COSEWIC
Assessment and Status Report

on the

Olive-sided Flycatcher
Contopus cooperi

in Canada

SPECIAL CONCERN
2018

COSEWIC
Committee on the Status of Endangered Wildlife in Canada

COSEPAC
Comité sur la situation des espèces en péril au Canada

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Olive-sided Flycatcher — Photo by John Reynolds.

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COSEWIC
Assessment Summary

Assessment Summary – April 2018

Common name
Olive-sided Flycatcher

Scientific name
Contopus cooperi

Status
Special Concern

Reason for designation
The Canadian population of this widespread forest songbird has experienced a substantial long-term decline, although the rate of decrease has slowed over the past decade. Loss of wintering habitat in northern South America is likely the greatest threat facing this aerial insectivore, but the species may also be affected by changes on the breeding grounds such as the effects of altered fire regimes and changing climates on nesting habitat quality, and reductions in the abundance and availability of aerial insect prey. Concerns for the species remain, as most of these threats are continuing, and those related to climate change may increase.

O Occurrence
Yukon, Northwest Territories, Nunavut, British, Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

Status history
Designated Threatened in November 2007. Status re-examined and designated Special Concern in April 2018.

COSEWIC
Executive Summary

Olive-sided Flycatcher
Contopus cooperi

Wildlife Species Description and Significance

Olive-sided Flycatcher (*Contopus cooperi*) is a medium-sized songbird, 18-20 cm in length. Adults are a deep brownish-olive above, with whitish extending from the throat, centre of breast and belly to the undertail coverts, contrasting sharply with the dark flanks and sides of the breast to appear vested. White tufts are also often visible above the wings on each side of the rump. The wings are dark with indistinct pale wing bars, and the bill is stout. Olive-sided Flycatchers tend to perch conspicuously atop tall trees or snags while foraging, giving their distinctive song—a loud three-note whistle: *Quick*, *THREE BEERS!*

Distribution

Olive-sided Flycatcher is a widespread migratory species, with 53% of its breeding range across most of forested Canada, and the remainder in the western and northeastern United States. The winter distribution is concentrated in northern South America, particularly in the Northern Andes Mountains in Colombia, Ecuador, and Peru, but also in western Brazil, Venezuela, and Bolivia. It is occasionally found wintering in other highland areas from Mexico through Central America, including parts of Guatemala, Belize, Honduras, and Costa Rica.

Habitat

Olive-sided Flycatcher is most often associated with edges of coniferous or mixed forests with tall trees or snags for perching, alongside open areas, or in burned forest with standing trees and snags. In natural conditions, these habitats may include open to semi-open mature forest stands, as well as mature stands with edges near wet areas (such as rivers, muskeg, bogs or swamps), burned forest, openings created by insect outbreaks, barrens, or other gaps. The species also uses forest stands adjacent to human-created openings (such as clearcuts, thinned stands, and prescribed burns). There is some limited evidence that birds nesting in and near harvested habitats experience lower breeding success than those nesting adjacent to natural (e.g., burned) openings. In the Rocky Mountains and westward, Olive-sided Flycatcher occurs in sparsely vegetated forests from sea level to 2250 m in proximity to wetland edge, whereas farther east, it is most frequently found near wetland areas or in recent burns.

Biology

Olive-sided Flycatcher is an aerial insectivore, generally making short foraging flights from a high perch to intercept flying insects. The egg and nestling stages in Canada can last from late May/mid-June to early/mid-August, depending on latitude. Olive-sided Flycatchers arrive on their Canadian breeding grounds between April and June, but predominantly around mid-May. They are socially monogamous, with large territories of 10-20 ha. Nests are typically built in coniferous trees. Average clutch size is three eggs, and a single brood is raised. Nest success ranges from 30 to 65%, differing by region and habitat type. Renesting is common if the first clutch fails. Olive-sided Flycatchers have been known to live for at least 7 years. Fall migration begins in late July, with most birds departing for the wintering grounds between mid-August and early September.

Population Sizes and Trends

Breeding Bird Survey (BBS) data indicate declines for Olive-sided Flycatcher in Canada, which are not significant in the short term (2.1% mean annual decline for the period 2006-2016, equating to a cumulative decline of 19%), but are significant in the long term (2.8% mean annual decline for the period 1989-2016, and a cumulative decline of 72% since 1970). Both short and long-term declines have been greatest in New Brunswick, British Columbia, Manitoba, and Yukon. Data from another large dataset (Boreal Avian Modelling Project) do not provide evidence of decline between 1997 and 2013.

Some migration monitoring stations report declining trends, though data are scarce. In the U.S. portion of the breeding range, there is evidence of northward range retractions in California, New Hampshire, and New York. Overall, evidence suggests that declines have continued over the past decade, though on average at a somewhat lower rate than previously.

Threats and Limiting Factors

Forest loss on the wintering grounds in Central and South America may be the most significant factor driving population declines. Insectivorous birds as a group have been experiencing declines, likely associated with widespread insect declines, pesticide use (particularly neonicotinoids), and changes in prey availability during the breeding season as a possible result of climate change. Habitat loss or degradation is likely affecting this species on both the breeding and wintering grounds. On the breeding grounds, this occurs through forest harvesting, anthropogenic disturbance such as development and service corridors, and changes in fire regimes associated with climate change and direct human intervention (fire suppression), all of which may reduce habitat quality and affect nest success.

Protection, Status, and Ranks

Olive-sided Flycatcher is classified as G4 (Apparently Secure) globally and in the United States, and N3 (Vulnerable) in Canada by NatureServe. Provincial and territorial breeding season rankings (except Nunavut, where it was not assessed) range from S1S3 to S4 (Critically Imperilled to Apparently Secure). All regional rankings have changed to be less secure since the last COSEWIC assessment in 2007. The IUCN Red List classified this species as Near Threatened in 2012 and again in 2016. Olive-sided Flycatcher is protected in Canada by the *Species at Risk Act* (2002), where it is listed as Threatened under Schedule 1. It is also listed on provincial species at risk legislation in New Brunswick, Nova Scotia, and Newfoundland and Labrador. It is protected in Canada under the *Migratory Birds Convention Act* (1994) and by similar legislation in the United States and Mexico.

TECHNICAL SUMMARY

Contopus cooperi

Olive-sided Flycatcher

Moucherolle à côtés olive

Range of occurrence in Canada: Yukon, Northwest Territories, Nunavut, British, Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

Demographic Information

Generation time	Unknown, but likely approximately 3 years, similar to most other small passerines.
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Yes, inferred.
Estimated percent of continuing decline in total number of mature individuals within 5 years.	Unknown.
Observed, inferred, or projected reduction in total number of mature individuals over the last 10 years.	Approximately -19%, based on BBS trend analysis.
Suspected percent reduction in total number of mature individuals over the next 10 years.	Approximately 3-30%, based on overall medium threat impact assessment.
Estimated percent reduction in total number of mature individuals over any 10-year period, over a time period including both the past and the future.	Approximately 15-20%, based on BBS trend analysis and mid-range of overall medium threat impact assessment.
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	a. Some but not others. b. Some but not others. c. No.
Are there extreme fluctuations in number of mature individuals?	No.

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	5.18 million km²
Index of area of occupancy (IAO) (Always report 2x2 grid value).	90,000 to 920,000 km²
Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No. b. No.
Number of “locations”* (use plausible range to reflect uncertainty if appropriate)	Unknown, but >>10
Is there an observed, inferred, or projected decline in extent of occurrence?	Unknown. Range retraction is likely in the south, but northward expansion may be possible.

* See Definitions and Abbreviations on COSEWIC website and IUCN (Feb 2014) for more information on this term

Is there an observed, inferred, or projected decline in index of area of occupancy?	Unknown. Declines are projected for southern parts of the range, but northward expansion is possible.
Is there an observed, inferred, or projected decline in number of subpopulations?	No.
Is there an observed, inferred, or projected decline in number of “locations”*?	No.
Is there an observed, inferred, or projected decline in area, extent, and quality of habitat?	Yes, inferred.
18. Are there extreme fluctuations in number of subpopulations?	No.
Are there extreme fluctuations in number of “locations”∗?	No.
Are there extreme fluctuations in extent of occurrence?	No.
Are there extreme fluctuations in index of area of occupancy?	No.

Number of Mature Individuals (in each subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
National population	900 000 – 9.2 million
Total	900 000 – 9.2 million

Quantitative Analysis

Is the probability of extinction in the wild at least 10% within 100 years?	Unknown; analysis not conducted.

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species?

Yes; four threat categories were recognized as having a low to high impact on this species (Appendix 1):

- Category 2: Agriculture and aquaculture (low to high), primarily the conversion of forests to agricultural croplands or livestock grazing areas on the wintering grounds
- Category 7: Natural system modifications (low to high), primarily changes to fire regimes (fire suppression or increase in severity, depending on region) and decreases in abundance of insect prey
- Category 3: Energy production and mining (low), in relation to reductions in Olive-sided Flycatcher density associated with oil and gas developments
- Category 4: Transportation and service corridors (low), with respect to reduced Olive-sided Flycatcher density along linear features

Threats with impacts that may be significant but are currently unknown include biological resource use (Category 5, specifically forest harvesting), invasive and problematic species (Category 8, with respect to increased predation), pollution (Category 9, in particular neonicotinoid pesticides and mercury), and climate change and severe weather (Category 11, considering habitat alteration, mismatch in timing of

insect prey availability, and mortality from storms). Threats from residential and commercial development (Category 1; collisions with buildings) are thought to be negligible. What additional limiting factors are relevant? The short breeding season, single brood raised, and very long migration may increase vulnerability of this species to adverse weather events.

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Declining (according to BBS data, US population declined 74.7% between 1966 and 2015). In states bordering Canada which have a breeding population, status is S4 (apparently secure) in Montana, Michigan, Vermont, and Maine, and S3 (vulnerable) in Washington, Idaho, New York, and New Hampshire
Is immigration known or possible	Possible.
Would immigrants be adapted to survive in Canada?	Yes.
Is there sufficient habitat for immigrants in Canada?	Yes.
Are conditions deteriorating in Canada?[+]	Unknown but likely.
Are conditions for the source population deteriorating?[+]	Yes.
Is the Canadian population considered to be a sink?[+]	No.
Is rescue from outside populations likely?	No.

Data Sensitive Species

Is this a data sensitive species? No.

Status History

COSEWIC: Designated Threatened in November 2007. Status re-examined and designated Special Concern in April 2018.

[+] See Table 3 (Guidelines for modifying status assessment based on rescue effect)

Status and Reasons for Designation:

Status: Special Concern	**Alpha-numeric codes:** Not applicable
Reasons for designation: The Canadian population of this widespread forest songbird has experienced a substantial long-term decline, although the rate of decrease has slowed over the past decade. Loss of wintering habitat in northern South America is likely the greatest threat facing this aerial insectivore, but the species may also be affected by changes on the breeding grounds such as the effects of altered fire regimes and changing climates on nesting habitat quality, and reductions in the abundance and availability of aerial insect prey. Concerns for the species remain, as most of these threats are continuing, and those related to climate change may increase.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Estimated rate of decline in total number of mature individuals does not meet thresholds.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. EOO and IAO exceed thresholds.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Total number of mature individuals exceeds thresholds.
Criterion D (Very Small or Restricted Population): Not applicable. Total number of mature individuals exceeds thresholds.
Criterion E (Quantitative Analysis): Analysis not conducted.

PREFACE

Olive-sided Flycatcher was previously assessed in 2007, at which time it was designated Threatened (COSEWIC 2007). This species has been subject to dedicated study since the previous assessment and subsequent listing under Canada's *Species at Risk Act*. New research has updated population projections, investigated regional habitat requirements, and engaged in species distribution modelling to examine abundance and population density. This work has refined estimates of declines, as well as proposed new hypotheses for threats and limiting factors.

