



Bird Surveys (Summer 2018) Following Habitat Restoration along Three Watercourses and in an Agroforestry Plot in the Lake Saint-Pierre Region

Baie-du-Febvre Area

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Table of Contents

1. Introduction	1
2. Methodology	2
2.1 Location and description of bird survey sites	2
2.1.1 Watercourses	2
2.1.2 Bertco agroforestry plot	3
2.2 Bird survey method	4
2.2.1 Watercourses	4
2.2.2 Bertco agroforestry plot.....	5
3. Results and Discussion	6
3.1 Watercourses.....	6
3.1.1 Brielle River and Côté-Lefebvre Creek	6
3.1.2 Blondin Creek	13
3.2 Bertco agroforestry plot.....	17
Conclusion	20
Bibliography	22
Appendix A. Field datasheet used for watercourses (available in French only)	24
Appendix B. Geographic coordinates of transects for inventoried watercourses	25
Appendix C. Field datasheet used for the Bertco agroforestry plot (available in French only)	26
Appendix D. Bertco agroforestry plot transect coordinates	27
Appendix E. Breeding indices from the Québec breeding bird atlas (QBBA, 2017)	28

List of Figures and Tables

Figure 1. Location of bird survey sites	2
Figure 2. Land use in the area of the three watercourses (0 to 100 year recurrence zone).....	3
Figure 3. Limits of the Bertco agroforestry plot	4
Table 1 - Average relative abundances per kilometre of shore and habitats used by birds at Brielle River and Côté-Lefebvre Creek and its adjacent environments during the 2018 and 2012 inventories	8
Table 2 - Average relative abundances per kilometre of shore and habitats used by birds at Côté-Lefebvre Creek and its adjacent environments during the 2018 and 2017 inventories	12
Table 3 - Average relative abundances per kilometre of shore and habitats used by birds at Blondin Creek and its adjacent environments during the 2018, 2017 and 2012 inventories	14
Table 4 - Results of bird surveys carried out in the Bertco agroforestry plot and adjacent environments in 2018, 2017 and 2012	18
Table 5 - Number of species recorded in each of the environments adjacent to the Bertco agroforestry plot.....	19

1. Introduction

Lake Saint-Pierre and its floodplain, which is the largest in Québec, is one of the major components of the St. Lawrence ecosystem. With more than 288 resident and migratory bird species and 79 fish species (MDDEFP, 2013), the lake offers an exceptional natural environment, which has received international recognition for its rich biodiversity (UNESCO Biosphere Reserve and RAMSAR site).

Agricultural activities have been carried out on the fertile floodplain of Lake Saint-Pierre for several centuries. However, beginning in the second half of the 20th century, perennial crops were gradually replaced by annual crops, even in the floodplain area (Dauphin and Jobin, 2016). Agricultural practices associated with annual cropping have resulted in degradation of natural habitats and reduced the amount of habitat available for many wildlife species (Latendresse et al., 2008; Rioux et al., 2009). Grassland birds (Bobolink, Eastern Meadowlark, etc.), whose populations are in decline (NABCI, 2012), and waterfowl are among the species that have been adversely affected by the disappearance of wet meadows and the conversion of perennial crops to annual crops. The loss of plant substrates due to fall tillage promotes soil erosion during high water periods and results in the destruction of key fish spawning and rearing grounds in the spring. This degradation has played a significant role in the decline of the Yellow Perch population in Lake Saint-Pierre (Magnan et al., 2017). To date, roughly 5,000 ha of potential Yellow Perch spawning habitat has been lost (TCRLSP, 2017).

With the aim of balancing agricultural activities and wildlife protection, an approach for restoring wildlife habitats on the shoreline of Lake Saint-Pierre has been developed (Groupe de travail « Intendance en milieu agricole: culture du littoral au lac Saint-Pierre », 2010). This approach involves stream maintenance (bank reprofiling, planting, etc.) and conversion of annual crops back to perennial crops or natural grasslands. In these regards, three watercourses of the Baie-du-Febvre area were restored in 2012 with the goal of restoring fish habitat while allowing the cultivation of adjacent lands. In parallel with this work, an agroforestry plot was established at Bertco Farm to evaluate the impact on wildlife and agronomy of intercropping traditional cereal crops (or alfalfa) and rows of trees (oaks, maples, poplars, walnuts) spaced 40 m apart in a single field.

Bird surveys were conducted for the first time in the summer of 2012 to provide a portrait of the avian communities present at these four sites (ie. The three watercourses and the agroforestry plot) before the start of the habitat management and restoration work. New inventories were conducted in the summer of 2017 to measure the evolution of bird communities five years after the work was completed. Due to the high water levels in 2017, the inventories were repeated in 2018 in order to draw a representative portrait of the bird communities that frequent the various sites.

This approach is part of the project “Restore the Lake Saint-Pierre shoreline”, which is being carried out jointly by the Canadian Wildlife Service (CWS) of Environment and Climate Change Canada (ECCC) and the Québec Department of Forests, Wildlife and Parks (MFFP), as part of the 2016–2021 programming of the St. Lawrence Action Plan (SLAP).

2. Methodology

2.1 Location and description of bird survey sites

The three watercourses under study are located in the south-east portion of the floodplain of Lake Saint-Pierre. It is the Brielle River and the Côte-Lefebvre and Blondin creeks. The agroforestry plot is located outside the 0 to 100 year recurrence zone on the Bertco farm property. The location of these sites is shown in **Figure 1**.

