

Olive-sided Flycatcher, Contopus cooperi in New Brunswick: Status Report



Prepared for:

Committee on the Status of Species at Risk in New Brunswick (NB COSSAR) Natural Resources and Energy Development

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This document, "Olive-sided Flycatcher *Contopus cooperi* in New Brunswick: Status Report", has been drafted by Marc-André Villard for the New Brunswick Department of Natural Resources and Energy Development for use by the Committee on the Status of Species at Risk (COSSAR) in New Brunswick. It is intended to be a supplemental report to the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC) document "COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada 2018".

The material presented in this report is intended to provide information relevant to the status of Olivesided Flycatcher specifically in New Brunswick. It is intended to be used in conjunction with the information contained in the national COSEWIC (2018) status report for Olive-sided Flycatcher, to undertake a status assessment of the species in New Brunswick. It is not to be considered a stand-alone report.

The national COSEWIC (2018) status report for Olive-sided Flycatcher can be accessed on the federal Species at Risk public registry:

https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewicassessments-status-reports/olive-sided-flycatcher-2018.html

Photo credit: Alain Clavette

EXECUTIVE SUMMARY:

The Olive-sided Flycatcher is a medium-sized insectivorous songbird that is widespread across forest regions of Canada, as well as Rocky Mountains and Appalachian Mountains in the United States. In New Brunswick, it is present in all forested regions, reaching its highest abundance in the Central Uplands ecoregion. This flycatcher typically occupies open to semi-open, mature forest stands, often near wetlands or rivers, or in forest clearings created by natural disturbances or harvesting.

The species has declined by 61.6% in Canada between 1970 and 2019, and by 93.2% in New Brunswick over the same period. New Brunswick is among the North American jurisdictions where long-term declines have been highest across the entire breeding range. More recently (2009-2019), populations have increased in Canada (by 9.8%), but the trend remains negative in New Brunswick, corresponding to a 50.9% decline over the period. Limiting factors and threats to the New Brunswick population are most likely associated with habitat decline through the loss of old spruce-fir and old mixedwood stands and fine-scale habitat features required by the species. Considering that Olive-sided Flycatcher produces a single brood per year and performs a long-distance migration, it is especially vulnerable to low reproductive success and adverse weather events.

TECHNICAL SUMMARY FOR NEW BRUNSWICK

Olive-sided Flycatcher Contopus cooperi

Moucherolle à côtés olive

Range of occurrence in New Brunswick: throughout NB

	Demographic Information				
1.	Generation time (usually average age of parents in the population)	3.21 (Bird et al. 2020)			
2.	Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Yes, inferred based on BBS			
3.	Estimated percent of continuing decline in total number of mature individuals within [5 years]	Unknown.			
4.	[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years].	Inferred. Approximately -50.9%, based on BBS trend analysis for 2009-2019.			
5.	[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years].	Unknown, but continuing decline expected due to ongoing threats.			
6.	[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any period [10 years], including both the past and the future.	-50.9%, according to BBS short- term trend			
7.	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			
8.	Are there extreme fluctuations in number of mature individuals?	No.			

Extent and Occupancy Information

9.	Estimated extent of occurrence (EOO)	101,576 km²			
10.	Index of area of occupancy (IAO) (Always report 2x2 grid value).	4,128 km²			
11.	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			

12.	Number of "locations"* (use plausible range to reflect uncertainty if appropriate)	Unknown but >>10
13.	Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	No. The species was detected throughout the province during both atlassing periods.
14.	Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Yes, inferred from the breeding bird atlas, which shows a reduction in squares with breeding evidence and in the probability of observation during the second breeding bird atlas (Stewart et al. 2015), which declined in most of the province except the northwest.
15.	Is there an [observed, inferred, or projected] continuing decline in number of subpopulations?	Not applicable.
16.	Is there an [observed, inferred, or projected] continuing decline in number of "locations"?	Likely.
17.	Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes. Inferred decline in area and quality of habitat, due to ongoing threats.
18.	Are there extreme fluctuations in number of subpopulations?	No.
19.	Are there extreme fluctuations in number of "locations"*?	No.
20.	Are there extreme fluctuations in extent of occurrence?	No.
21.	Are there extreme fluctuations in index of area of occupancy?	No.

Number of Mature Individuals (in each subpopulation)

22.	Subpopulations (give plausible ranges)	N Mature Individuals
		5,100 (95% CI: 2,200-9,800)
	Total	5,100

Quantitative Analysis

23.	Is the probability of extinction in the wild at least [20%	Analysis not conducted.
	within 20 years or 5 generations whichever is longer up to	
	a maximum of 100 years, or 10% within 100 years]?	