Key national actions that have been implemented include initiating research projects to determine migratory connectivity between Canadian breeding populations and wintering populations (Hagelin pers. comm. 2017; Stehelin pers. obs.), completing modelling of species distribution nationally and regionally (Psyllakis and Gillingham 2009; Haché *et al*. 2014; Westwood 2016); completing Bird Conservation Strategies for Canada that include provisions for management of Olive-sided Flycatcher; surveying for this species by the Department of National Defence on its lands; and inclusion of Olive-sided Flycatcher during environmental assessments and land-use development projects (Environment Canada 2016). The Boreal Avian Modelling Project (BAM) and Environment and Climate Change Canada (ECCC) have partnered on a project to support the definition and identification of critical habitat for this species (Schmiegelow pers. comm. 2017).

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2018)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service

Environnement et Changement climatique Canada
Service canadien de la faune

Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Scientific name: *Contopus cooperi*

English name: Olive-sided Flycatcher

French name: Moucherolle à côtés olive

Classification: Class: Aves, Order Passeriformes, Family Tyrannidae

Morphological Description

Olive-sided Flycatcher is a medium-sized songbird, 18-20 cm in length. Its plumage is deep brownish olive-grey above and on sides and flanks, strongly contrasting with the white breast and belly (Altman and Sallabanks 2012; Figure 1). The wings are dark, with indistinct pale greyish wing bars and white edging to the tertial and inner secondary feathers. The tail appears relatively short. The bill is stout, with the upper mandible blackish and the lower mandible pale with a dark tip. The bird often shows an erect crest on the head (Altman and Sallabanks 2012). The sexes are similar in appearance, although males average slightly larger (male wing length: 103-117 mm, female wing length: 96-109 mm, Pyle 1997). Juveniles are similar to adults, except that their upperparts are brownish and the wing bars and tertial feather edges are buffy (Altman and Sallabanks 2012). Olive-sided Flycatcher is distinguished from the similar Eastern Wood-Pewee (*C. virens*) and Western Wood-Pewee (*C. sordidulus*) by its song, larger size, stockier build, and distinctive plumage (COSEWIC 2008; Altman and Sallabanks 2012).

Figure 1: Olive-sided Flycatcher on a tree-top perch. Photo taken at Colony Farm, Coquitlam, British Columbia, by John Reynolds.

Population Spatial Structure and Variability

Studies have not been completed to examine whether geographical, ecological, or behavioural barriers exist to movement that may create genetic or demographic isolation for this species.

Designatable Units

The designatable unit considered is the entire Canadian population of Olive-sided Flycatcher. There are no known subspecies or varieties. Ongoing work evaluating migratory pathways and genetic relatedness may in future identify discrete and evolutionarily significant populations, but there is no evidence to support more than one designatable unit at this time.

Special Significance

The majority of this species' breeding range (53%) occurs in Canada (BirdLife International 2016), and it is representative of northern forests. Olive-sided Flycatcher is familiar to many Canadians, particularly because of its loud and easily recognizable song, a loud three-note whistle: *Quick, THREE BEERS!,* which it gives from conspicuous perches atop tall trees or snags, and which can be heard from up to 1 km away.

DISTRIBUTION

Global Range

Olive-sided Flycatcher has a wide breeding range across Canada and the western and northeastern United States (Figure 2). The highest breeding densities are found west of the Rocky Mountains from Alaska, through Yukon to northwestern British Columbia (Altman and Sallabanks 2012; Partners In Flight Science Committee 2013a; Haché *et al*. 2014). It winters primarily in the Northern Andes Mountains, particularly in Colombia, Ecuador, and Peru, but also western Brazil, Venezuela, and Bolivia. It is occasionally found wintering in other parts of Central America, such as Panama, as well as elsewhere in South America, including Guatemala, Belize, Honduras, and Costa Rica (Hagelin pers.comm. 2017; Partners In Flight 2018).

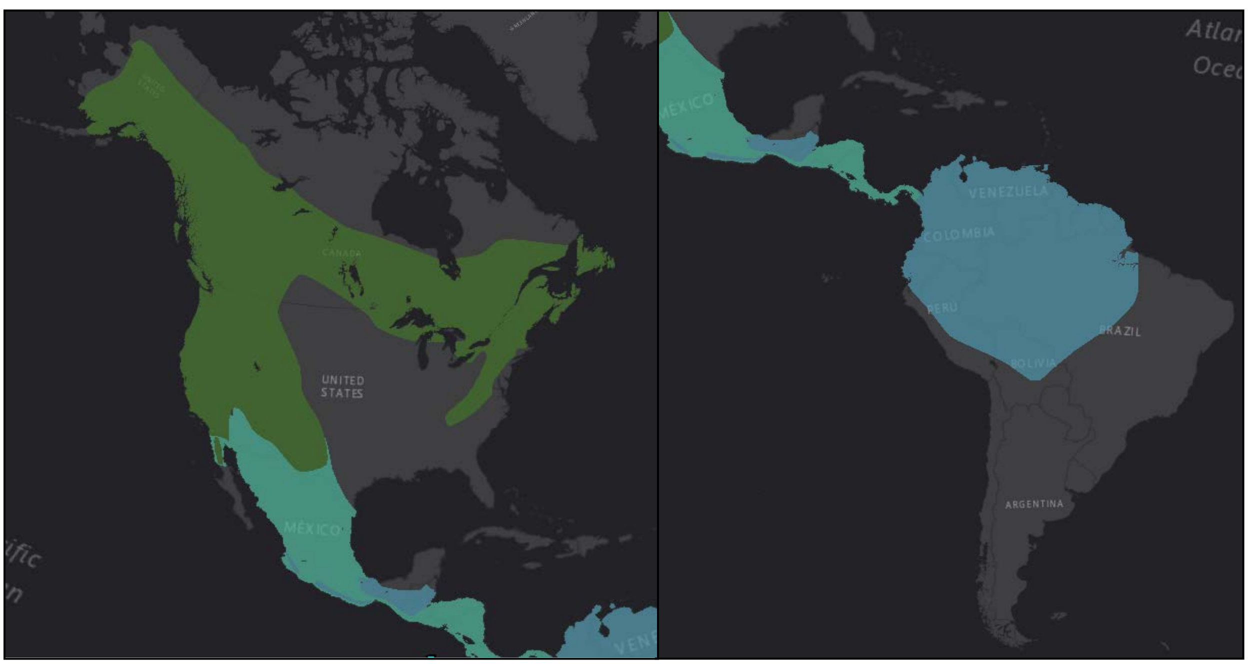

Figure 2: Global range of Olive-sided Flycatcher, showing breeding-only range (green), migration-only range (teal), and wintering range (blue). Data from BirdLife International (2016).

Canadian Range

Olive-sided Flycatchers breed throughout most of forested Canada. In Yukon, it breeds in forested valleys throughout much of the territory, north at least to the Porcupine River (Sinclair *et al*. 2003; eBird 2017). In the Northwest Territories, Olive-sided Flycatcher is found north to the Gwich'in Settlement Area, as well as east and west of Great Slave Lake and Great Bear Lake and has been documented at many sites across the southern edge of the territory (NT/NU Bird Checklist Survey Database; Upham-Mills unpublished data; eBird 2017). Olive-sided Flycatchers breed in most forested areas of British Columbia (except Haida Gwaii; Campbell *et al*. 1990; eBird 2017) and Alberta (except the southern parkland and grassland regions; McGillivray and Semenchuk 1998; eBird 2017). During the most recent Breeding Bird Atlas in British Columbia, probability of observation was highest on southern Vancouver Island as well as east of the Coast Mountains in the central plateau (Weber 2015). In Saskatchewan, Smith (1996) described Olive-sided Flycatcher as a fairly common summer resident throughout the subarctic and boreal forests. Although there are only sparse eBird data in the province from 2007-2017, this may be a factor of relatively low eBird use in Saskatchewan as compared to other provinces (eBird 2017). In Manitoba it has been recorded throughout much of the forested regions of the province (eBird 2017), and has been considered an uncommon breeder in the boreal forest (Manitoba Avian Research Committee 2003). During the most recent Manitoba Breeding Bird Atlas, breeding evidence was documented most heavily in the north-central part of the province (Manitoba Breeding Bird Atlas 2015). In Ontario it is widespread throughout the boreal forest zone and at lower densities in the Great Lakes-St. Lawrence forest to the southern edge of the Canadian Shield (Cheskey 2007; eBird 2017). Relative abundance was documented as highest in the northwest part of the province between the Severn River and Manitoba border as well as north of Lake of the Woods, in the north-central region near Winisk River Provincial Park, east of Lake Nipigon and north of Lake Superior (Cheskey 2007). A large area of high relative abundance was observed along the northeastern border of Québec and Ontario. In Québec it is widespread south of the 52nd parallel (Gauthier and Aubry 1996). Québec's most recent atlas documented breeding evidence across the southern part of the province, but Olive-sided Flycatcher was not observed in atlas squares north of La Grande Rivière Reservoir (AONQ 2018). Olive-sided Flycatcher is found throughout the Maritimes, although abundance in southeastern New Brunswick and western Prince Edward Island is low, with relative abundance highest in southwestern Nova Scotia, northeastern mainland Nova Scotia along St. George's Bay, western Cape Breton Island, and northwestern New Brunswick (Erskine 1992; Stewart *et al.* 2015). It is also found in Newfoundland and Labrador (eBird 2017).

Extent of Occurrence and Area of Occupancy

The majority (53%) of the species' breeding range is in Canada, based on data from Partners In Flight (2018). Estimates from a different dataset suggest that Québec and British Columbia together support about half of the current Canadian breeding population (Haché *et al*. 2014). Extent of occurrence is approximately 5.18 million km^2, while the index of area of occupancy is estimated at 90,000-920,000 km^2, given an average territory size of 20 ha and an estimated population of 450,000 to 4.6 million breeding pairs (see **Abundance**).

Search Effort

This species has been widely documented across its range by citizen scientists through eBird, the North American Breeding Bird Survey, Breeding Bird Atlases in British Columbia, Alberta, Manitoba, Ontario, Québec, and the Maritimes, and many independent research and monitoring projects (see **Sampling Effort and Methods**).

HABITAT

Habitat Requirements

Olive-sided Flycatcher uses coniferous or mixed forest (Burnett *et al*. 2008), often near water or wetlands in many regions (ON: Cheskey 1987; BC: Campbell *et al.* 1990; QC: Gauthier and Aubry 1996; YT: Sinclair *et al.* 2003; MB: Manitoba Avian Research Committee 2003). Specific associations with tree species, edge types, and wetland or upland conditions vary across the range. In western North America, Olive-sided Flycatcher can be found in both old growth forest (Carey *et al*. 1991; Schieck and Hobson 2000; Schieck and Song 2006) and early to mid-successional forests resulting from wildfire or timber harvest (Medin 1985; Medin and Booth 1989; Hutto 1995; Steventon *et al*. 1998; Davis *et al*. 1999; Lance and Phinney 2001; Meehan and George 2003; Schieck and Song 2006). In BC, this species breeds from sea level to 2250 m in a range of old or mature forest types near wetland edges, including low-elevation dry forests, spruce-dominated forests, and coastal Douglas-fir (Weber 2015; Norris pers. comm. 2017).

Olive-sided Flycatcher is most often associated with natural forest openings and other forest edges (especially along wetlands) or open to semi-open forest stands containing snags. Olive-sided Flycatcher requires habitat heterogeneity along high-contrast edges of two distinct habitats, most often occurring where mature forest meets burns, shrub fields, bogs, meadows, and other openings (Altman and Sallabanks 2012) or the edges of harvested forest, as long as there are tall snags and residual live trees for nesting, sallying, and foraging (Chambers 1999; Altman and Sallabanks 2012; Westwood 2016; Figure 1). Olive-sided Flycatcher abundance may be positively associated with insect outbreaks that create forest openings with dead snags, such as Spruce Budworm (*Choristoneura fumiferana*) in the eastern boreal forest (Bolgiano 2004) and Mountain Pine Beetle (*Dendroctonus ponderosae*) in the western montane areas (Weber 2015).