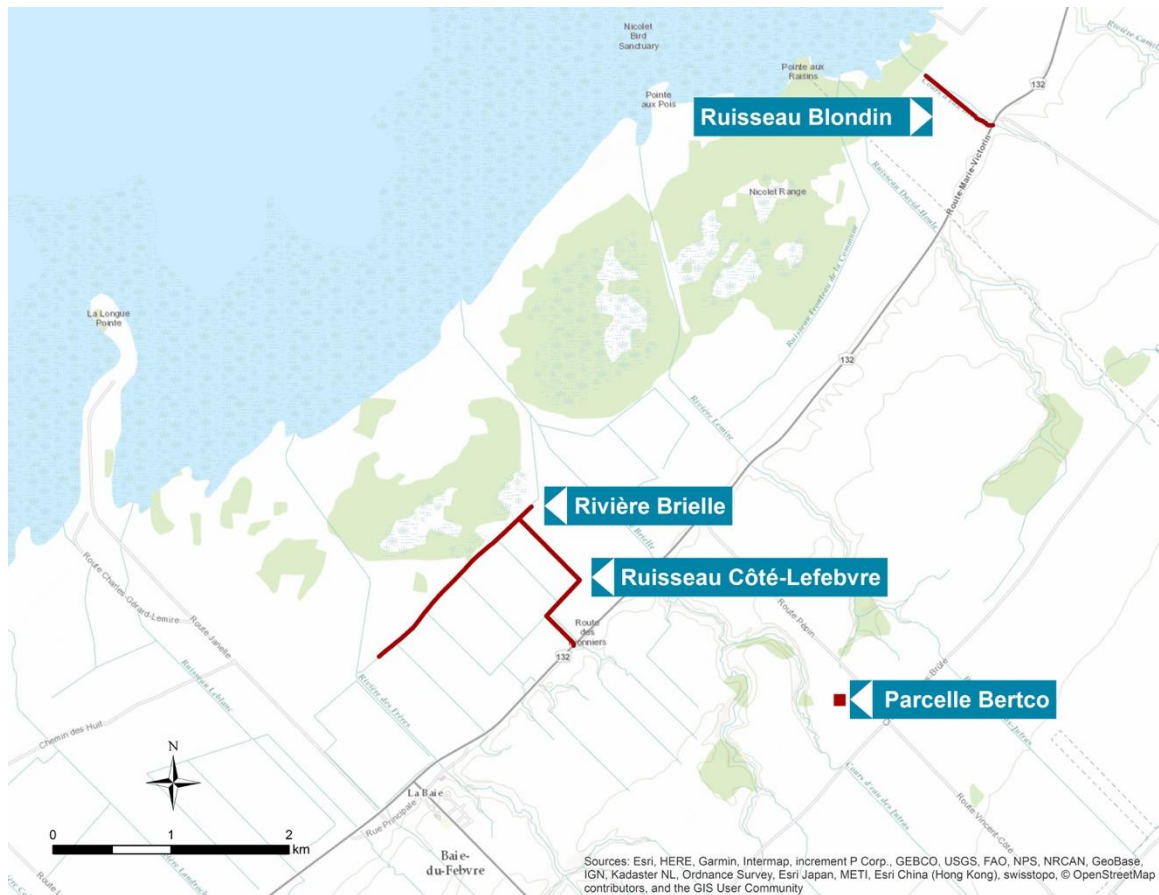


Figure 1. Location of bird survey sites (Rivière Brielle: Brielle river; Ruisseau Côte-Lefebvre: Côte-Lefebvre Creek; Ruisseau Blondin: Blondin Creek; Parcelle Bertco : Bertco plot)

2.1.1 Watercourses

The three watercourses restored in 2012 and being monitored are in agricultural landscape (**Figure 2**). The restoration work carried out includes the reprofiling of the banks as well as the planting of trees and shrubs.

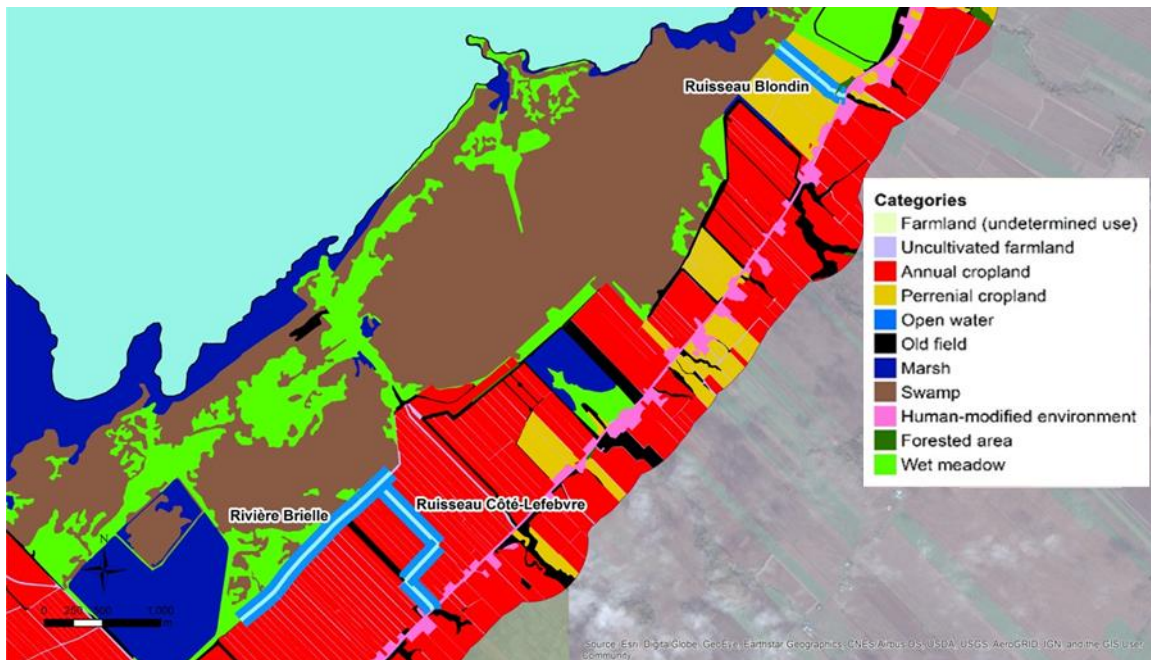


Figure 2. Land use in the area of the three watercourses (0 to 100 year recurrence zone)
 Source: ECCC and MDDELCC, 2018

Brielle River

The Brielle River, whose restored section is 2 km long, is located in the Baie-du-Febvre municipality (MRC of Nicolet-Yamaska). It is bordered on the north by the Department of National Defence lands and on the south by annual crops. About thirty agricultural ditches flow there. The vegetation planted in the riparian strip in 2012 was largely destroyed.

Ruisseau Côté-Lefebvre

The Côté-Lefebvre creek, whose restored section is 1.4 km long, is located in Baie-du-Febvre municipality (MRC of Nicolet-Yamaska). It drains farmland on both sides of the route 132 and empties into the Brielle River. In the restored section, the creek is bordered by annual crops only. The vegetation planted in the riparian strip in 2012 was largely destroyed.

Ruisseau Blondin

The Blondin Creek, whose restored section is 0.7 km long, is located between the route 132 and Department of National Defence lands in the municipality of Nicolet (MRC of Nicolet-Yamaska). The runoff water from agricultural land located south of the route 132 are the main source of this creek, and this one pours directly into Lake Saint-Pierre. Perennial crops and a small wood lot border Blondin Creek. The vegetation planted as part of the restoration work in 2012 is still present.