Threats (direct, from highest impact to least, as per International Union for Conservation of Nature [IUCN] Threats Calculator)

- 24. Was a threats calculator completed for this species? Yes, nationally. Threats that may be most relevant in New Brunswick are:
 - i. Agriculture and Aquaculture (conversion of forests to agricultural croplands or livestock grazing areas on the wintering grounds) impact Low High
 - ii. Natural System Modifications (decreases in abundance of insect prey) impact Low - High
 - iii. Biological Resource Use (logging and wood harvesting) was considered Unknown, though potentially significant, at the national level. In the Maritime provinces, a recent analysis suggests that Olive-sided Flycatcher may have been exposed to habitat degradation over the 1985-2019 period (Betts et al., 2021). Habitat degradation may be associated with forest management practices creating even-aged stands.
 - iv. Pollution (neonicotinoid pesticides and mercury) impact Unknown
 - v. Climate Change and Severe Weather (habitat alteration, mismatch in timing of insect prey availability, and mortality from storms) -- impact Unknown

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.

25.	Status of outside population(s) most likely to provide immigrants to New Brunswick.	Declining (according to BBS, US population declined by 66.9% between 1970 and 2019). In Québec, BBS trends show a long-term decline of 45.4%, but a short-term increase of 16.8%. Yet, Québec populations within BCR 14 are showing short term declines as well. In states bordering New Brunswick where the species breeds, status is S4 (apparently secure) in Maine and Vermont, and S3 (vulnerable) in New Hampshire (NatureServe 2021). BBS trends indicate a long-term decline in Maine, New Hampshire and Vermont, but stabilizing trends over the shorter term except in Maine, where a decline is still ongoing.
26.	Is immigration known or possible?	Possible
27.	Would immigrants be adapted to survive in New Brunswick?	Yes
28.	Is there sufficient habitat for immigrants in New Brunswick?	Yes

Rescue Effect (immigration from outside New Brunswick)

29.	Are conditions deteriorating in New Brunswick?+	Unknown but likely due to ongoing threats.
30.	Are conditions for the source (i.e., outside) population deteriorating? ⁺	No, except in Maine.
31.	Is the New Brunswick population considered to be a sink? ⁺	Unknown
32.	Is rescue from outside populations likely?	Possible, especially from Québec, where short term population trends are positive.

Data Sensitive Species

33.	Is this a data sensitive species?	No

Status History

34.	COSEWIC: Designated as Threatened in Canada in November 2007. Status re-examined and
	designated Special Concern in April 2018.
	NB COSSAR: not assessed yet.

⁺ See <u>Table 3</u> (Guidelines for modifying status assessment based on rescue effect)

STATUS OF THE OLIVE-SIDED FLYCATCHER Contopus cooperi IN NEW BRUNSWICK

WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE: See COSEWIC (2018)

Population Spatial Structure and Variability in New Brunswick: No distinct populations have been identified within New Brunswick. The species is widely distributed (ACCDC 2021), although it is more frequently reported in the Miramichi and St. John River watersheds during the breeding season (Stewart et al. 2015; eBird 2021).

Eligibility for assessment in New Brunswick: Chamberlain (1882) described Olive-sided Flycatcher as "A common summer resident; breeds." Squires (1952) qualified the species as "Not uncommon summer resident". In the second edition, Squires (1976) described the species as "Uncommon summer resident and transient", whereas Christie et al. (2004) considered it as an "Uncommon summer resident and migrant". According to the ACCDC database (2021), the species has been detected in all ecoregions of the province (Figure 1). eBird (2021) histograms show relatively continuous detection in New Brunswick from the last week of May to the first week of September.

DISTRIBUTION:

<u>Global Range</u>: Olive-sided Flycatcher has a wide breeding range across Canada and the western and northeastern United States. It winters primarily in the Northern Andes Mountains, particularly in Colombia, Ecuador, and Peru, but also western Brazil, Venezuela, and Bolivia (Altman and Sallabanks 2020).

<u>Canadian Range</u>: The Olive-sided Flycatcher breeds in most forested lands across Canada, from Yukon to Newfoundland and Labrador (COSEWIC 2018; eBird 2021). It breeds throughout the Maritimes (Figure 2; Stewart et al. 2015).

New Brunswick Range: Relative abundance is highest in the (NW) Highlands, Central Uplands and Eastern Lowlands ecoregions, especially in the Restigouche, St. John, and Miramichi river watersheds. Using all records from ACCDC (2021) database (n=1932), the Extent of Occurrence (EOO) for New Brunswick, based on a minimum convex polygon, is 101,576 km² (Figure 1); when restricting the data set to the last 10 years (n=389), the EOO is 91,747 km². Using all records from ACCDC (2021) database (n=1932), the Index of Area of Occupancy (IAO) for New Brunswick is 4,128 km²; when restricting the data set to the last 10 years (n=389), the IAO equals 836 km². However, this likely reflects different levels of search effort and survey coverage, at least in part.

Search Effort: Population trends discussed in this report were obtained from the North American Breeding Bird Survey (BBS), an annual, standardized, road-based survey which has been conducted since 1970 across Canada and the United States during the breeding season, to detect trends in breeding bird populations (Smith and Edwards 2020).

