2005 Environment Canada (EC) provided policy guidance to offer a structured set of criteria to inform the re-assessment of recovery feasibility. Recovery was still suggested as feasible under the new criteria. The same criteria are applied below using current information available in 2019; however, one additional criterion (see #2: immigration from the US) has been integrated into the 2019 assessment. I have also divided CSORT bullet point #3 (considerations pertinent to habitat protection and barred owl control) into criteria 3, 4 and 5 to allow separate discussion of:

- revised habitat management under SOMP2 regulations (point 3),
- improved (potential) future habitat management from 2019 forward (to better protect existing spotted owl habitat in BC by recognizing limitations of SOMP2) (point 4); and,
- barred owl control (point 5).

In addition, the 2019 assessment (below), includes more detail on population enhancement measures (point 6), including captive breeding and barred owl control, as these actions have been underway for over a decade. The results of these efforts are also considered in the 2019 assessment whereas in 2005 they were simply identified as feasible recovery actions for implementation.

As per guidance set by Environment Canada (2005) determination of recovery feasibility must not consider human-centric values including aesthetic, economic, or other social values when assessing recovery feasibility as these considerations are accommodated separately in the recovery process. This assessment of recovery feasibility suggests that spotted owl recovery in BC continues to be ecologically and technically feasible based on the following rationale:

1. Extant population (updated with 2018 results): Breeding pairs were still present in Canada in 2017 (two sites with pairs and one single owl). Unfortunately, by 2018 all three known remaining sites were occupied by only single owls; however, there is some possibility that pairs remain undetected. Regardless, breeding in the wild population was most recently confirmed in 2017 at both the Spuzzum and Utzius territories near Boston Bar.
2. Immigration (not considered in 2005): Breeding pairs are still present immediately south of the international Canada-US border and immigration from the US resident population of spotted owls is still occurring. For example, Greendrop Lake territory (near Chilliwack) was found active in 2015 after three years of inactivity (Gillis 2016a) and a new female (unknown origin, possibly

from the US) was detected at Spuzzum Creek (paired with the resident male at that site) in 2015. In an independent demographic review in Washing State J. Buchanan (2016) spoke to recovery potential in Canada and concluded, given the amount and distribution of habitat in British Columbia, it remains possible to restore a population of several hundred spotted owls in the BC. I agree with Joe Buchanan’s position: “the presence and connectivity of spotted owl populations on both sides of the international border should allow for more stability in that part of the owl’s range” (Buchanan 2016).

3. Potential to better conserve existing SOMP2 managed habitat (note: managed habitat is considered in the context of SOMP2 as implemented in 2009): Sufficient suitable habitat to support a sustainable population of spotted owls is not currently conserved in BC. Protection of habitat in isolation of other direct management measures will not be sufficient to promote recovery. Of concern, and contrary to stated CSORT recovery goals, conservation of existing old-growth spotted owl habitat (and recruitment of new habitat) is currently not being achieved effectively under SOMP2 as only 12.5% of available suitable Class A spotted owl habitat is protected by SOMP2 designations. In addition, even in managed areas harvest of suitable spotted owl habitats continues today¹⁸.
4. Potential to better conserve existing unprotected habitat: Recovery is further challenged as 87.5% of available Class A habitat exists outside SOMP2 reserve boundaries and is currently unprotected. Forest harvest is currently permitted in these areas despite the value of these habitats for spotted owl recovery. Unfortunately, the distribution and amount on the landscape is likely not sufficient to allow recovery through additional habitat protection alone. Since 2000 there has been 29,909 ha of suitable spotted owl habitat (i.e., approximately 10 viable territories) commercially harvested in BC. The continuing harvest of suitable spotted owl habitat is largely promoted by the Province under the BCTS Program. It is laudable that two major commercial forestry licensees (Interfor and Canfor) both voluntarily elected to cease harvest in managed spotted owl habitat (in 2006) to support recovery but this positive step was negated as BCTS re-instigated harvest of spotted owl habitat within both tenures despite increased understanding of the owls decline, and contrary to recommendations for more conservative management in BC (Chutter et al. 2004; Appendix 1 (request for interim measures)).
5. Barred owl control (treated speculatively in 2005): Removal, including translocation and lethal removal of 189 barred owls from active spotted owl breeding areas has been suggested to be effective in reducing pressure on resident spotted owls (Diller 2016, Gillis 2016a). Research on the effects of barred owl removal confirmed barred owl control (i.e., removal) had a positive effect on spotted owl survivorship and fecundity rates with a concomitant reduction on spotted owl extirpation rates (Diller et al. 2016). The effect of barred owl removal was unknown in the 2005 assessment as this action hadn’t yet been applied. Since 2005 barred owl control measures were applied by J. Gillis; these actions have had a suggested positive effect on spotted owl persistence and productivity in BC (Gillis 2016a).
6. Population augmentation (treated speculatively in 2005): The captive breeding program has now been in operation for over 12 years; efficacy of program success is included in this assessment. The previous (2005) assessment was based on an optimistic projection of program effectiveness. Release rates were anticipated as 20 owls to be released each year (I. Blackburn pers. com.). Since 2006/7 the Canadian spotted owl captive breeding program has bred eight