Some efforts have been made to discern habitat preferences among different edge types. Olive-sided Flycatcher may be associated with post-fire landscapes (Hutto and Young 1999), as it has higher abundance and occupancy in areas post-burn than in other types of clearing-forest edge interfaces (Hutto 1995; Meehan and George 2003; Kotliar 2007; Altman and Sallabanks 2012). In Minnesota, Olive-sided Flycatcher was most abundant seven years post-fire (Haney *et al*. 2008). Detection rates of this species are documented as higher in recent burns (Matsuoka *et al*. 2011), aligning with population density modelling by Haché *et al*. (2014), who also predicted higher densities in conifer and mixedwood stands with taller trees than surrounding areas, as well as landscapes containing habitat that is shrubby and wet, or had recent burns.

There are some regional differences in habitat associations. In the boreal forest of western Canada (BC, AB, SK, YT, NT) Olive-sided Flycatcher is often associated with mature forests (Norris pers. comm. 2017) generally associated with young forest (0-30 years) post-fire and post-clearcut harvest if residual live trees are retained (Morissette *et al*. 2002; Schieck and Song 2006). On the Pacific coast, it is associated with mature coastal forests (Weber 2015; Norris pers. comm. 2017). In Yukon, it is also found breeding in late seral stage forest with natural openings at mid-elevations, sometimes at treeline (940 m above sea level, Stehelin, unpublished data) and in old mixedwood forest (>125 years post-fire; Schieck and Song 2006). In the south-central portion of the breeding range, including Minnesota, it is found in Red Pine (*Pinus resinosa*) forests (Atwell *et al*. 2008), although there is no documented association with Red Pine forests in Canada. In eastern and northern boreal Canada, Olive-sided Flycatcher tends to be particularly associated with open habitat of muskeg, bogs and swamps dominated by spruce (*Picea* spp., particularly Black Spruce, *Picea mariana*) and Tamarack (*Larix laricina*) (WRCS Inc. and Silvitech Consulting 1996; Hagan *et al*. 1997; Azeria *et al*. 2011; Anctil *et al*. 2017). In Québec, Anctil *et al*. (2017) reported breeding Olive-sided Flycatchers in a harvested landscape of Black Spruce-moss forests with high ratios of forest edges and wetlands. In the Atlantic Provinces, Olive-sided Flycatcher is found in forested areas where scattered trees remain after clearcutting or fire, as well as mature stands of Black Spruce adjacent to bogs, fens, beaver ponds, or clearcuts (Erskine 1992; Stewart *et al.* 2015; Westwood 2016). The species is less common in areas dominated by hardwoods, or where dense young second-growth forest has developed after fires or farm abandonment (Erskine 1992).

Nests are generally in conifers, towards the tips of branches in some regions. They are constructed of twigs, arboreal lichens, and rootlets, and may be lined with grasses and pine needles (Altman and Sallabanks 2012). In Alaska, they are built at an average of 6.4 m above the ground (range 3-12 m; Wright 1997). In Ontario, nests are most often placed in conifers, such as White Spruce (*Picea glauca*), Black Spruce, Jack Pine (*Pinus banksiana*) and Balsam Fir (*Abies balsamea*; Peck and James 1987), while in Nova Scotia and Québec, nests have exclusively been observed in Black Spruce (Westwood 2016; Anctil *et al*. 2017). In Alaska, Wright (1997) found that nests were predominantly (81%) in live coniferous trees that were slightly shorter than the surrounding canopy. In Yukon, 15 nests were placed at 8.5 m (± 0.5) m above the ground, in live White Spruce that averaged 11.5 m (± 0.4 m) tall and most were placed on branches near the trunk (Stehelin, unpublished data). Of ten nests observed in Northwest Territories, eight were placed in live Black Spruce, and two in snags, at an average nest height of 4.8 m and average nest tree height of 7.6 m (Upham-Mills, unpublished data).

Open areas with tall trees or snags for perching are required for foraging, where individuals sally forth from a high, prominent perch to intercept flying insects (including Hymenoptera, Diptera, Lepidoptera, Odonata, and other insect groups) and then typically return to the same perch (Altman and Sallabanks 2012). This habitat structure is used throughout the year. In Alaska, perches used by males while singing were 1.4 times taller than the surrounding canopy and generally located in White Spruce with a dead top, or completely dead White Spruce trees (Wright 1997). In Québec, a tendency to choose taller trees for sallying perches was also observed, although it was not statistically significant (Anctil *et al*. 2017). Territory sizes for this species are relatively large, and vary depending on landscape features, but generally range between 10 and 20 ha (Wright 1997; Altman and Sallabanks 2012). In California, territories as large as 45 ha have been documented (Bock and Lynch 1970).

The primary wintering habitat for this species is in the Andean foothills (BirdLife International 2016), where its typical habitat is mature forests bordering wetlands, burns, blowdowns, or clearcuts with remnant snags or live trees. Although generally wintering at elevations of 800-2,000 m, this species has been observed from 50-4,000 m (Hagelin n.d.; Altman and Sallabanks 2012; de Lima Pereira 2016).

Habitat Trends

The amount of mature forest on the breeding range has decreased over the past century or more, with declines still ongoing (Pasher *et al.* 2013). The boreal forest is estimated to support 57% of the Olive-sided Flycatcher population (Boreal Songbird Initiative 2012), and approximately 20% of the boreal forest has been affected by anthropogenic disturbance (Wells *et al*. 2014). Fire, forest harvesting, and other disturbances are also impacting habitat availability and quality across the breeding range, though impacts have not been well qualified.

The impacts of disturbances that increase the amount of edge on the landscape vary depending on their type and configuration, as well as the region in which they occur. In the western portion of the breeding range, Meehan and George (2003) found that Olive-sided Flycatcher was more abundant in a fragmented landscape of late-seral Douglas-fir (*Pseudotsuga menziesii*) and Western Hemlock (*Tsuga heterophylla*) with a high density of edges than in unfragmented forest. Occupancy and abundance of Olive-sided Flycatcher seem to be influenced by the type of forest management techniques used (including clearcutting, thinning, block retention, and other treatments). In Minnesota, Atwell *et al*. (2008) only observed Olive-sided Flycatcher in those Red Pine forests which had undergone an experimental partial harvesting treatment to create gaps, and not in intact forests, but densities were too low to test for significance. Similarly, on Vancouver Island, of three harvesting treatments (control, group retention, and clear-cut), Olive-sided Flycatcher was found only in group retention blocks (Preston and Harestad 2007). In Oregon, habitat availability is expected to decrease with ongoing clearcutting over the next 50 years, and then predicted to increase again once regrown stands are thinned (Spies *et al*. 2007). In Québec, Olive-sided Flycatchers prefer to nest in recent cuts of mixed stands having more forest edges than in random plots at the territory level, and 41.8% of forest edges within Olive-sided Flycatcher territories were associated with wetlands (Anctil *et al.* 2017). More than 90% of the mixed stands within nesting territories resulted from forest harvesting, mainly clearcutting (mean age: 20 years, range 4-34 years). Thus, the species selected for cut blocks, whether recent or older (Anctil *et al.* 2017).

Given that Olive-sided Flycatchers use anthropogenically created forest gaps, Erskine (1992) suggested that the amount of suitable habitat may have actually increased in eastern Canada since European settlement. However, the continued decline of Olive-sided Flycatcher across its breeding range (BirdLife International 2016) suggests that either breeding habitat supply is not the only concern for this species, or that early successional forests created by timber harvest are unsuitable and may act as ecological traps. Robertson and Hutto (2007) found that pairs nesting in thinned forest in Montana had only half the breeding success of pairs nesting in a burned forest with natural openings. This was attributed to a higher abundance of nest predators in the thinned landscape, causing greater egg and nestling loss (Robertson and Hutto 2007). The difference in nest success was thought by Robertson (2012) to also be potentially related to differing perch availability in the two landscape types, but forest conditions and predators in Montana may differ in important ways from those in Canadian habitats.

Olive-sided Flycatcher was more abundant in burned areas than either unburned or burned and salvage-logged forests in Saskatchewan (Morissette *et al*. 2002), though time since burn is likely important (Meehan and George 2003). In the southern breeding range, attempts are generally made to suppress forest fires (Cumming 2005), which may have a negative influence on habitat supply. In lieu of natural fires, it is possible that forest harvesting may provide some of the required gaps and openings. In the southwestern portion of the breeding range, abundance has been documented as higher in forests where fuels are reduced by removing dense shrubs (Alexander *et al*. 2007). Salvage logging, which removes standing dead trees following a disturbance such as fire, would remove perches that are essential for foraging. In the western portion of the breeding range, fire size and intensity are expected to increase substantially with climate change (BC FLNRO 2014; Boulanger *et al.* 2014), which may remove current habitat and change future habitat availability. Western Canada, particularly British Columbia, showed high rates of forest loss from 2000-2012 as a result of logging, fire, and an outbreak of Mountain Pine Beetle (Hansen *et al*. 2013).

An alternative hypothesis for the population decline relates to habitat loss on the wintering grounds in South America (Altman 1999). Orejuela (1985) stated that by 1985, 85% of Andean montane forests had been significantly altered. Diamond (1991) predicted that, if habitat loss continued at 1991 rates, Olive-sided Flycatcher would lose 39% of its wintering habitat between 1980 and 2000, though this hypothesis was not subsequently evaluated. Significant forest alteration continues at high rates in areas thought to be important non-breeding areas for Olive-sided Flycatcher, such as Colombia and Western Brazil (Armenteras *et al*. 2006; Hansen *et al.* 2010). Estimates in some regions of Colombia are as high as 3.7% of forest cover loss per year (Armenteras *et al*. 2006). Recent geolocator and GPS data from birds migrating from breeding sites in boreal Alaska confirm that wintering grounds overlap with areas of high forest loss (Hagelin *et al*. 2014).

BIOLOGY

In recent years, much has been learned about Olive-sided Flycatcher breeding biology and migration. Its life history traits may limit its potential for population growth and recovery, given that it has a lengthy nesting period, one of the shortest breeding ground periods among passerines, and possibly the longest migration of any North American flycatcher species (Environment Canada 2016).

Life Cycle and Reproduction

Olive-sided Flycatcher is socially monogamous, with nesting pairs generally well-spaced (Altman and Sallabanks 2012). Territories often border other Olive-sided Flycatcher territories, or drainage features (Wright 1997). Alaskan breeding densities have been reported as 0.024 breeding adults/ha (Handel *et al*. 2009). Across all landscapes, predicted breeding densities across Canada range from 0.001 males/ha in Saskatchewan in Bird Conservation Region (BCR) 6 at the low end, to the highest values of 0.025 males/ha in Nova Scotia in BCR14 and 0.1 males/ha in Yukon in BCR 14 (Haché *et al*. 2014).

It was previously thought that pair bonds are formed when females arrive on the breeding territories, but recent evidence from tracked individuals in Alaska suggests that females arrive on breeding grounds before males (Hagelin *et al*. 2014). Females choose the nest site, construct the nest, and lay one egg per day for an average clutch size of 3 (range 2-5; Altman and Sallabanks 2012).

The egg and nestling stages in Canada can last from late May/mid-June to early/mid-August, depending on latitude (Rousseu and Drolet 2017). However, caution is advised when using predictions for this species in the northern part of its breeding range because they are based on relatively limited data. This nesting period was generated from predictive models based mainly on the mean annual temperature and using nest records from Project NestWatch (Bird Studies Canada 2018).

New World flycatchers (Tyrannidae) breeding in North America have the lowest reproductive rates of all passerines, and are not known to produce more than one brood per season (Altman and Sallabanks 2012). Adults show site fidelity, with Anctil *et al.* (2017) reporting that 11 of the 21 sites (52%) revisited were reoccupied the following year.

Only the females incubate, with males providing them food during this period. The incubation period ranges from 15-19 days. The female broods the nestlings for the first week, with both parents feeding the young. The nestling period lasts from 17-23 days. Females consume fecal sacs of young nestlings (Hagelin *et al*. 2015). Similar to other flycatchers, growth rates of young are slow, leading to a lengthy nestling period that may result in greater likelihood of nest predation (Kotliar 2007). Fledglings depend on parents for food for up to one week post-fledging (Altman and Sallabanks 2012), and remain on territory for up to 17 days after leaving the nest (Wright 1997). After fledging, young often remain close to the nest, and may remain together as a family until fall migration (Altman and Sallabanks 2012).