2.1.2 Bertco agroforestry plot

The Bertco plot is located in the municipality of Baie-du-Febvre (MRC of Nicolet-Yamaska), between the route 132 and the Pays Brûlé road. It consists of a 10 ha development where an intercropping agroforestry system (IAS), alternating rows of trees and stripes of cultivated land, have been set up (**Figure 3**; Rivest et al. 2018). The implanted IAS at Bertco farm is one of the second generation, characterized by a 40 m

spacing between the rows (this distance varies from 8 m to 15 m for the IAS of the first generation and 25 m to 40 m for those of the second generation). In total, the IAS, count four rows of trees formed of noble hardwoods with moderate growth (oaks, maples, walnuts) which separate one of the others by fast-growing hybrid poplars, a provision that allows to divide the harvest of wood over time (Rivest et al., 2018). On the stripes of land between rows of trees, the owners rotate crops of cereals and legumes (in 2018, the crop was soybean). The parcel is bordered by a wood lot to the north, by other annual crops and agricultural gullies to the east and south, and by a windbreak hedge of tamaracks to the west.

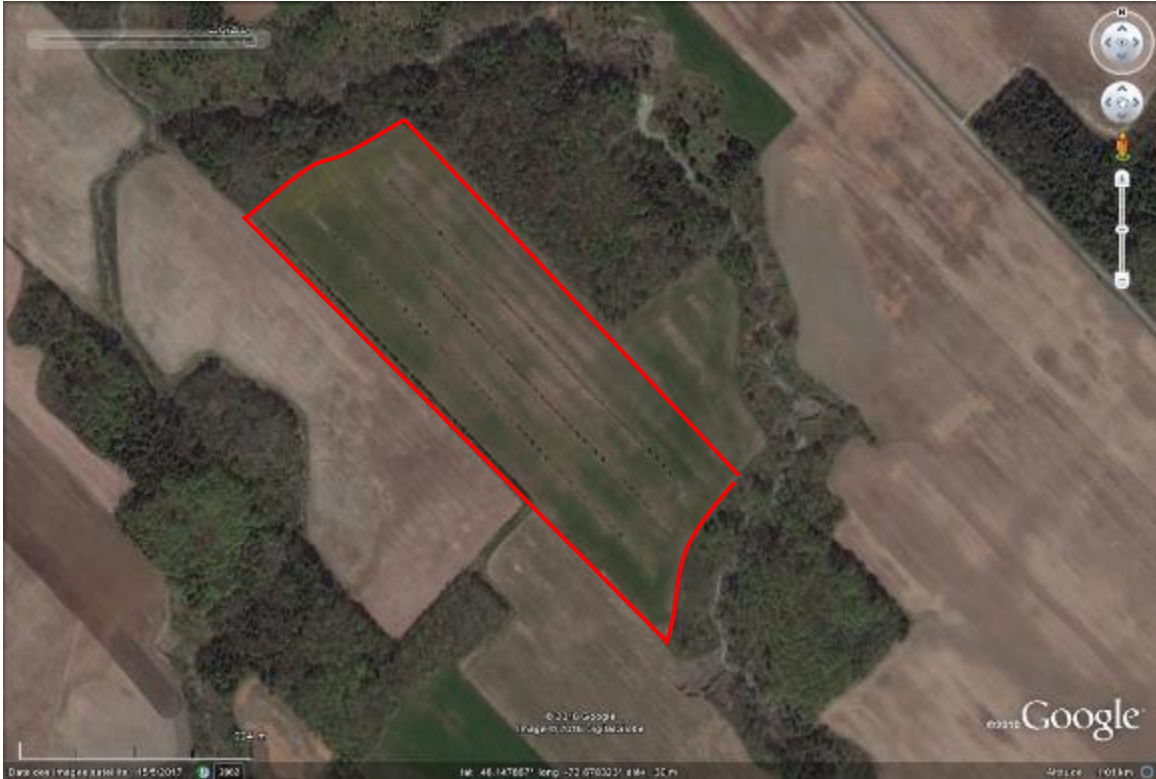


Figure 3. Limits of the Bertco agroforestry plot (Source: Google Earth, 2017)

2.2 Bird survey method

Although species at risk have been observed in 2017 on the sites, their presence did not have any consequences on the surveys in 2018, which were carried out according to the same protocol as 2017. In addition, restoration work took place in October, after the bird breeding season was completed. Bird surveys were conducted using techniques to identify the majority of species present at the sites while obtaining relative abundance data for several of them.

2.2.1 Watercourses

The transect method was chosen for the bird survey along the three watercourses located in the Baie-du-Febvre and Nicolet sectors. This involved counting all birds detected by walking slowly (2 to 3 km/h) along one bank of the watercourse and noting all birds seen

or heard near this area, as well as in adjacent habitats. All individuals detected on either bank had to be recorded (Deschênes et al. 1999; Jobin et al. 2001).

The observer noted the location of each bird detected in relation to the watercourse (open water, bank, vegetated riparian strip or adjacent habitat), its sex (if possible) and the type of detection (visual [individual, nest or family] or auditory [call, song]). Only the behaviour most indicative of breeding was recorded for a given individual. Thus, when the same individual uttered a cry and a song, it was singing, a territorial behaviour, was then noted. If an individual was observed in its nest or in the presence of (young or juveniles), it is this observation which would have been recorded since it makes it possible to confirm the nesting of the bird. Some individuals were considered as different when they were heard or seen simultaneously or when the observations were sufficiently distant from each other so that they could not relate to the same individual. In case of uncertainty, the observer must consider that it was the same individual. Birds feeding in flight (e.g., swallows) or flying within the habitat or over it were recorded and counted, whereas birds merely flying over the site without using it (e.g., vultures or gulls high in the air) were recorded but not included in the total count.

The observer was required to note the location of each bird detected in relation to the watercourse (open water, bank, vegetated riparian strip or adjacent habitat), its sex (if possible). When a bird was detected in the vegetated riparian strip, the observer was to note the plant composition, specifically whether it was dominated by trees, shrubs, herbaceous vegetation or a combination thereof. When a bird was recorded in the adjacent habitat, the observer was to specify the bird's position, that is, whether it was located within the first 25 m from the watercourse (immediately adjacent habitat) or farther than 25 m away (more distant habitat); the type of habitat being used at the time was also recorded (Deschênes et al., 2003). The field datasheet used for the transect survey is presented in Appendix A.

Maps of the sites to be surveyed were produced in advance and the geographic coordinates were added to the maps (Appendix B), allowing the observer to determine his/her position in the field with a GPS. A single observer performed the counts. The sites were visited twice, more than seven days apart, during the month of June 2018. The surveys were carried out between sunrise and 10:00 a.m. under ideal conditions (clear to partly cloudy skies, no rainfall, and no wind to light wind). During data compilation, this convention was used: one bird seen or cry heard (male or female) = 0.5 pair; one singing male or a family seen or heard, or an observed nest = 1 pair. Because watercourses have been visited twice, it was the highest values for each species who was retained (better index of the medium's carrying capacity).