The Maritimes Breeding Bird Atlas is a 5-yr project conducted in New Brunswick, Nova Scotia and Prince Edward Island from 1986-1990 (1st atlas) and from 2006-2010 (2nd atlas). The second atlas included more survey effort (e.g. number of bird records) and this effort was better distributed.

Distributional data have been compiled by Atlantic Canada Conservation Data Centre (ACCDC 2021) using data points from the Maritimes Breeding Bird Atlas (Erskine 1992; Stewart et al. 2015), ACCDC surveys, the Maritimes Marsh Monitoring Project, the North American Breeding Bird Survey, Stantec report on Energy East Pipeline (Stantec 2014), Environmentally Significant Areas of New Brunswick (Tims and Craig 1995), surveys conducted on Nature Trust of New Brunswick reserves (Wisniowski and Dowding 2019; Wallace 2020) as well as locations entered in iNaturalist and eBird.

HABITAT:

<u>Habitat Requirements:</u> Westwood et al. (2019) have conducted one of the few quantitative analyses documenting habitat use in New Brunswick. Their model, developed from data collected in selected ecoregions of New Brunswick and Nova Scotia, indicates that density was highest in stands dominated by red (*Picea rubens*) or black spruce (*P. mariana*) and balsam fir (*Abies balsamea*), and that it increased with the proportion of forest growing on areas with a depth to the water table less than 1 m, and decreased with canopy closure and mean canopy height. An index of human footprint, as well as road density, had negative effects, whereas landscape complexity and connectivity had positive effects.

Fine-scale habitat use can be described based on field observations conducted in the Central Uplands and Highlands ecoregions in June and July 2019 (M-A Villard, personal observations). Singing males were detected in cutblocks with retention of scattered tall trees and snags. According to Altman and Sallabanks (2020), 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. Among the sites M-A Villard visited, the highest density of singing males was found at the edge of a recent accidental burn that left many standing trees and snags (eBird checklist S57347035). All occupied sites were located close (<1 km) to a lake, river, or wetland. Of course, more systematic surveys would be necessary to contrast local habitat characteristics at occupied and unoccupied sites.

Brooks (2020) also collected presence data in Kent, Northumberland, and Sunbury counties. She selected sites with a high probability of occupancy based on maps from the breeding bird atlas and other data on habitat features and, thus, it is difficult to use such surveys to identify habitat characteristics actually selected for by the species. Of the 62 sites where Olive-sided Flycatcher was detected, 56 (90.3%) contained clearcuts within 4.9 ha buffers (minimum territory size) and 58 (93.5%) within 19.6 ha buffers (mean territory size). Among occupied sites, Olive-sided Flycatchers returned earlier in spring at 28 sites harvested 0-21 years prior to the survey than at four unharvested sites.

Altman and Sallabanks (2020) indicated Olive-sided Flycatcher frequently use natural edges along wooded shorelines of streams, lakes, rivers, beaver ponds, and bogs. They are common in the open habitat of bogs and swamps dominated by spruce and tamarack in boreal areas. During lichen surveys in old cedar swamps in the Skutik/St. Croix watershed, Watts (pers. comm.) described habitat where he observed singing males occupying territories for more than two weeks as follows: "margins of peatlands" or lakeshores with "open to semi-open (spruce-dominated) canopies, heavy shrub layers and scattered spruce suitable for song perches and nest sites".

In the northern Rocky Mountains, Robertson and Hutto (2007) concluded that thinned stands acted as population sinks for Olive-sided Flycatchers, owing to the preference expressed by the birds (earlier territory settlement) in spite of higher nest predation rates relative to a nearby burn. Because their study was based on a single plot of each type (thinned versus burned), their conclusions must be considered with caution.

<u>Habitat Trends</u>: Betts et al. (2021) modelled habitat trends in the Maritime Provinces for the 1985-2019 period using bird census data and Landsat imagery (30-m resolution). Their results indicate that this species has experienced an 18% decline in the extent of its habitat over 35 years. However, it is unclear to what extent habitat components can be properly captured by Landsat imagery, considering the functional importance of scattered trees and snags (see Habitat Requirements).

A recent habitat supply analysis (NB DERD 2017) indicates that the area of old spruce-fir habitat (OSFH) on Crown lands and small private holdings (84% of NB forested area) declined by almost two thirds between 1987 and 2012 when considering the smallest (10 ha) patch size (Figure 3). This OSFH area is expected to decline a further 31% by 2037, with most of that decline to be realized by 2022 (Figure 4). Trends are similar though less pronounced for old mixedwood habitat (OMWH). The Betts et al. (2021) analysis is consistent with these changes in forest conditions; habitat loss for Olive-sided Flycatcher appears to have accelerated beginning in the mid-2000s and particularly around 2015; ninety-three percent of the 54 forest bird species they included in their analysis lost habitat over the last decade.