Several recent studies provide information on nest success. Of 13 monitored nests in Québec, 6 (46.2%) fledged young, 5 nests failed, and the outcome of 2 nests was undetermined (Anctil *et al.* 2017); in one nest, three young were found dead with no obvious cause. In central Alaska, 8 of 13 pairs (62%) fledged young, and in northwestern Oregon, 82 of 126 pairs (65%) fledged young (Altman and Sallabanks 2012). In southern Yukon, 80% of nests (n=14) fledged at least one young in each of two years of study (2014 and 2015, Stehelin unpublished data), and in Northwest Territories, seven of nine monitored nests had live nestlings in mid-July, though overall nest success is unknown (Upham-Mills unpublished data). A recent study in Alaska also reported relatively high nest success (80% of 41 nests fledged at least one chick 2013-2016; Baluss 2017). In Montana, Robertson and Hutto (2007) reported a 61% nest success in burned forest (n=18) but only 30% success in selectively harvested forest (n=18), with successful nests generally found under thicker canopy cover than unsuccessful nests. For nests in regenerating areas after forest fires, recentness of burn may be important, as nests have been shown to be more likely to fail in recently burned areas (Meehan and George 2003).

Very few data exist on lifespan and survivorship of adults. In central Alaska, in the 1990s, five of nine colour-banded adults (56%) returned to the breeding territory the following year (Wright 1997). A study of migratory survival currently underway indicates that ~30% of birds fitted with bands and geolocating devices returned to three different sites in Alaska over a three-year period (25 of 85 deployments recovered between 2014-2016; Hagelin *et al*. 2016). Two birds that survived at least seven years after first capture have been recovered during banding studies (one in California and one in Ontario; Altman and Sallabanks 2012).

Diet

Beal (1912) reported that Hymenopterans (bees, wasps, ants, etc.) accounted for 83% of stomach contents in 63 specimens from across the U.S. Hymenoptera also form a large component of the diet in the wintering grounds in Costa Rica (Sherry 1984). Percentages may have changed in recent decades due to widespread, massive declines in flying insect biomass (Hallmann *et al*. 2017). Meehan and George (2003) found that Coleoptera (beetle) remains formed a large part of Olive-sided Flycatcher feces in California (COSEWIC 2007). In Yukon, the most commonly observed prey types were Odonata (dragonflies and damselflies) and large Hymenoptera, followed by Diptera (flies; Stehelin unpublished data; Upham-Mills unpublished data). Ongoing work in Alaska is attempting to correlate insect biomass and type with Olive-sided Flycatcher occupancy (Haberski *et al*. 2016).

Physiology and Adaptability

There is no record of behavioural or physiological traits that may render this species vulnerable to anthropogenic activities or other dangers.

Dispersal and Migration

Olive-sided Flycatchers arrive in Canada between April and June, but predominantly in mid- to late May. They begin fall migration in late July to early August. Olive-sided Flycatchers travel as much as 8,000 km between their wintering and breeding grounds, with migration and wintering periods accounting for most of the annual cycle (COSEWIC 2008; Altman and Sallabanks 2012). Total annual distance travelled for breeders in Alaska ranged between 12,000 and 14,000 km (Hagelin *et al.* 2014). The availability of resources, changes to habitat, and inclement weather can all reduce survivorship of migrants during migration and winter (Moore *et al*. 1995). Ten Olive-sided Flycatchers fitted with geolocators in Alaska showed a clockwise migration pattern heading south across the central United States and Mexico to overwintering areas (southeastern Peru for females, southwestern Peru, Ecuador and Colombia for males) and returning to breeding grounds in Alaska using the west coast of North America (Hagelin *et al*. 2014). On average, these Alaskan-breeding birds spent only 71 days on the breeding grounds, yet 107 days travelling during migration (Hagelin *et al*. 2014). Banding data and geolocator data provide evidence that birds return to the same general area, with both breeding site and wintering ground fidelity (Altman and Sallabanks 2012; Hagelin *et al*. 2014), though geolocator data are not yet accurate enough to assess fidelity to winter territories (McKinnon *et al*. 2013).

During migration, Olive-sided Flycatchers use more riparian and non-coniferous habitats than while breeding. Habitat types likely used during migration include pine-oak, evergreen and semi-deciduous forests and edges (in Mexico and northern Central America), highlands (Honduras), and pine and oak forests and edges (Guatemala), and second-growth scrubby woodland (Costa Rica; Altman and Sallabanks 2012; Environment Canada 2014).

Interspecific Interactions

There are few known incidences of predation attempts on adults. Olive-sided Flycatcher remains have been found at a Peregrine Falcon (*Falco peregrinus)* eyrie in Alaska (Cade *et al*. 1968). Altercations between adult Olive-sided Flycatcher and Sharp-shinned Hawk (*Accipiter striatus*) were observed in two separate years in southern Yukon and one resulted in the death of an adult female flycatcher (Stehelin pers. obs.). Gray Jay (*Perisoreus canadensis)* is suspected to be an important nest predator (Anctil *et al*. 2017), although direct observations of predation have not been reported in Canada. In Oregon, a Gray Jay was observed taking two Olive-sided Flycatcher eggs (Altman and Sallabanks 2012). Both sexes aggressively defend the nest area, attacking both potential predators and human intruders. Robertson and Hutto (2007) suspect that increased predation was the primary cause for significantly reduced breeding success in thinned versus burned forest; Red Squirrel (*Tamiasciurus hudsonicus*), Gray Jay and Common Raven (*Corvus corax*) were all more than twice as common on harvested plots (Robertson and Hutto 2007). However, this study was conducted in Montana and may not be generalizable to Canada.

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

Olive-sided Flycatcher is conspicuous because of its loud song and tendency to perch on tall trees in open habitats. Wright (1997) found that the Breeding Bird Survey (BBS) protocol was well suited to detect Olive-sided Flycatcher if singing males were present. Its estimated effective detection radius is 146 ± 25 m in open conifer forest, and 154 ± 32 m in non-forest habitats, which is higher than other flycatchers and most passerines (Matsuoka *et al*. 2012).

Records for this species are included in three major scientific databases in Canada: the BBS, provincial Breeding Bird Atlases (BBA), and the Boreal Avian Modelling Project (BAM) database. The BAM database includes standardized point count data from both BBS and BBAs, as well as other projects (Barker *et al*. 2015). Several provinces have completed more than one BBA, allowing for regional estimations of changes in area of occupancy. These are Alberta (1st atlas: 1987-1992; 2nd atlas: 2000-2005; Federation of Alberta Naturalists 2007), Ontario (1st atlas: 1981-1985, 2nd atlas: 2001-2005, Cadman *et al*. 2007), Québec (1st atlas: 1984-1989, 2nd atlas: 2010-2014; AONQ 2018), and the Maritimes (1st atlas: 1986-1990, 2nd atlas: 2006-2010; Erskine 1992; Stewart *et al*. 2015). Additionally, British Columbia (2008-2012) and Manitoba (2010-2014) have recently completed their first atlases. Olive-sided Flycatcher is also documented at banding stations, where they are uncommonly captured because of their tendency to travel high in the canopy (DeSante *et al*. 2015) but are recorded through census data and other observations (see **Fluctuations and Trends**).

Sampling is biased towards southern regions, which are more easily accessible, and this is particularly so for the BBS (Machtans *et al*. 2014; Van Wilgenburg *et al*. 2015). Undersampling of more northern boreal forest leads to uncertainty about accuracy of population trends for this species. Even with some corrections for on- vs off-road sampling, prediction uncertainty is higher outside of heavily sampled areas (Haché *et al*. 2014). This uncertainty across much of the Olive-sided Flycatcher's breeding range may be a significant impediment to national and regional trend estimation (Dunn *et al*. 2005; Matsuoka *et al*. 2011).

Species distribution modelling is a common modern method for predicting suitable habitat and population densities, and has been used for Olive-sided Flycatcher. A national model was completed by Haché *et al*. (2014), and several regional models have been developed or are in development (Yukon: Stehelin pers. comm. 2017; British Columbia: Psyllakis and Gillingham 2009; Oregon: Spies *et al*. 2007 and Shirley *et al*. 2013; British Columbia: Norris pers. comm. 2017; California: Stralberg and Gardali 2007; Ontario: Weeber pers. comm. 2017; Wisconsin: Beaudry *et al*. 2010; Québec: Tremblay pers. comm. 2017; Atlantic Canada: Westwood 2016).

Abundance

Haché *et al*. (2014) used the national BAM dataset of Olive-sided Flycatcher presences and absences from 1990-2013 to derive a Canadian population estimate of 9.2 million (4.6 million males), with 60% concentrated in Bird Conservation Regions (BCR) 4 (Northwestern Interior Forest – BC, YK, NWT, AB), 8 (Boreal Softwood Shield – SK, MB, ON, QC, NL), and 12 (Boreal Hardwood Transition – MB, ON, QC). This estimate was an order of magnitude higher than others, such as Partners in Flight (PIF), who estimated the Canadian population at 900,000 individuals (Partners In Flight Science Committee 2013). Other estimates have placed the Canadian population at 450,000 birds (COSEWIC 2007), or a range of 50,000 to 500,000 adults (Environment Canada 2014).

The discrepancies among estimates reflect differences in estimation methods and underlying datasets. The estimates by Environment Canada (2014) and Partners In Flight Science Committee (2013) are based on BBS data, which consist of roadside point counts. In contrast, Haché *et al*. (2014) used BAM's point count database (Barker *et al*. 2015), 60% of which is off-road. Haché *et al*. (2014) postulated that the large discrepancies in population estimates were a result of BAM's more complete spatial dataset across the interior boreal forest. In addition, BAM and PIF use different strategies to correct for bias and effective detection distance (Sólymos *et al*. 2013). In general, estimation methods which use an effective detection radius (for this species, BAM used 121 m) approach as compared to a maximum detection distance (for this species, PIF used 300-400 m, depending on year) yield population size estimates 0.8-15 times greater (Matsuoka *et al.* 2012). Both estimates corrected for time of day with different equations. Combining the difference in approaches for this species accounts for a 3.75x multiplier for BAM estimates as compared to PIF, not including the impacts of roadside bias (Sòlymos pers. comm. 2018). However, Haché *et al.* (2014) may have overpredicted abundance in BCR4 and the Rocky Mountain Corridor (Sòlymos pers. comm. 2018). Actual population size is likely somewhere between the 900,000 estimated by PIF and the 9.2 million estimated by BAM.

Across its range, Olive-sided Flycatcher is patchily distributed and generally found at low densities. The average count of observed birds on BBS routes in Canada from 2005-2015 ranged from 0.01 birds/route (Manitoba) to 2.1 birds/route (Yukon; Smith unpublished data). Higher densities of birds were also observed in British Columbia (1.7 birds/route) and Nova Scotia (1.1 birds/route), with all other provinces and territories averaging less than one bird per BBS route (Smith unpublished data).

Fluctuations and Trends

BBS data indicate widespread long-term (Table 1) and short-term (Table 2) declines in Olive-sided Flycatcher populations across North America, some of which are significant (Environment and Climate Change Canada 2017). The mean annual population change for Olive-sided Flycatcher in Canada for 1970-2016 is estimated at -2.8% per year (range -3.5 to -2.1%), corresponding to a total population decline of 72% (range -62% to -80%). Long-term trends (27-46 years, depending on region) are significantly negative for all provinces and territories except for Newfoundland and Labrador and Northwest Territories, which are negative, but with an upper 95% confidence limit above zero. Long-term declines are greatest in Saskatchewan (-4.7% per year), New Brunswick (-4.5%), Manitoba (-3.60%), Yukon (-2.94%), and British Columbia (-2.91%). Global population loss over 44 years (1970-2014) was calculated at 78% (Rosenberg *et al.* 2016). Rosenberg *et al.* (2016) projected that if trends continue, the global population of Olive-sided Flycatcher could fall a further 50% in 24 years.