To facilitate the results presentation, the term "riparian area" is used in the "Results and Discussion" section to designate the portion that includes water, the shoreline, strip of riparian vegetation and the immediate adjacent environment.

2.2.2 Bertco agroforestry plot

The protocol used for the inventory of the agroforestry plot is inspired by the one used at the same site in 2012 during the pre-restoration inventories and it consisted of a complete count of the birds present in the plot. To do this, the observer walked slowly (at a speed of 2 or 3 km/h) along transect distant about 50 metres and noted all the birds seen or

heard on the field datasheet provided for this purpose (**Appendix C**). Three transect were necessary to cover the plot.

For each bird detected, the observer noted the type of detection (visual [individual, nest or family group] or auditory [call or song]) and its sex (if possible). For a given individual, only the behaviour most indicative of nesting was recorded (for more details on how to record listed birds, refer to the section on watercourses). The observer also noted the position of each bird in relation to the plot (inside or outside the plot) as well as the habitat used. Only one observer conducted the surveys. The site has been visited twice more than seven days apart in June 2018. The surveys were carried out between sunrise and 10:00 a.m. under ideal conditions (clear to partly cloudy skies, no rainfall, and no wind to light wind). When compiling data, the observations were converted to a number of pairs according to the convention described in the watercourses section.

3. Results and Discussion

3.1 Watercourses

3.1.1 Brielle River and Côté-Lefebvre Creek

The Brielle River was surveyed on June 15 and 26, 2018, and Côté-Lefebvre Creek on June 8 and 26. The surveys were conducted between sunrise and 9 a.m. under ideal weather conditions. Observations for these two watercourses were combined to enable comparison with the 2012 results.

A total of 43 species were observed during the surveys of these two watercourses in 2018, 23 of which used the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat) [**Table 1**]. The watercourse was used by 5 species, while the vegetated riparian strip (composed of grasses, shrubs and trees) and the adjacent habitat (annual crops) were used by 12 and 15 species, respectively. The highest density of pairs was observed in the vegetated riparian strip (24.2 pairs/km), compared to 3.8 for the watercourse and 17.6 for the immediately adjacent habitat. The riparian zone averaged 28 pairs per kilometre in 2018, compared to 39.7 pairs per kilometre in 2012.

The most common species in the riparian zone were, in decreasing order: the Song Sparrow; the Red-winged Blackbird; the Yellow Warbler; the American Goldfinch and the Common Yellowthroat in a tie for fourth; and the Spotted Sandpiper. These six species represent 69% of the observed pairs. The Song Sparrow, the Red-winged Blackbird, the American Goldfinch and the Spotted Sandpiper were 1.5 to 5.1 times more abundant in the vegetated riparian strip than in the adjacent habitat. The Yellow Warbler was as abundant in the riparian strip as in the adjacent habitat, while the Common Yellowthroat was present only in the adjacent habitat (shrub and forested swamps located on National Defence lands).

Three species of anatidae occurred in the watercourses: the Gadwall, Mallard and Blue-winged Teal. The Tree Swallow was observed feeding in flight over the watercourses. The Great Blue Heron was observed in flight over the Brielle River. All species recorded in the vegetated riparian strip, with the exception of the Spotted Sandpiper, were associated with

woody vegetation (trees or shrubs). The immediately adjacent habitats consisted of annual crops, undeveloped natural farm hedgerows, marshes, swamps, human-modified environments, and wet meadows. The Song Sparrow, Spotted Sandpiper, American Robin, Killdeer and Eastern Kingbird were observed feeding on bare ground on annual cropland. Several species occurred in the swamps on National Defence land: the Song Sparrow, Swamp Sparrow, Red-winged Blackbird, American Goldfinch, American Robin, Willow Flycatcher, Least Flycatcher, Yellow Warbler and Common Yellowthroat. The European Starling, House Sparrow and Common Grackle were observed near homes along Route 132.

Table 1 - Average relative abundances per kilometre of shore and habitats used by birds at Brielle River and Côté-Lefebvre Creek and its adjacent environments during the 2018 and 2012 inventories

		2018					2012 ⁶				
Code ¹	Species	Watercourse and riparian strip ²		Adjacent habitat		Total riparian zone ⁴	Adjacent habitat		Watercourse and riparian strip ²	Adjacent habitat	Total riparian zone ⁴
		Mean abundance pairs/km	Habitat ³	0-25 m			> 25 m				
				Mean abundance pairs/km	Habitat ⁵		Mean abundance pairs/km	Habitat ⁵			
T	Horned Lark						2.14	AC; FH; SW; HU; WM		0.59	0.59
	Wilson's Snipe						1.00	MA			
JE	Song Sparrow	6.64	H; H+S; H+T; H+S+T	3.96	AC; FH; SW; WM	10.60	6.18	AC; FH; SW; HU; WM	1.47	7.06	8.53
T	Swamp Sparrow			1.50	MA; SW	1.50	7.50	MA	0.29	0.29	0.58
S	Savannah Sparrow						2.14	AC		0.29	0.29
H	Northern Harrier						0.25	MA			
S	American Bittern						0.50	MA			
H	Wood Duck								0.29		0.29
P	Gadwall	0.75	W			0.75			0.59	0.44	1.03
P	Mallard	1.00	W			1.00			0.29	6.18	6.47
T	Red-breasted Grosbeak						1.50	SW			
T	Red-winged Blackbird	7.71	H; H+T; H+S+T; T	1.50	SW	9.21	12.93	AC; MA; SW	0.74	9.56	10.3
P	American Goldfinch	1.50	H+T	1.00	FH; SW	2.50				0.59	0.59
AT	Spotted Sandpiper	1.86	H	0.61	AC	2.47	0.75	AC; WM	0.44	0.88	1.32
H	American Crow						0.86	AC; FE			
JE	European Starling			0.71	HU	0.71					
H	Common Gallinule						0.25	MA			
H	Great Blue Heron	0.25	In flight			0.25					
S	Pied-billed Grebe						0.50	MA			
S	Veery						0.75	SW			
M	Black Tern						7.50	MA	0.44		0.44
In flight	Tree Swallow	1.50	In flight			1.50	0.75	MA; SW	0.15	2.14	2.29
H	Purple Martin								0.44		0.44
H	Barn Swallow								0.15		0.15
H	Cedar Waxwing	1.00	H+T			1.00					
T	American Robin	0.75	H+T	1.25	AC; SW	2.00				0.74	0.74
H	House Sparrow			0.71	HU	0.71					
S	Gray Catbird						0.50	SW			
T	Willow Flycatcher			0.50	SW	0.50	2.00	MA; SW		0.59	0.59
H	Eastern Phoebe	0.25	H+T			0.25					
T	Least Flycatcher			0.50	SW	0.50	1.50	SW			
X	Snow Goose						2.14	AC			
S	Baltimore Oriole						0.50	SW			
S	American Redstart						0.50	SW			
T	Yellow Warbler	2.00	H+T	2.00	SW	4.00	3.50	SW		0.59	0.59