The habitat supply analysis (NB DERD 2017), based on the photo-interpreted land cover inventory, tabulated 398,000 ha of wet forest in New Brunswick. There are 67,000 ha of cedar swamp, 61,000 ha of fen, 100,000 ha of open/shrub bog habitats, and 177,000 ha of associated wet habitats dominated by Black Spruce (176,000 ha fully treed and 1,000 ha partially treed); however, not all of that habitat area may be suitable for Olive-sided Flycatcher.

The peatland layer, maintained by the Minerals and Resource Development Branch, NB DNRED, indicates there are 140,000 ha of peatland area on 1,231 peatlands in New Brunswick. Of these peatlands, 817 were ground verified in the 1970s and 1980s to be peatlands (with at least 40cm of peat; Keys and Henderson 1987). Approximately 10,000 ha (7% of total area) on 54 peatlands have been disturbed by peat extraction, including approximately 1,250 ha that are restored or in the process of being restored to wetland habitat (E. Prystupa, pers. comm.). An additional approximately 2,000 ha (1.4%) has been disturbed (land conversion) as a result of other activities, including forestry, cranberries, and roads and other infrastructure on peatlands. Most peat extraction occurs on open or low shrub bog, and there is a requirement to leave a 50m buffer between development and the treed edge of the peatland. The peat industry has been concentrated in northeastern New Brunswick, mainly the Acadian Peninsula and east of Miramichi in the Baie-Sainte-Anne area (NB DEM 2015).

No data are available on trends in cedar swamps and fens, but a rapid examination of areas where these habitat types are concentrated in the province (NB DERD 2017, Fig. 28) does not indicate that they host the highest abundances of Olive-sided Flycatcher, nor does it suggest spatial autocorrelation with areas of decline in probability of observation of the species between atlassing periods (Stewart et al. 2015).

BIOLOGY: (see also COSEWIC 2018)

Life Cycle and Reproduction: New World flycatchers (Tyrannidae) breeding in North America have the lowest reproductive rates of all passerines, and they are not known to produce more than one brood per season (Altman and Sallabanks 2020). 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).

In the Nepisiguit watershed, M-A Villard found a nest in a cutblock with scattered trees and snags, ca. 5 m above ground near the tip of a short limb in a thinly foliaged black spruce tree (eBird checklist S57935168, 3 July 2019).

Sources of Adult and other life stage mortality and parasitism: Very few data exist on lifespan and survivorship of adults. Two birds that survived at least seven years after first capture have been recovered during banding studies (Altman and Sallabanks 2020). 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. The only direct observation of nest predation was of Gray Jay (*Perisoreus canadensis*) taking 2 eggs during egg-laying stage in nw. Oregon (Altman 1999). Other potential predators in New Brunswick are Red Squirrel (*Tamiasciurus hudsonicus*), Northern Flying Squirrel (*Glaucomys sabrinus*), and Common Raven (*Corvus corax*). The Olive-sided Flycatcher is a rare host species for the Brown-headed Cowbird (*Molothrus ater*), probably as a result of its aggressive nest defense.

Diet and Foraging Behaviour: Hymenopterans accounted for 83% of stomach contents in 63 specimens from across the U.S (Beal 1912); they also take Diptera, Lepidoptera, Orthoptera, Odonata, and other insect groups (Altman and Sallabanks 2020). Percentages may have changed in recent decades due to widespread, massive declines in flying insect biomass (Hallmann et al. 2017).

Physiology and Adaptability: There is no record of behavioural or physiological traits that may render this species vulnerable to anthropogenic activities or other dangers (COSEWIC 2018). Possibly vulnerable to climate change effects: the high degree of openness of the canopy at occupied sites may render the species susceptible to warming temperatures (Betts et al., 2021).

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 8000 km between their wintering and breeding grounds, with migration and wintering periods accounting for most of the annual cycle (Altman and Sallabanks 2020). The availability of resources, changes to habitat, and inclement weather can all reduce survivorship of migrants during migration and winter (Moore et al. 1995). Banding data and geolocator data provide evidence that birds show breeding site and wintering ground fidelity (Hagelin et al. 2014; Altman and Sallabanks 2020).

Interspecific Interactions: There are few known incidences of predation attempts on adults. 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. 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, Gray Jay and Common Raven were all more than twice as common on harvested plots (Robertson and Hutto 2007). However, that study was conducted in Montana and may not be generalizable to Canada.

POPULATION SIZES AND TRENDS IN NEW BRUNSWICK:

<u>Sampling Effort and Methods</u>: This species is easily detected by song during the breeding season. Males often sing from the tallest tree or snag available in their territory (Altman and Sallabanks 2020) and songs can be detected from very far. The effective detection range is estimated to be 150-175 m (McGarigal and McComb 1995). Therefore, this species can be accurately surveyed by BBS and breeding bird atlassers.