¹⁸ As an illustrative example the Province has recently proposed additional commercial forest harvest under the Province’s BCTS program; harvest is proposed within one of two last remaining active spotted owl conservation areas (Spuzzum Creek). These actions are proposed despite spotted owl management objectives set forth by the Province (SARCO) in SOMP2.

spotted owls in captivity (predicted release rates suggested 240 owls would be released by 2018 (Ian Blackburn pers. comm.). No captive bred spotted owls have been released yet. In addition to the discrepancy between anticipated and actual success the negative impact to the wild population should not be ignored. At least ten spotted owls have been removed from the wild to provide stock for the captive breeding program, which is likely to have adversely affected production and recruitment in the remaining wild population¹⁹. These results are far less optimistic relative to anticipated breeding rates which speculatively predicated a rate of production of approximately 20 juvenile owls produced per year (I. Blackburn pers. comm.). However, valuable lessons have been learned since the program's inception, providing potential for future success.

This current assessment of the feasibility of recovery recognizes additional challenges than those outlined in previous assessments. Ecologically, recovery is further complicated in 2019 by ongoing habitat loss, as protection measures under SOMP2 did not faithfully implement the recommendations provided to the Province by CSORT in the 2007 Action Plan Guidance document (see Chutter et al. 2007). Furthermore, in the 2005 CSORT feasibility assessment, consideration of population augmentation as a recovery action component was based on optimistic predicted or anticipated results whereas the current (2019) assessment of recovery feasibility is informed by actual results from the spotted owl captive breeding program initiated in 2007.

Over a decade has passed since SOMP2 was implemented in 2006 and it is clear that the certainty of recovery is more tenuous today relative to the previous 2005 CSORT assessment. The current (2018) known population of only three remaining single owls in the BC wild population is a stark contrast with the 2004 known population of 25 individuals (including eight breeding pairs and nine single adults) when recovery feasibility was assessed by CSORT in 2004, and 22 individuals (including six pairs) when recovery feasibility was re-assessed by CSORT 2005. The current 2018 status of spotted owl in BC allows retrospective consideration of the effectiveness of spotted owl management (including habitat and population management) since the last assessment by CSORT in 2005; SOMP2 is clearly not achieving the desired recovery outcome.

Although actions required to allow recovery, given current conditions and current management by the Province, seem daunting under the SARA the province is obligated to try as recovery is technically and biologically feasible. The ECCC toolbox, and the SARA, specify use of a precautionary approach, where *"...species for which recovery feasibility is unknown would be considered recoverable until proven otherwise"*. In this assessment recovery is still deemed technically and biologically feasible but it is clear that the Province will face several significant logistical, societal and economic challenges. Recovery actions need to be implemented more conservatively (with regards to timber harvest in spotted owl habitat), with strict adherence to scientific principle and without delay for improved habitat protection if the Province faithfully intends to successfully recover spotted owls in BC.

¹⁹ In favor of the captive breeding program survivorship of captive owls is higher – in the wild longevity is estimated at ~15-17 years whereas in captivity one individual owl, kept by E. Forsman, survived for 32 years.

20. Attached is a document prepared by the Canadian Spotted Owl Recovery Team (“CSORT”) that we refer to as the Action Plan Guidance. What is your understanding of the nature of this document?

Synopsis: The 2007 Action Plan Guidance document was prepared by CSORT to supplement the 2004 Recovery Strategy and to provide further guidance to the Province during the development of SOMP2. Being based on the best available science at the time, it was meant to encourage and facilitate compliance with SARA requirements in identification of Critical Habitat for spotted owl.