T	Common Yellowthroat			2.50	SW; WM	2.50	7.21	MA; SW; HU		0.74	0.74
S	Northern Flicker						0.50	SW			
H	Downy Woodpecker								0.15		0.15
T	Eastern Wood Pewee						2.00	SW			
DD	Killdeer	0.25	S	0.25	AC	0.50	1.07	AC		0.74	0.74
AT	Common Grackle	1.25	H+O	0.36	HU	1.61	0.75	AC; MA	0.15	1.03	1.18
H	Blue-winged Teal	0.25	W			0.25					
H	Mourning Dove						0.71	SW		0.59	0.59
H	Great Crested Flycatcher						0.25	SW			
H	Eastern Kingbird	0.50	H+O	0.25	AC	0.75				0.29	0.29
H	Brown-headed Cowbird						0.25	SW	0.15	0.59	0.74
T	Warbling Vireo	0.50	H+O			0.50	4.50	SW			
Vegetated riparian strip only											
Total		27.96	24.21	17.60		45.56	72.52				39.66
Number of species		17	12	15		23	31				24

¹ Code: Breeding evidence observed (using the codes from the Québec Breeding Bird Atlas, 2017). Descriptions of the categories appear in Appendix E.

² Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

³ W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

⁴ Total riparian zone = water + bank + riparian strip + adjacent habitat (0–25 m).

⁵ Habitat codes: AC = annual cropland; FH = farm hedgerow; FO = forested area; HU = human-modified environment; MA = marsh; OF = old fields; OW = open water; PC = perennial cropland; SW = swamp; WM = wet meadow.

⁶ Note: There are some discrepancies between the 2012 values provided here and the data published in the report (Jobin 2015), due to the fact that some adjustments had to be made to the original data.

In 2012, 24 species were detected, and a density of 39.7 pairs/km was measured in the riparian zone (**Table 1**). The number of species and the pair density were similar to those recorded in 2018 (23 species and 45.7 pairs/km), which would be expected given that the vegetation planted in the riparian strip in 2012 had been destroyed and the buffer did not meet the regulation width in several places. Three of the six most abundant species in 2012 were also the most abundant in 2018: the Red-winged Blackbird, Song Sparrow and Spotted Sandpiper. It should be noted that the number of pairs calculated for 2012 had been underestimated for some species. Only the number of individuals is available for 2012; this number was divided by 2 to obtain the number of pairs. This method does not consider the nature of the observation (e.g. singing male is equivalent to 1 pair, while 1 female or male calling is equivalent to 0.5 pair), resulting in an underestimation of the number of songbird pairs.



No woody vegetation is present on the south shore of the Brielle River, and the riparian strip does not always meet the regulation width. A berm of soil placed at the interface between the watercourse and a number of agricultural plots acts as a dike (photo taken on June 16, 2018, by Alexandre Nicole).

The species recorded in the distant adjacent habitat (> 25 m) provide an indication of the birds that use the landscape around Brielle River and Côté-Lefebvre Creek. In all, 31 species were observed in these habitats, which consist of annual crops, marshes and swamps. A density of 72.5 pairs/km was measured in adjacent habitats located at a distance from these watercourses, which is the highest density of all watercourses surveyed in 2018 (Nicole and Dauphin 2019). This is due to the presence of a managed marsh and shrub and forested swamps on National Defence lands. The swamps were home to 17 species, including the Rose-breasted Grosbeak, Veery, Eastern Wood Pewee (a species of special concern in Canada) and Great Crested Flycatcher. It should be noted that the Northern Saw-whet Owl was also heard in the swamps during surveys of anurans conducted on April 24, 2018. The marshes were home to 12 species, including Wilson's

Snipe, Northern Harrier, American Bittern, Common Gallinule, Pied-billed Grebe and Black Tern.

Table 2 presents the results of the 2018 and 2017 surveys for Côté-Lefebvre Creek only. In all, 14 species were observed during surveys of this watercourse in 2018, only seven of which were observed using the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat). The contribution of the Côté-Lefebvre Creek riparian zone to the combined result of the Brielle River and Côté-Lefebvre Creek surveys is 6.6 pairs/km out of a total of 45.6 pairs/km. Over a distance of 1.4 kilometres, only one species was observed using the watercourse (the Tree Swallow, in flight), and three species were using the vegetated riparian strip (the Song Sparrow, Red-winged Blackbird and Spotted Sandpiper). Since most species in the immediately adjacent habitats were observed near homes along Route 132, only four species were actually using the watercourse's riparian zone. The density of these four species was 4.8 pairs/km, the lowest of all watercourses surveyed in 2018 (Nicole and Dauphin 2019).



There is no woody vegetation on the banks of Côté-Lefebvre Creek (except for a short section near its mouth), and the high flows of 2017 and 2018 affected the establishment of herbaceous vegetation (photo taken on June 8, 2018, by Alexandre Nicole).

Species observed more than 25 m from the watercourse were not recorded in the 2012 surveys, so the 2018 results cannot be compared to the 2012 results for distant adjacent habitats.

Finally, the Raven (1 individual) and the Bald Eagle (a species designated as vulnerable in Québec, 1 individual) flew over the site, but did not stop there.