Table 1: Long-term population trends (27-46 years) from Breeding Bird Survey results for Olive-sided Flycatcher (Environment and Climate Change Canada unpublished data).

Area	Time Period	Annual Trend	95% Limits		Overall Reliability	N Routes	Percent of Breeding Population Sampled
			Lower	Upper			
Continental	1970-2016	-2.64	-3.10	-2.18	Medium	1373	45
Canada	1970-2016	-2.75	-3.46	-2.06	Medium	583	36
British Columbia	1970-2016	-2.91	-3.75	-2.09	Medium	142	37
Alberta	1970-2016	-2.66	-4.18	-1.15	Medium	80	33
Saskatchewan[1]	1989-2016	-4.70	-10.2	-0.05	Low	26	31
Manitoba[1]	1989-2016	-3.60	-5.44	-1.65	Low	43	38
Ontario	1970-2016	-1.60	-3.15	-0.002	Medium	119	47
Québec	1970-2016	-2.43	-3.77	-1.06	Medium	106	36
New Brunswick	1970-2016	-4.50	-5.45	-3.48	High	39	99
Nova Scotia / PEI	1970-2016	-1.94	-3.01	-0.88	High	39	96
Newfoundland and Labrador	1976-2016	-0.81	-3.54	2.71	Medium	14	32
Northwest Territories[1]	1989-2016	-1.99	-5.25	1.15	Low	23	7
Yukon	1973-2016	-2.94	-4.60	-1.32	Low	40	16

[1] – trends are presented over a shorter time period (1989-2016) for Saskatchewan, Manitoba, and Northwest Territories, because of very small sample sizes in earlier years, compromising the reliability of longer-term analyses

Table 2: Short-term population trends (10 years) from Breeding Bird Survey results for Olive-sided Flycatcher (Environment and Climate Change Canada unpublished data).

Area	Time Period	Annual Trend	95% Limits		Overall Reliability	N Routes	Percent of Breeding Population Sampled
			Lower	Upper			
Continental	2006-2016	-2.20	-3.63	-0.08	Medium	1231	48
Canada	2006-2016	-2.09	-4.27	1.32	Medium	531	37
British Columbia	2006-2016	-2.99	-5.30	-0.89	Medium	111	41
Alberta	2006-2016	-3.33	-8.61	0.20	Medium	74	18
Saskatchewan	2006-2016	0.30	-10.2	14.8	Low	22	7
Manitoba	2006-2016	-3.01	-5.70	1.36	Low	40	16
Ontario	2006-2016	-0.13	-3.20	7.35	Low	112	34
Québec	2006-2016	-0.61	-5.78	9.09	Low	92	26
New Brunswick	2006-2016	-4.48	-6.93	-1.42	Medium	30	99
Nova Scotia / PEI	2006-2016	-1.70	-4.81	2.14	Low	35	95
Newfoundland and Labrador	2006-2016	0.80	-3.97	12.9	Low	25	14
Northwest Territories	2006-2016	-2.06	-10.2	6.26	Low	21	8
Yukon	2006-2016	-3.13	-6.52	-0.49	Medium	35	29

For 2006-2016, the mean annual change in Canada was estimated at -2.1% (range -4.3% to +1.3%), equating to a cumulative change of -19% (range -35 to +14) over ten years; the probability of the decline over this period being steeper than -30% is 0.12 (Smith pers. comm. 2018). Over this period, the species was estimated to be declining in ten provinces and territories (significantly in Yukon, British Columbia, and New Brunswick), and increasing non-significantly only in Saskatchewan and Newfoundland and Labrador (Table 2). Estimated rates of decline over the short term were greatest in New Brunswick (-4.5% per year), Alberta (-3.3%), Yukon (-3.1%), and British Columbia (-3.0%). Although the annual index of decline over the past decade is lower than previously (Figure 4), the population continues to decline (Figure 5).

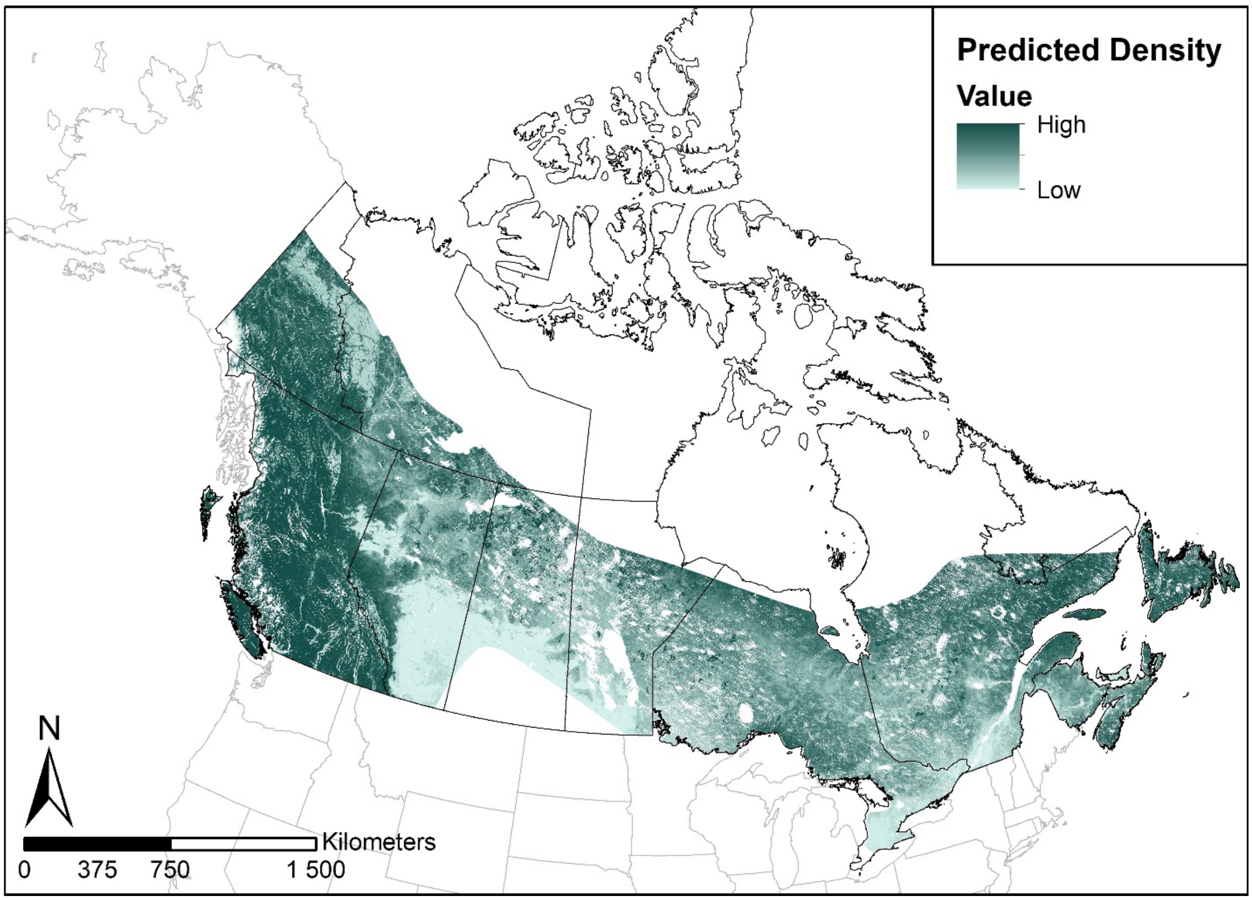

Figure 3: Population density model (territorial males/ha) of Olive-sided Flycatcher across forested regions of Canada within the range delineated by BirdLife International, based on habitat suitability only (Haché *et al*. 2014). Actual observations are not mapped.

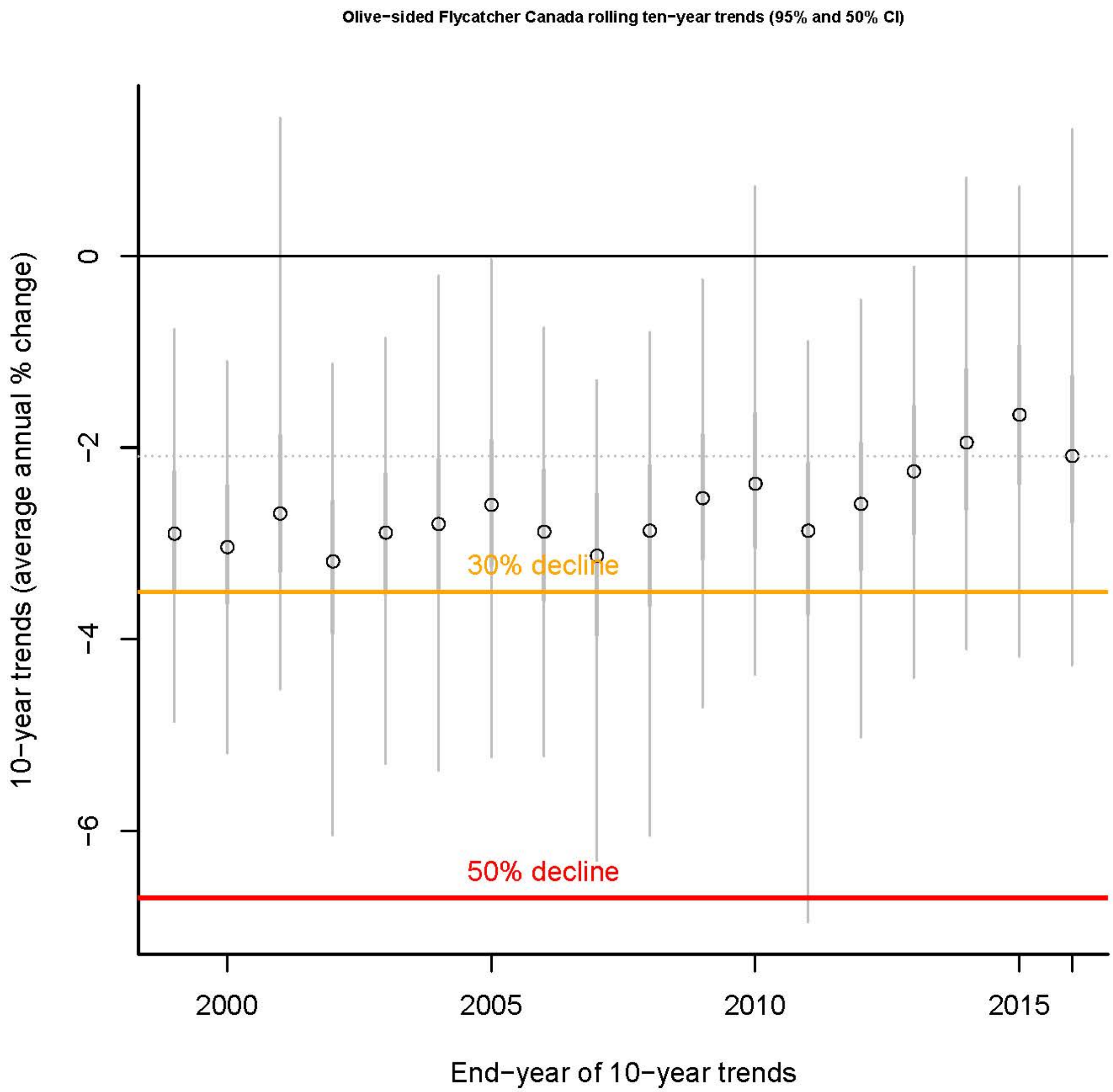

Figure 4: Average index of decline for the Olive-sided Flycatcher over a series of intervals, with each entry indicating the average for the prior ten years. Vertical lines represent 95% credible intervals and the horizontal orange and red lines represent rates of decline equivalent to 30% and 50%, respectively, over ten years (Adam Smith, Environment and Climate Change Canada, unpublished data). Although credible intervals are broad, the range of values of mean estimates varies relatively little across years, and is consistently negative, but at a rate less than that equating to a 30% decline over ten years.