Abundance: According to the Partners in Flight population estimates database (2021), the breeding population of Olive-sided Flycatcher in New Brunswick is estimated at 5,100 mature individuals (95% C.I.: 2,200-9,800) (Table 2). It was detected on 17 out of 32 routes during the time period (2006-2015) used to produce the population estimates (Will et al 2020). During the second Maritimes Breeding Bird Atlas, relative abundance was found to be highest in the Highlands and Central Uplands ecoregions in northwestern New Brunswick (Stewart et al. 2015).

Fluctuations and Trends: Breeding Bird Survey trend data indicate a long-term decline (-5.34/year; cumulative decline -93.2%, 95% CI: -96.6, -86.6) in New Brunswick over the 1970-2019 period (Figure 5). This trend is based on 39 routes and deemed highly reliable. Over the short term (2009-2019), the declining rate has decreased (Figure 6), but there was still an estimated 50.9% loss (95% CI: -71.7, -13), based on data from 30 routes. The probability of a >50% decline is 0.528, and the probability of a 25-50% decline is 0.402; totalled, the probability of a decline greater than 25% of Olive-sided Flycatcher in New Brunswick from 2009-2019 is 0.930 (Table 3).

The Maritimes Breeding Bird Atlas indicates a decrease in number of occupied atlas squares in New Brunswick from 387 to 349 between the two atlassing periods (Figure2), as well as a decline in probability of observation across most of the province except the southwest (Valley Lowlands ecoregion) and a small area in the Northern Uplands (Stewart et al. 2015).

Rescue Effect: The New Brunswick population could be rescued by immigration from neighboring jurisdictions, but their own populations have suffered long term declines (Figure 7). Over the short term (2009-2019), the population has increased in parts of Québec, west and north of Bird Conservation Region (BCR) 14 (Atlantic Northern Forest; Environment Canada 2013). They have remained stable in New Hampshire and Vermont, but population estimates are very low for those states (Table 2). Populations continue to decline in Maine, Nova Scotia, PEI and all of BCR 14 overall (Table 3; Sauer et al. 2019). Therefore, most of the immigration into New Brunswick would be expected to come from Québec populations.

THREATS AND LIMITING FACTORS IN NEW BRUNSWICK:

Forest Harvesting: Forest habitat decline through the replacement of naturally-regenerated, unevenaged conifer/mixedwood stands with spruce plantations appears to be the main threat to Olive-sided Flycatchers specific to New Brunswick. Spruce plantations do not provide the vertical structure and canopy openings required by this species (see Habitat Requirements). According to the National Forestry Database, the area planted averaged 18,587 ha per year (range: 11,505-23,506) in New Brunswick and has remained relatively stable over the 1990-2019 period, particularly the rate on Crown land. However, these areas can be considered as cumulative habitat loss for this particular bird species, as new areas are planted each year. Portions of the high suitability habitat in wet sites or near (within 60m of) wetlands or watercourses are at lower risk of being converted to plantations, as plantations are generally established on medium to well drained productive sites and encompass areas that are not as suitable for Olive-sided Flycatchers.

The National Forestry Database also provides annual statistics on harvest by method, and groups the different methods into even-aged (clearcut, shelterwood and seed-tree) and uneven-aged (selection, thinning) techniques (see Figure 8 footnote for details). Uneven-aged harvest treatments would be more beneficial for Olive-sided Flycatcher as they would potentially create more suitable habitat structures for the species. However, uneven-aged harvest treatments are currently used infrequently within forest types used by Olive-sided Flycatcher. Shelterwood has been categorized as an even-aged method, but at least temporarily, it might create uneven-aged habitat. Shelterwood harvesting is becoming an increasing rare harvest treatment, and it has shown a monotonous decline in area treated since 1992 on Crown land, with a similar but more recent (post-2008) decline on private lands. Selection, categorized as an uneven-aged method, likely applies mainly to hardwood forest, which is not typically used by Olive-sided Flycatcher. An analysis of the NB DNRED forest inventory indicates of the 146,000 ha on Crown land that have been harvested since 1990 using partial cut methods, 72% and 28% occurred in hardwood- and softwood-dominated forest, respectively (NB DNRED preliminary analysis 2021). Overall, annual trends reported by the National Forestry Database, considering all of the techniques, show that uneven-aged treatments are used to a much lesser extent every year than even-aged treatments (Figure 8), averaging 18% (range: 4%-27%) of the total harvest.