Table 2 - Average relative abundances per kilometre of shore and habitats used by birds at Côté-Lefebvre Creek and its adjacent environments during the 2018 and 2017 inventories

Code ¹	Species	2018							2017						
		Watercourse and riparian strip ²		Adjacent habitat		Total riparian zone ⁴	Adjacent habitat		Watercourse and riparian strip ²		Adjacent habitat		Total riparian zone ⁴	Adjacent habitat	
		Relative abundance pairs/km	Habitat ³	0-25 m			> 25 m		Relative abundance pairs/km	Habitat ³	0-25 m			> 25 m	
				Relative abundance pairs/km	Habitat ³	Relative abundance pairs/km	Habitat ³	Relative abundance pairs/km			Habitat ³	Relative abundance pairs/km	Habitat ³		
T	Horned Lark						2.14	AC							
T	Song Sparrow	2.14	H; H+S; H+T	0.71	HA	2.85	1.43	AC; HU	2.08	H	1.39	UF	3.47	1.39	UF; OF
T	Swamp Sparrow														
T	Savannah Sparrow						2.14	AC	0.69	H			0.69	0.69	UF; OF
H	Gadwall									0.35	UF	0.35	0.69	WM	
C	Red-winged Blackbird	0.71	H			0.71	1.43	AC	0.35	H		0.35			
T	American Goldfinch														
NF	Spotted Sandpiper	0.36	H	0.36	AC	0.72			0.69	H		0.69			
H	American Crow						0.36	FO							
JE	European Starling			0.71	HU	0.71									
X	Great Blue Heron												0.35	In flight	
H	Black Tern								0.35	In flight (over water)		0.35			
H	Tree Swallow	0.50	In flight (over water)			0.50			1.04	In flight (over water)	0.35	UF	1.39		
S	American Robin										0.35	UF	0.35	0.69	
H	House Sparrow			0.71	HU	0.71									
X	Snow Goose						2.14	AC	0.35	In flight (over water)		0.35			
S	Common Yellowthroat						0.71	HU							
DD	Killdeer						1.07	AC						1.39	
X	Bald Eagle													0.35	
H	Common Grackle			0.36	HU	0.36			0.35	In flight (over water)	0.35	UF	0.69	1.04	
S	Mourning Dove						0.71	HU					0.69	HU	
T	Brown-headed Cowbird														
		Vegetated riparian strip only					Vegetated riparian strip only								
	Total	3.71	3.21	2.85		6.56	12.13		5.90	3.81	2.78		8.68	7.29	
	Number of species	4	3	5		7	9		8	4	5		10	9	

¹ Code: Breeding evidence observed (using the codes from the Québec Breeding Bird Atlas, 2017). Descriptions of the categories appear in Appendix E.

² Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

³ W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

⁴ Total riparian zone = water + bank + riparian strip + adjacent habitat (0–25 m).

⁵ Habitat codes: AC = annual cropland; FH = farm hedgerow; FO = forested area; HU = human-modified environment; MA = marsh; OF = old field; OW = open water; PC = perennial cropland; SW = swamp; UF = uncultivated farmland; WM = wet meadow.

⁶ Note: There are some discrepancies between the 2012 values provided here and the data published in the report (Jobin 2015), due to the fact that some adjustments had to be made to the original data.

3.1.2 Blondin Creek

Blondin Creek was surveyed twice, on June 8 and 15, 2018. The surveys were conducted between sunrise and 10 a.m. under ideal conditions.



Blondin Creek (photo taken on June 15, 2018, by Alexandre Nicole)

In all, 27 species were observed during the surveys of Blondin Creek, 18 of which were using the riparian zone (water + bank + vegetated riparian strip + immediately adjacent habitat) [Table 3]. Two species were using the watercourse, six were using the vegetated riparian strip (composed of grasses, shrubs and trees) and 12 were using the immediately adjacent habitat (perennial crops and swamps). The riparian zone averaged 37.2 pairs/km in 2018, compared to 49.3 pairs/km in 2017.

Twice as many pairs were present in the adjacent habitat as in the vegetated riparian strip (20.7 versus 10.7 pairs/km), while the watercourse had a density of 5.7 pairs/km. In 2017, the opposite was true, with the vegetated riparian strip supporting a higher density of pairs than the immediately adjacent habitat. The partial flooding of these habitats in 2017 probably helps to explain this result.

The most common species in the riparian zone were, in decreasing order: the Red-winged Blackbird; the Tree Swallow and the Yellow Warbler in a tie for second; and Wilson's Snipe and the Cedar Waxwing in a tie for third. These five species accounted for 52% of the observed pairs. Only the Red-winged Blackbird and Wilson's Snipe were also among the most abundant species in 2017.

Table 3 - Average relative abundances per kilometre of shore and habitats used by birds at Blondin Creek and its adjacent environments during the 2018, 2017 and 2012 inventories

Code ^{e1}	Species	2018						2017						2012 ^e				
		Watercourse and riparian strip ²		Adjacent habitat		Total riparian zone ⁴	Adjacent habitat		Watercourse and riparian strip ²		Adjacent habitat		Total riparian zone ⁴	Watercourse and riparian strip ²		Total riparian zone ⁴		
		Relative abundance pairs/km	Habitat ³	0-25 m			> 25 m		Relative abundance pairs/km	Habitat ³	0-25 m			> 25 m			Relative abundance pairs/km	0-25 m
				Relative abundance pairs/km	Habitat ³	Relative abundance pairs/km	Habitat ³	Relative abundance pairs/km			Habitat ³	Relative abundance pairs/km	Habitat ³					
T	Wilson's Snipe			2.86	PC	2.86	2.86	PC; MA	2.86	H		2.86			2.14	1.43	3.57	
NF	Song Sparrow	1.43	H; S+T			1.43	4.29	PC; SW	1.43	H+S+T	1.43	FO	2.86	1.43	SW	1.43		1.43
T	Swamp Sparrow			1.43	PC; SW	1.43	2.86	PC	2.86	H+S; H+S+T	2.86	PC	5.71	1.43	SW	2.86	1.43	4.29
T	Savannah Sparrow													1.43	PC		2.86	2.86
S	Chipping Sparrow						1.43	HU										
T	American Bittern						1.43	PC; MA						1.43	MA			
H	Mallard								4.29	W			4.29			1.43		1.43
P	Northern Shoveler								1.43	W			1.43					
S	Rose-breasted Grosbeak						1.43	SW										
AT	Red-winged Blackbird	2.86	H+S; H+T; H+S+T	2.14	PC	5.00	5.00	PC; SW	8.57	H+S; H+S+T	2.86	PC	11.43	0.71	PC	2.86	9.29	12.14
H	American Goldfinch	0.71	In flight			0.71								0.71	WL			
H	American Crow						0.71	SW										
AT	European Starling	1.43	T	0.71	PC	2.14	0.71	PC	0.71	In flight			0.71				4.29	4.29
T	Bobolink			1.43	PC	1.43	2.86	PC									2.14	2.14
T	Pied-billed Grebe						1.43	MA						1.43	MA; SW			
JE	Common Raven													1.43	HU			
X	Great Blue Heron	0.71	W			0.71	0.71	PC			0.71	PC	0.71					
H	Black Tern								2.86	In flight (over water)			2.86					
H	Tree Swallow	2.86	In flight (over water)	1.43	PC	4.29			1.43	In flight (over water)			1.43	1.43	PC	0.71		0.71
H	Barn Swallow								0.71	In flight (over water)			0.71				0.71	0.71
H	Cedar Waxwing	2.86	T			2.86												
T	Sora										1.43	PC	1.43	1.43	PC			
AT	American Robin	0.71	T	0.71	PC	1.42	2.14	PC; SW	1.43	H			1.43			0.71	1.43	2.14
T	Least Flycatcher			1.43	SW	1.43	1.43	SW										
S	Baltimore Oriole						2.86	SW						1.43	SW		0.71	0.71