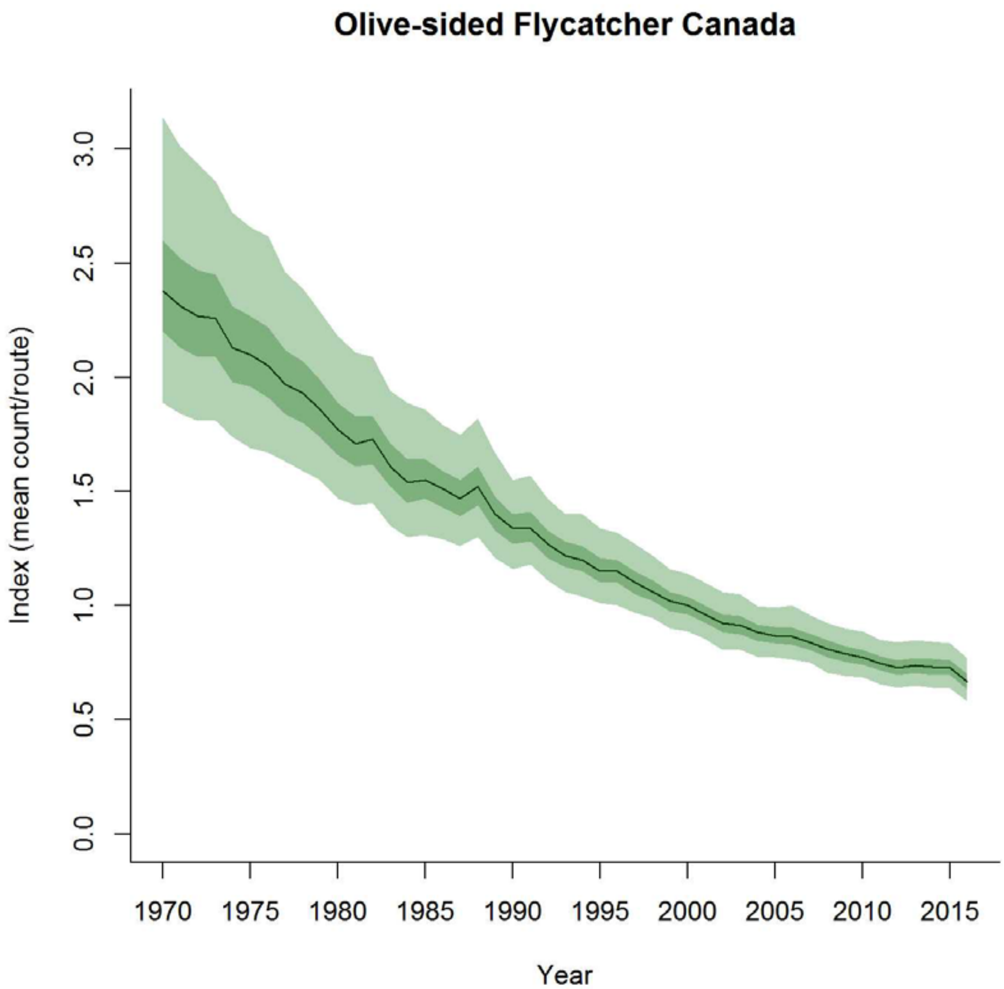

Figure 5: Annual index of population change for Olive-sided Flycatcher from 1970-2016 based on Breeding Bird Survey data. Light and dark green shaded areas depict upper and lower 95% and 50% credible intervals, respectively (Adam Smith, Environment and Climate Change Canada, unpublished data).

However, as reported in Table 1 and Table 2, the overall reliability of BBS trend estimates for many regions is low, and in many cases only a minority of the species' range is sampled by BBS routes, which are largely biased toward the south. Modelling by the Boreal Avian Modelling Project did not find evidence for a decline in the Canadian population of Olive-sided Flycatcher between 1997 and 2013 (Haché *et al*. 2014), likely due to estimation methods that differed from those used for BBS data (see **Abundance**). Overall, the species may be relatively stable or declining by as much as 19% over a ten-year period, but additional work is needed to improve estimate accuracy.

Other regional projects estimating population trends for this species, all in the southern part of the range, have reported declines. Combining datasets in the northern US, Ralston *et al*. (2015) estimated population trend in the northeastern US from 1989-2013 for Olive-sided Flycatcher at -4%/year (confidence interval -5% to -2%) overall. In the Midwestern region (around the Great Lakes) the trend was also -4%/year, but in the southeastern part of the range (Maine, New Hampshire, and Vermont) it dipped to an average of -5%/year. Species distribution modelling has indicated that probability of occurrence in Oregon decreased between 1995 and 2005 (Shirley *et al*. 2013)

Canadian Migration Monitoring Network trends from 1997-2006 showed that data for Olive-sided Flycatcher are sparse due to low rates of detection (Crewe *et al*. 2008). The only site with enough data to estimate a trend is Thunder Cape Bird Observatory on Lake Superior; there the fall trend is +8.1% annually (1995-2014) and +21.1% annually over the most recent ten-year period (2004-2014) that has been analyzed (Canadian Migration Monitoring Network 2017). Monitoring Avian Productivity and Survivorship (MAPS) data, ranging from 1992-2006, were relatively sparse for this uncommon species, with only 125 individuals banded and 20 between-year recaptures. Based on these data, this program reported a non-significant decreasing trend (-3.9% per year; DeSante *et al.* 2015). However, DeSante *et al.* (2015) acknowledged a paucity of data for this species, with the lowest mean adult population density (0.2 adults per station) of any analyzed species.

In the southern portion of the breeding range, declines are translating into changes in area of occupancy. Comparison with earlier records (e.g., Burleigh 1935) suggests that the range of the species has retracted northward since the first half of the 20th century. This retraction is predicted to continue. Documentation in New Hampshire suggests continuing range retraction northward across the state, indicating that latitude was the strongest predictor of extinction probability (Glennon 2009). In California, localized extirpations have been reported as have some range expansions into new areas of forest plantation, although the overall population trend is declining (Widdowson 2008).

In Alberta, declines were noted between the first (1987-1991) and second (2001-2005) atlas periods in the boreal forest, parkland, and foothills natural regions, which comprise the vast majority of the species' range in the province (Federation of Alberta Naturalists 2007). In Ontario, probability of occupancy in atlas squares declined from 37.5% (1981-1985) to 34.8% (2001-2005) between the two time periods, with the difference stronger and statistically significant in the Southern Shield region (63.6% to 43.6%; Cheskey 2007). In Québec, the number of squares where the species was detected increased between the first (703, 1984-1989) and second atlas (904, 2010-2014), but their proportion decreased from 28.6 to 22.5% (AONQ 2018). Probability of observation declined significantly between atlases, particularly in the southern Laurentian and Appalachian hills (Robert pers. comm. 2018). In the Maritimes, the species was observed in more squares in the second atlas (796 squares, 2006-2010) than the first (671 squares, 1986-1990); however, this reflects an increase in survey coverage, and taking this into account, the probability of occurrence was estimated to have declined overall, especially over much of New Brunswick, although there was an increase in upland regions of Nova Scotia (Stewart *et al.* 2015).

Rescue Effect

BBS results suggest that Olive-sided Flycatcher populations in the United States are undergoing similar declines to those observed in Canada (Sauer *et al*. 2015), and that northward range retraction is occurring (Glennon 2009; Hunt 2016). Olive-sided Flycatcher appears to use similar habitat in the United States and Canada, so immigrants would likely be adapted for conditions in Canada, and the close proximity between populations may facilitate immigration (COSEWIC 2007). Rescue of Canadian populations by populations in the United States is therefore possible, but unlikely unless reasons for population declines in the United States can also be identified and addressed.

THREAT AND LIMITING FACTORS

Threats

Aerial insectivores as a group, particularly in northeastern North America, have been exhibiting dramatic population declines (Nebel *et al*. 2010). Predominant causes of decline are likely habitat loss and degradation on both the breeding and wintering grounds, as well as losses of insects and insect-producing environments on the breeding, migratory, and wintering ranges. The threats to Olive-sided Flycatcher have been categorized below (and in **Appendix 1**) following the IUCN-CMP (International Union for the Conservation of Nature – Conservation Measures Partnership) unified threats classification system, based on the standard lexicon for biodiversity conservation of Salafsky *et al*. (2008). This resulted in an overall score for Olive-sided Flycatcher of medium. Threats are described below in order of greatest to least impact, followed by those for which there is uncertainty about scope and or severity.

<u>Category 2: Agriculture and aquaculture (low to high threat impact):</u>

Loss of wintering habitat may be the most significant factor in population declines for Olive-sided Flycatcher (Altman and Sallabanks 2012). Declines in forest cover in the wintering range have been severe and ongoing despite some local gains (Hansen *et al*. 2013). In the Colombian Amazon, most forest loss is related to conversion of land for cattle pasture (Hettler *et al*. 2017), although some is also attributable to other agriculture and logging. Comparisons between the effects of crop-based agriculture and livestock farming and ranching are not currently available. Geolocator data suggest that individuals from Alaska are wintering near logging/converted lands on the wintering range (Hagelin *et al.* 2014). Agriculture likely affects a restricted to large part of the Olive-sided Flycatcher population, and has a moderate to serious effect, for an impact of low to high.

Category 7: Natural system modifications (low to high threat impact):

Changes to fire regime may have mixed effects on Olive-sided Flycatcher. Increasing forest fire frequency and severity due to climate change (Balshi *et al*. 2009), particularly in the western part of the range (BC FLNRO 2014; Boulanger *et al.* 2014), may eliminate breeding habitat and also reduce insect availability over the short-term, though edges of burns can be attractive to Olive-sided Flycatcher. Conversely, fire suppression has reduced burned areas and lengthened fire cycles in parts of the boreal region (Cumming 2005). Fire suppression is typically conducted close to areas of human settlement, where most BBS routes are located. Thus, population trends based on BBS data may over-represent the impacts of fire suppression.

Reductions in prey populations are a threat over the entire life cycle (breeding, migration, wintering). These may result from various factors, including use of pesticides/herbicides, changing moisture regimes, habitat change from forestry or fire, or habitat loss due to land conversion. Globally, declines and range retractions of insects have been widely documented (Young *et al*. 2016). Declines of pollinator insects such as Hymenoptera, an important diet item on breeding and wintering grounds (Beal 1912; Sherry 1984), are widespread in North America (Potts *et al*. 2010), and habitat loss or degradation is estimated to have threatened or impacted over 90% of insect groups worldwide (Price *et al*. 2011).

Increasing use of neonicotinoid pesticides has been associated with declines in insectivorous birds in Europe, at least in part through reducing availability of insect prey (Hallmann *et al*. 2014), and are speculated as a factor in Olive-sided Flycatcher declines (Altman and Sallabanks 2012), although specific effects on this species have not been demonstrated. Health Canada has recently proposed to ban Imidacloprid, the most commonly used neonicotinoid pesticide, and to phase out all agricultural and most cosmetic uses within 3-5 years (Health Canada 2016). Whether this likely ban impacts concentration of neonicotinoids in the environment will depend upon its enforcement and what other agricultural chemicals become commonly used in the place of Imidacloprid. Negative impacts during migration may also be possible (Eng *et al.* 2017), suggesting that exposure outside of Canadian borders may have impacts.

Overall, natural system modifications are believed to affect a restricted to large proportion of Olive-sided Flycatchers, with a severity ranging from slight to serious, for an impact of low to high.

Category 3: Energy production and mining (low threat impact) and Category 4: Transportation and service corridors (low threat impact)

Although Olive-sided Flycatchers use disturbed landscapes (Altman and Sallabanks 2012), species distribution models predict lower densities in association with linear features and anthropogenic disturbances (Haché *et al*. 2014; Westwood 2016). Detection rates of Olive-sided Flycatcher in the boreal forest are lower near roads (Matsuoka *et al*. 2011). In Atlantic Canada, predicted densities of the species were lower in areas with a higher human footprint, as well as near roads (Westwood 2016). Predicted densities were also higher in protected areas than in managed areas, suggesting a sensitivity to anthropogenic disturbance and habitat fragmentation.