According to the recent habitat supply analysis (NB DERD 2017), the overall areas of Old Spruce-fir Habitat (OSFH) and Old Mixedwood Habitat (OMWH) should stabilize over the next ten to fifteen years (Figure 4), particularly on Crown land. Some of this will be old forest that is currently in, or will soon be added to, the conservation land base, which will not be harvested, at least not by clear-cutting; some amount of partial harvest may occur, depending on the conservation forest type. Other areas of old forest may be cut, but at the same time, mid-aged stands and managed stands may reach mature conditions. However, it is unknown if these maturing stands will have the habitat complexity and spatial configuration required by Olive-sided Flycatchers. It does not appear that regenerating forest is replacing old forest at the rate that it is being harvested, especially when considering structural components. Betts et al (2021) concluded that forest birds breeding across the Maritimes, particularly mature forest species, have experienced pervasive habitat loss since 1985, due to structural and compositional forest changes. Also, it is difficult to predict levels of harvest on private lands, as it depends on the market, and fuelwood harvest is not typically reported (NB DERD 2017). Overall, it is expected that old forest will still be cut on private lands, which accounts for half of the forested area in New Brunswick, but it should stabilize on Crown lands.

Wet treed areas can be considered both forest and wetland. The habitat supply analysis (NB DERD 2017) tabulated 398,000 ha of wet forest in New Brunswick (e.g., cedar swamp, fen, treed bog). Wet areas with > 35m³/ha of merchantable trees are included in the forest inventory. They are also included on the Watercourse and Wetland Alteration (WAWA) Reference Map (NB DELG website), which indicates that a permit is required for any activity within 30m of the boundary on private land. These areas are considered during forest management activities on Crown Lands; for example, they are generally avoided during road construction, and there are requirements to avoid rutting during harvesting.

<u>Peat Extraction</u>: The area impacted by peat extraction in New Brunswick is expected to increase, with approximately 4,500 ha (3%) of commercial peatland area expected to be opened based on current

agreements. It is difficult to predict the rate at which these new areas will be opened, as decisions of when to open new peat fields depend on a variety of factors which are hard to predict. Though new peatland area will be opened for peat extraction, restoration activities are expected to increase substantially over the next decade as older peat fields are brought out of production, as required through Peat Leases and Environmental Impact Assessments. Companies that are members of the Canadian Sphagnum Peat Moss Association (CSPMA) have committed to reduce abandoned non-restored peat fields by 30% over 5 years (after 4 years, they are at 28%) and by 100% over 15 years (CSPMA 2022).

<u>Limiting Factors</u>: The short breeding season, single brood raised, specific habitat conditions, and very long migration may increase vulnerability of this species to adverse weather events.

<u>Number of Locations</u>: The number of locations would be based on forest harvesting activities, which would occur at a stand level. In addition, some forest harvesting might be beneficial to the species, depending on the methods employed (e.g., partial cut vs. clear cut treatments), and if it creates openings, leaves snags and results in the necessary stand structure. Therefore, there are >>10 locations in the province.

PROTECTION, STATUS, AND RANKS IN NEW BRUNSWICK:

Protection: The Olive-sided Flycatcher is protected in Canada under the *Migratory Birds Convention Act*, 1994 and under Canada's *Species at Risk Act*. It is further protected in New Brunswick under the NB *Fish & Wildlife Act* and the NB *Species at Risk Act*.

Legal listings:

- Canada's Species at Risk Act, Schedule 1: Threatened (23/2/2010)
- US Endangered Species Act: none
- NB Species at Risk Act: Threatened 2013 Listing Regulation 2013-38

Non-legal Status and Ranks: (NatureServe 2021)

- Global status: G4 (apparently secure)
- COSEWIC: Special Concern (April 2018)
- Canada: N4B, N3M (2016)
- United States: N4B
- For ranks for individual provinces and territories in Canada- see Table 4
- For ranks for individual states in the USA see Table 4

In New Brunswick, Olive-sided Flycatcher is ranked as S3B, S3M (NatureServe 2021), which means that it is ranked as vulnerable (S3) for both breeding and migrating stages.

Habitat Protection and Ownership: Olive-sided Flycatcher occurs within the bounds of Kouchibouguac National Park and Fundy National Park (Westwood et al. 2019; ACCDC 2021), as well as Mount Carleton Provincial Park and many other provincial parks and Protected Natural Areas throughout New Brunswick, where development and industrial activities are not permitted. Additional old forest stands

(50 kha OSFH, 33 kha OMWH) across the province are being considered for inclusion to the Protected Areas land base as a result of New Brunswick's commitment to double the amount of protected land in the province and achieve a target of 10% protection (NB DNRED Nature Legacy website). For example, some old wet cedar stands (5,000 ha) in southwest New Brunswick being considered might host the species, although a major spruce component is required (T. Watts, pers. comm.). Currently, about 20% of peatland area in New Brunswick is under protection as a National Park, Protected Natural Area or Provincially Significant Wetland; the Nature Legacy initiative will more than double this number (E. Prystupa pers.comm.).

In New Brunswick, the maintenance of habitat for wildlife species is a requirement of Crown forest management under the *Crown Lands and Forests Act*, 1980. Area targets and stand/landscape descriptions have been developed for six types of old forest habitats, including Old Spruce-fir Habitat, which is favoured by Olive-sided Flycatchers. Forest management plans include the spatial identification of area to meet habitat targets in appropriate stand and landscape configurations (NB DNR 2005).