S	Yellow Warbler			4.29	SW	4.29		4.29	SW			1.43	FO	1.43		2.86	SW		
T	Common Yellowthroat			1.43	SW; HU	1.43		1.43	WL	1.43	S+T			1.43		1.43	WL		
H	Rock Dove															1.43	HU		
S	Northern Flicker							0.71			H+S+T			0.71					
T	Eastern Wood Pewee						4.29	SW		0.00		1.43	SW	1.43		2.86	FO; SW		
S	Bald Eagle	1.43	T			1.43													
H	Common Grackle	1.43	In flight			1.43		2.86	PC; SW	1.43	In flight			1.43		2.86		53.57	56.43
S	Virginia Rail						1.43	PC		1.43	H+S			1.43					
P	Green-winged Teal									2.14	W			2.14					
T	Marsh Wren														2.86	PC; MA	1.43		1.43
S	Great Crested Flycatcher						1.43	SW											
S	Eastern Kingbird			1.43	PC; WM	1.43									1.43	SW	0.71		0.71
T	Warbling Vireo			1.43	SW	1.43		2.86	SW			1.43	FO; SW	1.43		2.86	SW	1.43	1.43
			Vegetate d riparian strip only								Vegetated riparian strip only								
	Total	16.43	10.72	20.72		37.15		50.74		35.71 (71.42)	20.72	13.57		49.29		30.00		17.14	79.29
	Number of species	10	6	12		18		22		16	8	8		21		18		10	11

¹ Code: Breeding evidence observed (using the codes from the Québec Breeding Bird Atlas, 2017). Descriptions of the categories appear in Appendix E.

² Watercourse and riparian strip = water + bank + vegetated riparian strip if present.

³ W = water; B = bank; H = herbaceous cover; S = shrub cover; T = tree cover.

⁴ Total riparian zone = water + bank + riparian strip + adjacent habitat (0–25 m).

⁵ Habitat codes: AC = annual cropland; FH = farm hedgerow; FO = forested area; HU = human-modified environment; MA = marsh; OF = old field; OW = open water; PC = perennial cropland; SW = swamp; WM = wet meadow.

⁶ Note: There are some discrepancies between the 2012 values provided here and the data published in the report (Jobin 2015), due to the fact that some adjustments had to be made to the original data.

The Red-winged Blackbird was more abundant in the vegetated riparian strip than in the adjacent habitat. The Tree Swallow was observed feeding above the water, but also flying over the perennial crops. The Yellow Warbler was only found in swamps in the adjacent habitat, which suggests that the vegetation structure of the riparian strip is not yet suitable for this species. Wilson's Snipe was associated with wet perennial crops, and the Cedar Waxwing was associated with mature trees.

No waterfowl species were recorded in the creek, and the Great Blue Heron was the only species observed using it. The Bald Eagle (a species designated as vulnerable in Québec) was observed in a mature American elm tree in the vegetated riparian strip. Nesting of the Song Sparrow was confirmed in the riparian strip with the observation of a nest containing three eggs. The Swamp Sparrow, the Common Yellowthroat and the Warbling Vireo were associated with swamps. Several species were present in the perennial crops in the immediately adjacent habitat, including the Bobolink (a species designated threatened in Canada).



Song Sparrow nest, June 8, 2018
(Photo: Alexandre Nicole)

In 2012, 16 species were detected, and a density of 40 pairs/km (excluding the flock of Common Grackles) was measured in the riparian zone (**Table 3**). This number of species and pair density are lower than in 2017 (21 species and 49 pairs/km), but similar to 2018 (18 species and 37.2 pairs/km). The Red-winged Blackbird and Wilson's Snipe were among the most abundant species in 2012, 2017 and 2018. The main differences between these three years involve water birds, marsh birds and ground-nesting species. Fewer waterfowl species were observed in the creek in 2012 and 2018 (1 or 0 in 2012 and 2018, compared to 3 in 2017), and the Sora and the Virginia Rail, species associated with marshes, were completely absent in 2012 and 2018. In contrast, the Savannah Sparrow and the Bobolink, two ground-nesting species, were not observed in the riparian zone in 2017, unlike in 2012, and the Bobolink was not observed in 2018. The high water level in 2017 made it impossible for these species to nest near the creek. The years 2012 and 2018 are similar to each other, and 2017 was an exceptional year because the spring flood extended beyond spring.

The results obtained in the distant adjacent habitat provide an indication of the birds that occur in the landscape of Blondin Creek. In all, 22 species were recorded in these habitats, which consist of perennial crops and forested swamps—4 more than in 2017. Their density was also higher: 50.7 pairs in 2018 compared to 30 pairs in 2017. Of these species, 12 were observed in the swamps, including the Rose-breasted Grosbeak, the Eastern Wood Pewee (a species of special concern in Canada) and the Great Crested Flycatcher, and 11 were observed in the perennial cropland, including the Wilson's Snipe, the Bobolink and the Virginia Rail.

Species observed more than 25 m from the creek were not recorded during the 2012 surveys, so the 2017 and 2018 results cannot be compared to those of 2012 for distant adjacent habitats. Finally, the Barn Swallow (1 individual, a species designated threatened in Canada) and the Mourning Dove (1 individual) flew over the site, but did not stop there.

3.2 Bertco agroforestry plot

The Bertco agroforestry plot was surveyed twice, on June 8 and 26, 2018. The surveys were conducted between sunrise and 9:15 a.m. under ideal conditions. As this plot is located outside the flood plain on the first terrace formed by the Champlain Sea (counting from Lake Saint-Pierre), its hydrology is not influenced by the St. Lawrence River.

In all, 37 species were observed during the 2018 surveys. Nine species forming 11.5 pairs were found in the managed plot, while 33 species forming 54 pairs were found in the adjacent habitat (**Table 4**). Within the plot, the Song Sparrow, the Vesper Sparrow and the American Robin were the most abundant species, making up 55% of the pairs observed. Five new species were detected in the plot in 2018: the Red-tailed Hawk (2 individuals), the Rose-breasted Grosbeak (1 singing male), the Northern Cardinal (1 female), the Ruby-throated Hummingbird (1 individual in flight) and the Yellow-bellied Sapsucker (1 individual in flight). The number of species detected in the plot was similar in 2012 and 2018 (9 or 10), while the density of pairs varied (between 12.5 and 17.5).