In Canada's boreal forest ecozone, recent increases in oil and gas development, mines, and their associated transportation and service corridors have resulted in the loss of nests of many bird species (Van Wilgenburg *et al*. 2013). These activities are likely to affect a small proportion of the population over the next ten years, with slight severity and a low overall impact.

<u>Category 11: Climate change and severe weather (unknown threat impact):</u>

Stralberg *et al.* (2015a) suggest that large avian distributional shifts may eventually occur in response to climate change. Applying their models to Olive-sided Flycatcher, population change based on climate is predicted to be -3.1% (confidence intervals -9.1 to 6.1%) between 2011 and 2040, with more severe declines in 2041-2070 (mean of -10.3%, confidence interval -26.6% to 3.7%; Stralberg *et al.* 2015b). However, due to limits to forest growth and succession, there may be lags between climate change and vegetation change. A 30-year vegetation lag would be expected to reduce core Olive-sided Flycatcher habitat by only 1%, compared to 23% for a 60-year lag (Stralberg *et al.* 2015c).

It is unknown what physiological tolerance limits related to climate exist for this species, or if habitat moves northward, how readily Olive-sided Flycatchers will be able to shift into new regions.

Changes in timing of insect emergence due to climate change may affect synchronization between Olive-sided Flycatcher hatching and peak food abundance. The prey-breeding temporal mismatch has been proposed to explain severe declines in Pied Flycatcher (*Ficedula hypoleuca*) (Both *et al*. 2006), as well as other migrant birds (Visser *et al*. 1998, 2006; Visser and Both 2005; Møller *et al*. 2008). Effects may be more severe for long-distant migrants such as Olive-sided Flycatcher (Visser and Both 2005; Both *et al*. 2006). The mismatch hypothesis has also been proposed to explain declines in Rusty Blackbird (*Euphagus carolinus*) (McClure *et al*. 2012), an insectivore with a breeding range overlapping that of Olive-sided Flycatcher (Westwood 2016).

Storms and extreme weather events have been documented as causing mortality in Olive-sided Flycatcher nestlings (Anctil *et al*. 2017). Large storm events (e.g., hurricanes) during migration have caused mass fatalities in other long-distance migrants, such as Chimney Swift (*Chaetura pelagica*) (Dionne *et al*. 2008).

In the short term (10 years), climate change may affect the population through extreme weather events, crossing thresholds of physiological tolerance, or changes in timing of insect emergence; however, given the many uncertainties, the impact of these threats is considered unknown.

Category 9: Pollution (unknown threat impact):

It is unknown whether neonicotinoids (see threat 7.3) or other pesticides or herbicides have direct lethal or sub-lethal physiological effects on Olive-sided Flycatcher. Extent and timing of exposure is also not known.

Mercury contamination has been documented as a threat for the Rusty Blackbird, which also preys on insects (COSEWIC 2006; Edmonds *et al*. 2010). Although Olive-sided Flycatchers have not been specifically tested for mercury contamination, they predominantly feed on insects with aquatic larval stages, and thus may be at risk for mercury bioaccumulation, particularly on the eastern part of the range. However, mercury levels from blood of breeding Olive-sided Flycatchers in Alaska were found to be relatively low compared to other songbirds (Hagelin, unpublished data).

Overall, all Olive-sided Flycatchers are likely to be exposed to at least some forms of pollution, but severity and therefore impact are unknown.

Category 5: Biological resource use (unknown threat impact):

The main biological resource use affecting Olive-sided Flycatcher is forest harvesting on the breeding grounds (forest harvesting on the wintering grounds is typically associated with deforestation for agriculture or pastureland). On the breeding grounds, the impacts of logging depend on the method used and the region in which it is employed (see **Habitat Trends**).

The addition of early seral habitat can contribute edge habitat for the species, and one study found occupied sites in harvested areas were similar in structure and composition to occupied sites with natural openings (Westwood 2016). Although these anthropogenically altered habitats may be attractive to Olive-sided Flycatchers, with similar structural features to early post-fire habitat, they might function as ecological traps where the birds experience lower breeding success (Robertson and Hutto 2007). In Montana, Robertson and Hutto (2007) found that nest success was twice as high in burned plots (n=18) compared to selectively harvested plots (n=18); reduced nest success was probably a result of relatively high abundance of nest predators found in the artificially disturbed forest. These findings are supported by data from Altman (1999), who reported that nest success for Olive-sided Flycatchers in the Cascade Mountains of west-central Oregon was highest in early post-fire habitats (62%, n=16) compared to semi-open forest (49%, n=33), to harvest units that retained trees (39%, n=89) or at the forest edge (33%, n=31). Contrasting findings were reported at the southwestern edge of the Olive-sided Flycatcher's range, northern California, where the species showed higher nest success in harvested areas (relative nest loss was 71% in burned areas and 20% unburned areas; Meehan and George 2003).

In Maine, abundance was higher in silvicultural thinning treatments (Hagan *et al*. 1997). Furthermore, Gauthier and Aubry (1996) have speculated that the large-scale clearcutting of older forests in eastern Canada may have changed forest structure to favour Olive-sided Flycatcher, which may explain the peak in their abundance in Québec in the

1980s. However, in Saskatchewan post-fire salvage logging reduced Olive-sided Flycatcher abundance (as well as abundance of most insectivorous birds; Morissette *et al*. 2002), likely by reducing snag and remnant stand availability. In Québec, the species favorably selected for nesting cut blocks, whether recent or older (Anctil *et al.* 2017). To date, the specific effects of forest harvesting on Olive-sided Flycatcher abundance and nest success are unclear, and likely depend on the type, timing, and location of harvesting.

Regional differences in population trends, though difficult to assess because of low sample sizes, may result from differing forest harvest practices that could impact nest predator and insect prey populations in different ways (COSEWIC 2007). Although forest harvesting is practised across a large proportion of the species' range, its severity and impact are unknown.

<u>Category 8: Invasive and other problematic species and genes (unknown threat impact):</u>

Although there is some documentation of predation by Red Squirrels, Gray Jays, and other natural predators (Altman and Sallabanks 2012; Anctil *et al*. 2017), predation rates are poorly quantified. It is unknown whether there are threats to Olive-sided Flycatcher related to predation and/or parasitism by invasive species.

<u>Category 1: Residential and commercial development (negligible impact):</u>

Collision with houses and other buildings in the U.S. is estimated to kill 2-9% of birds in North America annually (Loss *et al*. 2014), but less than 0.5% of the breeding bird population in Canada (Machtans *et al*. 2013). While there are few data on collisions specific to Olive-sided Flycatcher, the species largely avoids urban areas, and the impact of this threat is likely negligible.

Limiting Factors

This species has a very short breeding season compared to other passerines, and is only known to raise a single brood. This may predispose it to lower rates of recovery than other species. It also has the longest migration of any North American Flycatcher species, possibly increasing its exposure to adverse weather events and other risks associated with migration (e.g., loss or degradation of stopover habitat).

Number of Locations

Discrete locations of occurrences are not readily identifiable for this wide-ranging species. However, many of the threats as described above are regional or even site-specific in nature, and therefore the number of locations is certainly far greater than 10.

PROTECTION, STATUS, AND RANKS

Legal Protection and Status

Olive-sided Flycatcher (and its nest) is protected in Canada under the *Migratory Birds Convention Act* 1994, and paired legislation in the U.S. It also receives protection through the *Species at Risk Act* (SARA; Government of Canada 2002) under which it is listed on Schedule 1 as Threatened. As such, there are existing federal prohibitions from capturing, harming, killing, or collecting individuals of this species or its residence. Critical habitat has not yet been identified for protection. A federal Recovery Strategy exists for this species (Environment Canada 2016), which sets out a short-term population objective of halting the national decline by 2025. The long-term objective is to ensure a positive 10-year population trend after 2025. The distribution objective is to maintain the extent of occurrence of the population, as determined in 2016 (Environment Canada 2016).

Under provincial endangered species legislation, Olive-sided Flycatcher is listed as Special Concern in Ontario (S.O. 2007, Chapter 6). In Québec, the species is listed on the Liste des espèces susceptibles d'être désignées menacées ou vulnérables (list of wildlife species likely to be designated threatened or vulnerable), according to the *Loi sur les espèces menacées ou vulnérables* (RLRQ, c E-12.01) (Act respecting threatened or vulnerable species) (CQLR, c E-12.01). It is listed as Threatened in Manitoba (C.C.S.M. c E111), New Brunswick (S.N.B. 2012, c. 6), Nova Scotia (*Endangered Species Act 1998*, c. 11, s. 1. [amended 2010, c. 2, s. 99]), and Newfoundland and Labrador (SNL2001 CHAPTER E-10.1 [Amended: 2004 cL-3.1 s27; 2004 c36 s11]). The species is not listed under any other provincial/territorial endangered species legislation in Canada.

Non-Legal Status and Ranks

The most recent COSEWIC assessment of this species assigned a status of Threatened (COSEWIC 2007). NatureServe (2017) ranks the species globally as 'Apparently Secure', nationally as 'Vulnerable', and provincial/territorial rankings range from 'Critically Imperilled' to 'Apparently Secure' (Table 3). This species is not listed as 'Secure' for any portion of its range where it has been assessed.

Table 3: Global, national and provincial status for the Olive-sided Flycatcher (NatureServe 2015; Canadian Endangered Species Conservation Council 2016).

Location	Status	Description
Global	G4	Apparently Secure
USA	N4B	Apparently Secure
Canada	N3B	Vulnerable
Alberta	S3	Vulnerable
British Columbia	S3S4B	Vulnerable to Apparently Secure
Labrador	S3B	Vulnerable
Manitoba	S3B	Vulnerable
New Brunswick	S3B	Vulnerable
Newfoundland	S3B	Vulnerable
Northwest Territories	S1S3B	Critically Imperilled to Vulnerable
Nova Scotia	S2B	Imperilled
Ontario	S4B	Apparently Secure
Prince Edward Island	S2B	Imperilled
Québec	S3B	Vulnerable
Saskatchewan	S4B	Apparently Secure
Yukon	S3B	Vulnerable

Internationally, Olive-sided Flycatcher is listed by the IUCN as Near Threatened (BirdLife International 2016), and a number of watch lists include this species. It is a Partners in Flight species of high tri-national concern in Canada, the U.S., and Mexico (Berlanga *et al*. 2010). It is also coded yellow on the Audubon Watch List 2007 for the U.S., indicating national conservation concern due to a decline (Butcher *et al*. 2007). The species is on NABCI's watch list (North American Bird Conservation Initiative Canada 2016) with a concern score of 13, at the interface of moderate-high conservation concern. It is also on the Partners in Flight Watch list due to moderate threats on the breeding grounds and high non-breeding threats, as well as a steep continental population decline (Rosenberg *et al.* 2016). It is also listed as a species of special concern in many states in the U.S.

This species is listed in a number of Bird Conservation Region Strategies (e.g., Environment Canada 2013). It is also included in the multi-species action plan for 17 national parks, national park reserves, and national historic sites.

Habitat Protection and Ownership

Because Olive-sided Flycatcher is found in forested landscapes throughout Canada, the majority of its distribution lies on Crown lands, much of which is subject to forest management. Habitat protection must be carried out largely through forest management and fire management planning guidelines separately administered in each province and territory, and on federal lands (including Aboriginal lands). In some southern areas (e.g., Vancouver Island and the Maritime Provinces), significant habitat is also found on private landholdings. Critical Habitat has not yet been identified for this species.

Olive-sided Flycatchers breed in numerous provincial parks and Parks Canada Agency managed protected areas (see Table 4 for a list of national parks, national park reserves, and national historic sites, and associated breeding status), as well as on land held by private conservation agencies.

Table 4: Breeding status of Olive-sided Flycatcher in Canadian national parks, national park reserves, and national historic sites. Information collated from Managed Area Element Status Assessments (Parks Canada Agency 2016).