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED:

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- Churchill, James (ACCDC)
- Nocera, Joe (UNB)
- Smith, Adam (CWS)
- Watts, Todd (Peskotomuhkati Nation at Skutik)
- Westwood, Alana (Dalhousie U)

Thousands of dedicated, skilled volunteers throughout North America have generously donated their time and expertise over the years to bird monitoring programs.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER(S)

Marc-André Villard is an avian ecologist focusing on population response to forest management and landscape-level processes. His PhD research investigated the effects of habitat fragmentation on the distribution and pairing success of focal species including Wood Thrush (*Hylocichla mustelina*) and Ovenbird (*Seiurus aurocapilla*). He has examined the effects of intensive forest management on demographic parameters of focal species through field experiments, as well as trophic relationships linking mast-seeding trees, rodents, and songbird reproduction using time series. His field research has mainly been conducted in temperate and boreal forests of Québec, New Brunswick, and Alberta. Dr. Villard was a founding co-editor of Avian Conservation and Ecology. He works in Québec as a Conservation Biologist with Sépaq, on projects addressing species at risk, invasive species, and the effects of outdoor recreation on biodiversity.

COLLECTIONS EXAMINED

None.

Table 1. Forest Habitat type codes (NB DERD 2017).

Forest Habitat Type Code	Forest Habitat Type		
OFH	Old Forest		
OSFH	Old Spruce-Fir		
OMWH	Old Mixedwood		
OHWH	Old Hardwood		
ОТНН	Old Tolerant Hardwood		
OPIH	Old Pine		

Table 2. Breeding population estimates (rounded) with 95% uncertainty bounds for Olive-sidedFlycatcher in Canadian provinces and US states (or portions occurring) in Bird Conservation Region 14¹.From Partners in Flight (2021) population estimates database.

Province/ State	Country	Population estimate	Lower 95% bound	Upper 95% bound	BBS Average (birds/rte) ²	BBS Routes ³	Species Routes⁴
QC	CAN	3,500	1,500	6,800	0.290	38	18
NB	CAN	5,100	2,200	9,800	0.385	32	17
NS	CAN	8,400	4,400	15,000	0.824	31	23
PE	CAN	100	0	380	0.092	4	1
MA	USA	n/a					
ME	USA	4,800	2,000	9,200	0.311	59	24
NH	USA	210	16	520	0.048	23	5
VT	USA	260	20	750	0.058	23	5
NY	USA	650	48	1,700	0.028	103	5
n/a	CAN	1,100,000	830,000	1,400,000		4 152	950
n/a	USA	830,000	610,000	1,100,000		4,152	850

1: Bird Conservation Region 14 (Atlantic Northern Forest) includes the Maritime provinces, Québec's Gaspe Peninsula and Eastern Townships in Canada and most of the states of Maine, New Hampshire and Vermont and parts of New York, Massachusetts and Connecticut in the United States (Environment Canada 2013).

2: BBS Average (birds/rte) = Count per route per year (2006–2015) across all routes within a Region, stratified by jurisdictions (provinces, states, territories).

3: BBS Routes = no. BBS routes meeting data acceptance criteria in the Region in 2006–2015.

4: Species Routes = no. BBS routes in the Region where the species was detected in 2006–2015.

Table 3. Short-term (2009-2019) population trends and probabilities of decline for Olive-sided Flycatcher in New Brunswick and neighbouring jurisdictions within and outside Bird Conservation Region 14^{1,} based on Breeding Bird Survey data (Smith et al. 2019). Bolded trends are statistically significant.

Jurisdiction/ Region	Annual trend	2.5% Cl	97.5% Cl	Overall reliability	Cum. % change	Lower 95% Cl	Upper 95% Cl	Prob. decl. >50%	Prob. decl. 25-50%
NB	-6.86	-11.9	-1.38	Low	-50.9	-71.7	-13	0.528	0.402
NS+PE	-6.43	-10.1	-2.7	Low	-48.6	-65.5	-24	0.441	0.527
QC (BCR14)	-10.1	-16.5	3.51	Low	-65.4	-83.5	-30	0.844	0.138
All BCR 14	-7.04	-9.76	-4.1	Medium	-51.8	-64.2	-34.2	0.591	0.406
QC (BCR 8)	3.86	-2.72	10.7	Low	46.1	-24.1	175	0.001	0.023
QC (BCR 12)	-4.42	-9.95	1.12	Low	-36.4	-64.9	11.8	0.209	0.495
QC (BCR 13)	-2.92	-13.1	7.84	Low	-25.6	-75.4	113	0.238	0.266
QC	1.57	-3.69	6.96	Low	16.8	-31.3	96	0.001	0.048
Canada	0.944	-1.44	3.82	Medium	9.85	-13.5	45.4	0	0.001

¹: Bird Conservation Region 14 (Atlantic Northern Forest) includes the Maritime provinces, Québec's Gaspe Peninsula and Eastern Townships in Canada and most of the states of Maine, New Hampshire and Vermont and parts of New York, Massachusetts and Connecticut in the United States (Environment Canada 2013).