The document titled “Guidance and Some Components of Action Planning for the Northern spotted owl in British Columbia” (Chutter et al. 2007) is more concisely referred to by WC (and herein) as the “Action Plan Guidance” document. This document was prepared by CSORT to identify actions, considered reasonable in 2007, recommended to protect and recover spotted owls in Canada. The 2007 document was intended as a companion document to the previously submitted CSORT spotted owl recovery strategy²⁰ (Chutter et al. 2004) as the 2004 Recovery Strategy was not considered compliant with SARA requirements in identification of Critical Habitat for spotted owl. The 2007 Action Plan Guidance document was presented with the caveat that it “*did not necessarily represent the individual perspectives of the people involved in its formulation, nor the official positions of the organizations represented by CSORT members; rather it represented consensus of the team member’s views on what is required to recover the Spotted Owl in British Columbia*” (Chutter et al. 2007). The information and recommendations identified in the Action Plan Guidance document were based on the best available science at the time of submission to the Province in 2007.

The two combined documents (i.e., the 2004 Recovery Strategy and the 2007 Action Plan Guidance document) were proposed to constitute a single recovery plan for submission to Environment Canada to meet the Province’s requirements under the federal *Species at Risk Act (SARA)*. The 2007 Action Plan Guidance document consistently referenced the results of the spotted owl habitat model I developed and provided “*recommendations for actions that should be implemented to reach the recovery goals and objectives set out in the recovery strategy; and provide(d) advice on considerations for Critical Habitat (designation)*” (Chutter et al. 2007). It was hoped that the Ministry of Environment would use the document as guidance in their recovery planning efforts (while developing SOMP2) and that the Province would consider the recommendations and advice provided by the document during their independent development of SOMP2.

After its submission to the Province, by CSORT, the Province assigned responsibility for spotted owl management in BC to the Species at Risk Coordination Office (SARCO). The SARCO then developed its own independent action plan for federal submission with the CSORT recovery strategy. This SARCO developed action plan was subsequently accepted by the Provincial Government and submitted with the CSORT recovery strategy to comply with SARA requirements. It is now referred to as SOMP2 and sets governance for spotted owl recovery in Canada.

²⁰ The 2004 CSORT Recovery Strategy provided a summary of scientific knowledge, current to April 2004, and represented advice to the Province to set recovery goals, including recommended approaches and objectives to protect and recover spotted owls in BC.

21. The CSORT states in the Action Plan Guidance that it was drafted to “identify reasonable actions required to protect and recover the Northern Spotted Owl in Canada” (at page v). How does BC’s current approach to protecting and recovering the Spotted Owl exceed, meet, or fall short of these actions?

Synopsis: The CSORT Action Plan Guidance requested and recommended habitat protection that was not met by the Province under the habitat conservation and management measures afforded by SOMP2, including recommendations to identify CH. SOMP2 instead placed far greater emphasis on captive breeding and barred owl control, whose success and shortcomings have been discussed. Overall, based on the lack of protection of suitable habitat and outcomes of additional management efforts, the Province’s current approach under SOMP2 falls short of the Province’s explicitly stated goal to protect and recover spotted owls in Canada.

When SOMP2 was released and endorsed by the Province SARCO claimed it was consistent with guidance provided in the CSORT Recovery Strategy (2004); however, in consideration of the differences in protection afforded to spotted owl habitat (versus recommendations outlined in the Action Plan Guidance document (2007)) SOMP2 did not afford an equivalent degree of protection relative to the CSORT Action Plan Guidance document. Most notably, SOMP2 did not afford protection to all available spotted owl habitat in BC, nor to all recently active spotted owl territories (as requested in Appendix 1 (interim measures)). Furthermore, SOMP2 did not allow any additional protection (relative to the impact already allowed under SOMP1) to spotted owl habitat with the species range. Under SOMP2 there were no adjustments made to AAC targets, for spotted owl, within the three NRD’s in which spotted owl was known to have occurred and no protection for spotted owl habitat in the Sunshine Coast NRD. This effectively meant that, relative to SOMP1, there would be no additional protection of existing habitat under SOMP2. Under SOMP2, management efforts were instead focused more heavily on population augmentation, supported by optimistic speculation of successes for captive breeding efforts (1) and barred owl control (2). These programs are summarized as follows:

- 1) After more than ten years in operation the captive breeding program has only bred eight spotted owls (one of which is not viable for release), which falls short of early projections for the program (predicated release of 200 owls in ten years). It is notable that the same program has removed at least ten owls from the BC wild population to augment the breeding ‘stock’ of 21 owls in captivity today. At least one, if not two, spotted owls have died during, or shortly after, capture. A spotted owl was diagnosed to have died from blunt-force trauma (in 2006) after capture was completed using noosing techniques (J. Gillis pers com 2006 and Dr. H. Schwantje (Provincial veterinarian)). There are rumors that a second owl was also lost during or shortly after capture, but this information is not publicly available. The current captive breeding stock includes three owls from the U.S., eight individuals successfully brought in from the wild, one owl hit by a car, and eight young produced by the program (I. Blackburn pers. com.).
- 2) The barred owl control program has effectively removed 189 barred owls (138 were captured and relocated; 51 were shot (Cox 2018)) with some noted benefit to resident spotted owls at removal sites (Gillis 2016a). The sustainability of these efforts is questionable in the context of effort, moral values, and counter-effects from natural recruitment rates of barred owls within the range of spotted owl in BC. Based on productivity and sympatric population estimates,

anticipated recruitment rates for barred owl are approximated at 5,400 new barred owls fledged within the spotted owl's range of in BC annually.

Together, and coupled with the fact that CH has still not been formally or appropriately identified under SOMP2 (as recommended on Page v of the 2007 Action Plan Guidance document) these statistics demonstrate that the Province's current approach under SOMP2 falls short of the Province's explicitly stated goal, and of obligations, as stated as a requirement under the federal *SARA*, to protect and recover spotted owls in BC.



*"For the animal shall not be measured
by man.
In a world older and more complete
than ours, they move finished and
complete,
gifted with extensions of the senses we
have lost or never attained,
living by voices we shall never hear."*

Henry Beston
Author (1888-1968)
"The Outermost House"

**The spotted owl conveys a message,
through its own decline, regarding the
management of old-growth forest
resources in BC. Will we be wise enough to
listen?**

Date: February 24, 2019

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Appendix 1: Image Catalogue

Image Description	Page/Figure Number	Location	Date
Spotted Owl (male)	Cover Page	Boulder Creek	June, 2004
Northern Spotted Owl	P.8	East Anderson Creek	June 10, 2010
California Spotted Owl	P.8	Oregon Caves NM	April, 2002
Mexican Spotted Owl	P.8	Scheelite Creek, Arizona	May 29, 2006
Stein Provincial Park	P. 12 / Figure 3	Scudamore Creek, BC	May 28, 2007
Upper Pitt	P. 12 / Figure 4	Upper Pitt River, BC	June 2002
Barred Owl	P. 14 / Figure 5	Logan Park, Victoria, BC	March 28, 2006
Spotted Owl (dead)	P. 14 / Figure 6	Stein Valley, BC	March 2004
Spotted owl adult and nestling in cavity nest	P. 17	Boulder Creek, BC	June, 2003
Spotted owl adult and nestlings in platform nest	P. 17	Boulder Creek, BC	June, 2002
Sockeye Creek nest	P 18	Sockeye Creek, BC	May, 2006
Logging truck	P. 20	Harrison, BC	June, 2004
Clear-cut near Texas Creek	P. 20	Texas Creek, near Lillooet, BC	September 14, 2011
Clear-cut near Anderson Creek	P. 34	Anderson Creek, near Boston Bar, BC	2001
Sub-adult Spotted Owl	P. 38	Anderson Lake, BC	January 2005
Anderson clear-cut	P. 39	East Anderson SRMZ	2000
Barred Owl (adult)	P. 42	Logan Park, Victoria, BC	March 27, 2006
Great Horned Owl	P. 42	Oak Bay, Victoria, BC	August 28, 2015
Billygoat Creek	P. 44	Baptiste, BC	September 18, 2009
Spotted Owl in flight	P. 46	Mowhokum Creek	June 10, 2010
Bushy-tailed Woodrat	P. 46	Lillooet, BC	August 21, 2014
Enterprise Creek	P. 55	Cayoosh Creek, BC	May 3, 2006
Mexican Spotted Owl	P. 68	Scheelite Creek, BC	May 29, 2006