Confirmed or Highly Suspected Breeding Resident	Unconfirmed Breeding Resident or Migrant
Banff National Park	Beaubears Island National Historic Site
Cape Breton National Park	Bruce Peninsula National Park
Elk Island National Park	Chilkoot Trail National Historic Site
Forillon National Park	Fort Rodd Hill National Historic Site
Fundy National Park	Georgian Bay Islands National Park
Gros Morne National Park	Glacier National Park
Gulf Islands National Park Reserve	Kejimkujik National Park and Historic Site – Seaside Adjunct
Jasper National Park	Kluane National Park and Reserve
Kejimkujik National Park and Historic Site	Mingan Archipelago National Park Reserve
Kootenay National Park	Pacific Rim National Park Reserve
Kouchibouguac National Park	Point Pelee National Park
La Mauricie National Park	Thousand Islands National Park
Mount Revelstoke National Park	
Nahanni National Park Reserve	
Prince Albert National Park	
Prince Edward Island National Park	
Pukaskwa National Park	
Riding Mountain National Park	
Terra Nova National Park	
Wapusk National Park	
Waterton Lakes National Park	
Wood Buffalo National Park	
Yoho National Park	
York Redoubt National Historic Site	

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BIOGRAPHICAL SUMMARY OF REPORT WRITERS

Dr. Alana Westwood is a researcher whose focus is spatial modelling of the distribution of species as well as the effect of forest management practices and conservation policies on species at risk across Canada. Her PhD research examined the habitat associations and distribution of the Olive-sided Flycatcher, Rusty Blackbird (*Euphagus carolinus*), and Canada Warbler (*Cardellina canadensis*) in Nova Scotia. She works in both applied conservation and habitat management, as well as science policy. She is a contributing scientist to the Boreal Avian Modelling Project (www.borealbirds.ca), which engages in species distribution modelling of landbird species at a continental scale. She has published scientific papers relating to forest management and species at risk recovery, as well as numerous technical reports, conference proceedings, and workshops.

Tara Stehelin is a PhD candidate in the Department of Renewable Resources at the University of Alberta (2012 – 2017) and affiliate of the Boreal Avian Modelling Project. Her PhD research project focuses on Olive-sided Flycatcher and Western Wood-Pewee (*Contopus sordidulus*) breeding ecology, phenology, feeding habits, and migratory patterns in the southern Yukon, as well as more broadly on habitat associations in the northern and western boreal forest of North America. She also instructs and coordinates biology programs at Yukon College/Yukon University in Whitehorse, Yukon. She has published reports, conference presentations, and scientific papers on the evolution and functions of song in New World Flycatchers and on breeding ecology and behaviour of *Contopus* flycatchers, as well as completed a status report on the Western Wood-Pewee for Alberta (2016).

COLLECTIONS EXAMINED

No collections were examined during preparation of this Status Report.

Appendix 1. Threats Classification Table for Olive-sided Flycatcher.

Species or Ecosystem Scientific Name	Olive-sided Flycatcher *Contopus cooperi*			
Element ID			**Elcode**	
Date:	23/08/2017			
Assessor(s):	Alana Westwood (writer); Marcel Gahbauer (Birds SSC Co-chair); Kristiina Ovaska (facilitator); Mary Sabine (New Brunswick); Kaitlyn Cooper (GRRB); Pam Sinclair, Marc-Andre Villard & Liana Zanette (Birds SSC); Junior Tremblay, Sybil Feinman, Rich Russell, Kathy St. Laurent, Bruno Drolet, Alexandre Anctil & Ruben Boles (ECCC); Leah Ramsay (British Columbia); Julie Hagelin (Alaska).			
References:	COSEWIC status report (draft, June 2017)			

Overall Threat Impact Calculation Help:

Threat Impact		**Level 1 Threat Impact Counts: high range**	**low range**
A	Very High	0	0
B	High	2	0
C	Medium	0	0
D	Low	2	4
Calculated Overall Threat Impact:		Very High	Medium

Assigned Overall Threat Impact:	**C = Medium**
Impact Adjustment Reasons:	
Overall Threat Comments	This species has a very large range and many of the threats are poorly quantified. Due to high uncertainty, particularly regarding wintering ground impacts, Overall Threat Impact was assessed as medium, which is consistent with recent rates of decline. More information is needed to determine severity of several threats, most notably pollution and climate change; more information on migratory routes and better characterization of breeding ground populations would assist with more accurately quantifying scope of some threats.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1	Residential & commercial development		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	
1.1	Housing & urban areas		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	Information about building strikes is not known for this species. However, most of the Olive-sided Flycatcher range is outside major urban areas and it is not known to be a regular migrant through cities either. As such, the exposure to this threat is likely negligible, although severity would be serious for those affected, given the high rate of mortality from building collisions.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1.2	Commercial & industrial areas		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	As above.
1.3	Tourism & recreation areas						
2	Agriculture & aquaculture	BD	High - Low	Large - Restricted (11-70%)	Serious - Moderate (11-70%)	High (Continuing)	
2.1	Annual & perennial non-timber crops	BD	High - Low	Large - Restricted (11-70%)	Serious - Moderate (11-70%)	High (Continuing)	Conversion of forested habitat on the wintering grounds to agriculture via slash and burn techniques could seriously affect the population, though it is uncertain how much land conversion is for agriculture crops as compared to livestock (see 2.3). Further conversion of habitat on the breeding grounds to agriculture is unlikely. More information is needed about the wintering locations of breeding populations to accurately predict this effect.
2.2	Wood & pulp plantations		Unknown	Unknown	Unknown	Moderate (Possibly in the short term, < 10 yrs/3 gen)	The effects of reforestation on both breeding grounds and wintering grounds populations are unknown. Although it is possible that reforesting previously unsuitable areas (e.g. pasture on the wintering grounds) could benefit populations, even-age plantation forests may not provide suitable foraging structures. More study is required.
2.3	Livestock farming & ranching	BD	High - Low	Large - Restricted (11-70%)	Serious - Moderate (11-70%)	High (Continuing)	Conversion of forested habitat on the wintering grounds to agriculture via slash and burn techniques could seriously affect the population, though it is uncertain how much land conversion is for agriculture crops as compared to livestock (see 2.1). Further conversion of habitat on the breeding grounds to agriculture is unlikely. More information is needed about the wintering locations of breeding populations to accurately predict this effect.
2.4	Marine & freshwater aquaculture						
3	Energy production & mining	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
3.1	Oil & gas drilling	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Although Olive-sided Flycatchers use disturbed areas and fragmented landscapes (Altman and Sallabanks 2012), ongoing oil and gas development and supporting linear features, such as seismic lines, are negatively associated with breeding density (Hache *et al*. 2014). However, there are considerable uncertainties regarding the expansion rate of oil and gas drilling in Canada's boreal forest in the near future.
3.2	Mining & quarrying		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	Open-pit mines in forested areas cover a negligible part of the species range, but may have some impact by introducing linear features and removing habitat.
3.3	Renewable energy		Negligible	Negligible (<1%)	Serious - Moderate (11-70%)	High (Continuing)	Impacts of collisions with wind turbines have not been quantified for this species. Habitat may possibly be removed for wind turbine or solar installations, with serious to moderate consequences for those birds affected, but scope is likely negligible
4	Transportation & service corridors	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	
4.1	Roads & railroads	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Continued expansion of linear features into intact forest may negatively impact Olive-sided Flycatcher density, which has been lower near roads (nationally) and lower in areas of higher human footprint (regionally). Impact of new roads on the population is likely to be small (closer to 1%).
4.2	Utility & service lines		Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)	Given the relatively low numbers of large-scale transmission projects, this is not likely to affect a substantial proportion of the population. Rates of collision impacts with utility lines are not quantified for this species.
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use		Unknown	Restricted - Small (1-30%)	Unknown	High (Continuing)	
5.1	Hunting & collecting terrestrial animals						
5.2	Gathering terrestrial plants						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
5.3	Logging & wood harvesting		Unknown	Restricted - Small (1-30%)	Unknown	High (Continuing)	Logging on the wintering grounds is considered under 2.2 & 2.3, as it generally results in land-use conversion. On the breeding grounds, the impacts of logging may vary regionally and with type of harvest used. In some regions and under some cutting types, Olive-sided Flycatchers are positively associated with stand-level disturbances, which include forest harvesting where edge or some mature trees remain (Altman and Sallabanks 2012). One study suggest that such habitats are ecological traps for this species (Robertson and Hutto 2007), although there are contrary findings in other studies (e.g. Meehan and George 2003), and effects of harvesting on reproductive success are overall unknown. More information is needed regarding nest success under varying forestry practices.
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance						
6.1	Recreational activities						
6.2	War, civil unrest & military exercises						
6.3	Work & other activities						
7	Natural system modifications	BD	High - Low	Large - Restricted (11-70%)	Serious - Slight (1-70%)	High (Continuing)	
7.1	Fire & fire suppression		Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)	This section scores fire suppression only, as increases in fire as a result of climate change are scored under 11.1. This species is postulated to have evolved with fire, and removal of fire from the landscape will likely affect habitat availability and potentially nest success, though this may be on the longer term due to successional forest changes. Most of the range of Olive-sided Flycatcher is in the northern boreal forest, which is generally not subject to fire suppression.
7.2	Dams & water management/use						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.3	Other ecosystem modifications	BD	High - Low	Large - Restricted (11-70%)	Serious - Slight (1-70%)	High (Continuing)	Activities which reduce prey populations are a threat over the entire life-cycle (breeding, migration, wintering). These include, among others, pesticides/herbicides, habitat removal from forestry, and habitat removal from other forms of land conversion. Collectively, these are likely to affect a large to restricted portion of the population, but severity is variable depending on the effect, and may range from serious to slight, with more research required to understand consequences for this species.
8	Invasive & other problematic species & genes		Unknown	Unknown	Unknown	High (Continuing)	
8.1	Invasive non-native/alien species/diseases						
8.2	Problematic native species/diseases		Unknown	Unknown	Unknown	High (Continuing)	Though there is some documentation that predation by Red Squirrels and other natural predators may reduce nest success in areas affected by forestry (Robertson and Hutto 2007), predation rates are poorly quantified. It is unknown whether the effects of Red Squirrels, Brown-headed Cowbirds, or other possible predators or parasites on Olive-sided Flycatcher will increase.
8.3	Introduced genetic material						
8.4	Problematic species/diseases of unknown origin						
8.5	Viral/prion-induced diseases						
8.6	Diseases of unknown cause						
9	Pollution		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	
9.1	Domestic & urban waste water						
9.2	Industrial & military effluents						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.3	Agricultural & forestry effluents		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	Neonicotinoids have been implicated in aerial insectivore declines through indirect effects (see 7.3). It is uncertain what proportion of the population is directly exposed to agricultural pesticides on both the breeding and wintering grounds, and whether these chemicals have lethal or sublethal effects on this species. A potential ban is imminent for the most widely-used neonicotinoid in Canada.
9.4	Garbage & solid waste						
9.5	Air-borne pollutants		Unknown	Unknown	Unknown	High (Continuing)	Mercury contamination is affecting other insectivorous species in eastern Canada (e.g., Rusty Blackbird). Although Olive-sided Flycatcher has not been tested for contamination, it may be susceptible, given that the species preys on insects with aquatic larvae.
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	
11.1	Habitat shifting & alteration		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	Over the next 50 years, Stralberg *et al.* (2015) predict a considerable change in range, but over the next ten years the severity of this effect is considered unknown. Increases in forest fire frequency, extent, and severity as a result of climate change could remove suitable habitat for Olive-sided Flycatcher
11.2	Droughts						
11.3	Temperature extremes		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	Unusual cold weather events could affect insect abundance, but severity of effects within the next decade is unknown.
11.4	Storms & flooding		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	Intense storms during nesting can affect nestling survival, and storms may pose a threat over the course of lengthy migrations. However, these effects have not yet been quantified.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.5	Other impacts		Unknown	Pervasive - Restricted (11-100%)	Unknown	High (Continuing)	A temporal prey mismatch due to climate change has been proposed as a hypothesis for declines in aerial insectivores, and this may increase as climate change progresses, but severity remains unknown.