Table 4. Conservation Status Ranks for Olive-sided Flycatcher in jurisdictions of Bird Conservation Region14. Ranks were determined using NatureServe methodology (Master et al. 2012).

Jurisdiction	General Status 2015 Rank ¹
QC	S3B
NB	S3B, S3M
NS	S2B
PE	S2B
ME	S4B
NH	S3B
VT	S4B
NY	S3B
MA	SHB, S2N

¹NatureServe (2016), CESCC 2016

¹: Bird Conservation Region 14 (Atlantic Northern Forest) includes the Maritime provinces, Québec's Gaspe Peninsula and Eastern Townships in Canada and most of the states of Maine, New Hampshire and Vermont and parts of New York, Massachusetts and Connecticut in the United States (Environment Canada 2013).

Figure 1. Distribution of Olive-sided Flycatcher in New Brunswick, 1960-2020, shown as individual observation sites (black squares = 1960-2010; yellow dots = 2011-2020) and Extent of Occurrence (green boundary = sites from 1960-2010; red and white boundary = sites from 2011-2020). Data Source: ACCDC 2021 database. Also shown are NB Eco-regions (solid colours, grey borders) and Eco-districts (green lines), as per New Brunswick's Ecological Land Classification (NB DNR 2007).



Figure 2. Breeding distribution of Olive-sided Flycatcher in the Maritime Provinces (Stewart et al, 2015). Black dots indicate squares where the species was recorded during the 1st atlas (1986 – 1990) but not the 2nd atlas (2006-2010). White dots indicate squares where the species was recorded during the 2nd atlas but not the 1st.





Figure 3. Distribution of area by patch size for Old Spruce-fir Habitat for provincial and federal Crown land and small private holdings combined, 1987 and 2012 (reproduced from NB DERD 2017).

Figure 4. Old-forest habitat abundance in New Brunswick at the smallest habitat-specific patch size for provincial and federal Crown land and small private holdings combined, 1987-2037. Habitat acronyms are given in Table 1; patch sizes (ha) are attached to habitat labels (reproduced from NB DERD 2017).



Figure 5. Long-term trend estimates from the North American Breeding Bird Survey for Olive-sided Flycatcher in New Brunswick from 1970 – 2019, showing the average annual percent change in the population, along with upper and lower 95% credible limits on the estimated annual trend. (Smith et al. 2019).



Figure 6. Short-term trend estimates from the North American Breeding Bird Survey for Olive-sided Flycatcher in New Brunswick from 2009 – 2019, showing the average annual percent change in the population, along with upper and lower 95% credible limits on the estimated annual trend. (Smith et al. 2019).



Figure 7. Long-term BBS trends (1966-2015) for Olive-sided Flycatcher across North America. Areas of increase are blue, and areas of decline are red. Areas where there is no apparent trend, or where there wasn't enough information to determine if a trend exists, are white; grey areas were not surveyed. (Sauer et al. 2019).





Figure 8. Areas (in kha) of forest harvested annually by general method^{1,2} in New Brunswick, 1990 - 2019. Data source: National Forestry Database website.

¹ Even-aged Management:

- Clearcut a method of regenerating an even-aged forest stand in which new seedlings become established in fully exposed microenvironments after removal of most or all existing trees. Regeneration can originate naturally or artificially. Clearcutting can be done in blocks, strips or patches. This method can be distinguished from seed tree and shelterwood methods in that trees are left because of operational or utilization constraints, rather than as a means to secure regeneration. May occur in one or two stages:
 - 1-stage: The timber crop is removed from the harvest block, strip or patch, as a single silvicultural treatment. Operational objectives could entail that this volume be removed over several operating seasons.
 - 2-stage: Two harvests are prescribed to remove the existing timber crop. The first stage is normally timed to salvage volumes that are vulnerable to loss by insect and disease agents or to remove one of several stories in a multi-storied stand. The second stage removes the balance of the crop and creates the potential for regeneration establishment. The time lag between first and second harvests typically spans many operating seasons.
- Shelterwood removal of the mature timber in a series of cuttings that extend over a relatively short portion
 of the rotation, by means of which the establishment of essentially even-aged reproduction under the partial
 shelter of the remaining trees is encouraged.
- Seed-tree (method) a method of regenerating a forest stand in which all trees are removed from the area except for a small number of seed-bearing trees that are left singly or in small groups. The objective is to create an even-aged stand.

² Uneven-aged Management:

- Selection a method of regenerating a forest stand and maintaining an uneven-aged structure by removing some trees in all size classes either singly or in small groups or strips.
- Thinning a cutting made in an immature crop or stand primarily to accelerate diameter increment, but also, by suitable selection, to improve the average form of the trees that remain. Commercial thinning a thinning in which harvested tress are removed from the site and used for commercial purposes.