The Song Sparrow and the Vesper Sparrow nest on the ground (the Song Sparrow also nests near the ground) and use crops for foraging and nesting, while trees are used as perches for singing and as lookout sites. The Savannah Sparrow, which also nests on the ground and whose nesting was confirmed within the plot in 2017, was observed only in the adjacent habitat in 2018.

Of the 8 other species observed within the plot, 4 were observed in flight: the Red-tailed Hawk, the Ruby-throated Hummingbird, the Cedar Waxwing and the Yellow-bellied Sapsucker. The Rose-breasted Grosbeak and the American Goldfinch used the trees as perches for singing. Finally, the Northern Cardinal and the American Robin were observed feeding on the ground.



Bertco agroforestry plot (photo taken on June 22, 2017, by Alexandre Nicole)

Table 4 - Results of bird surveys carried out in the Bertco agroforestry plot and adjacent environments in 2018, 2017 and 2012

Code ¹	Species	Agroforestry plot			Adjacent habitat			2012 ³
		2018	2017	2012 ³	2018	2017	Habitat ²	
		Pairs	Pairs	Pairs	Pairs	Pairs		
P	Song Sparrow	2.5	4	5	5	8	OF; FH; FO	0.5
AT	Savannah Sparrow		2		1	1	AC	
T	Vesper Sparrow	2	2	3	1	1	FH	
H	Red-tailed Hawk	1				1	AC	
P	Rose-breasted Grosbeak	1			2	1	FO	
H	Northern Cardinal	0.5						
H	American Goldfinch	1	1	1	1			
H	Ruby-throated Hummingbird	0.5						
H	American Crow				1	1	FO; In flight	
S	Black-billed Cuckoo					1	FO	
H	European Starling			0.5				2
S	Blue Jay				0.5	1	FO; In flight	
T	Wood Thrush				1	2	FO	
T	Veery				1	2	FO	
S	Hermit Thrush					1	FO	
H	Cedar Waxwing	2	1		1		FO	
AT	Belted Kingfisher					1	OF	
T	American Robin	1.5	1	1.5	1.5	2	FH; OF; FO	1
S	Black-capped Chickadee				1.5	1	FO	
S	Alder Flycatcher			1	4	1	FH	
S	Gray Catbird				1	0.5	OF	
S	Least Flycatcher					1	FO	
AT	Baltimore Oriole		1		1		FO	
S	Chestnut-sided Warbler				1		FO	
S	Black-throated Green Warbler				1	1	FO	
T	Ovenbird				1	3	FO	
S	American Redstart				1		FO	
T	Yellow Warbler				2	2	OF; FH	1
S	Common Yellowthroat				4	2	OF; FH; FO	2
S	Black-and-white Warbler				2	1	FO	
S	Pine Warbler					1	FO	
P	Hairy Woodpecker				1		FO	
T	Northern Flicker		1		1.5	1	OF; FH; FO	
S	Yellow-bellied Sapsucker	0.5			2	0.5	FH; FO	0.5
S	Downy Woodpecker				0.5	2	FO	
T	Eastern Wood Pewee				1	3	FO	
S	Scarlet Tanager					2	FO	
H	Killdeer			2	0.5	1	AC	1
H	Common Grackle					1.5	FH	
T	White-breasted Nuthatch					1	FO	
JE	House Wren				1	2	FO	
P	Great Crested Flycatcher		0.5		1	3	FH; FO	1

H	Eastern Kingbird		0.5		0.5	OF	
P	Brown-headed Cowbird	1	3	1	4	OF; FH	0.5
T	Warbling Vireo			2	2	FO	
T	Red-eyed Vireo			7	7	FO	1
Total		12.5	14.5	17.5	54	67	10.5
Number of species		10	10	9	33	37	10

¹ Code: Breeding evidence observed (using the codes from the Québec Breeding Bird Atlas, 2017). Descriptions of the categories appear in Appendix E.

² Habitat codes: **AC** = annual crops; **OF** = old field; **FH** = farm hedgerow; **FO** = forested area.

³ Note: There are some discrepancies between the 2012 values provided here and the data published in the report (Jobin 2015), due to the fact that some adjustments had to be made to the original data.

In 2012, the Song Sparrow and the Vesper Sparrow were among the most abundant species in the plot, and a similar number of pairs was detected there. The Killdeer, whose nesting was confirmed in 2012, ranked third in abundance that year, but was not detected in 2017 or 2018. Tree growth between survey periods could explain why the Killdeer abandoned this nesting habitat, as the species prefers open environments with little or no herbaceous vegetation and has little tolerance for woody species. The trees also explain the presence in 2017 and 2018 of species that were absent in 2012, such as the Rose-breasted Grosbeak, Cedar Waxwing, Baltimore Oriole, Northern Flicker, Yellow-bellied Sapsucker and Great Crested Flycatcher.

The species found in the adjacent habitats provide an indication of the bird species that occur in the landscape surrounding the agroforestry plot. In all, 33 species forming 54 pairs were recorded in these habitats, which consist of wooded areas, old fields in a ravine, a windbreak hedgerow and annual crops.

The number of species detected in each habitat is presented in **Table 5**. Wooded areas top the list with 28 species; the most abundant were the Red-eyed Vireo, the Rose-breasted Grosbeak, the Black-and-white Warbler, the Yellow-bellied Sapsucker and the Warbling Vireo. Eight species were present in the tamarack hedgerow west of the plot. In all, 7 species of warblers were detected in all habitats. Finally, the Savannah Sparrow, the Vesper Sparrow and the Killdeer were observed in the surrounding annual cropland, which was the habitat with the fewest species recorded.

Table 5 - Number of species recorded in each of the environments adjacent to the Bertco agroforestry plot

Habitats	Number of species	
	2018	2017
Annual crops	3	3
Oldfield	4	9
Larch hedgerow	8	6
Forest environments	28	24
In flight	1	1
Total	33	37

Ten species were recorded in the adjacent habitats during the 2012 surveys. All species observed in 2012 were also observed in 2017 and 2018, with the exception of the European Starling. The significantly higher number of species (up to 37) detected in the adjacent habitats in 2017 and 2018 is likely due to the fact that in 2012, only birds seen or heard in the first 25 metres of adjacent habitat were noted. Finally, the Mourning Dove (2 individuals) was observed flying over the site, but not using it.

Conclusion

Watercourses

The surveys of the three watercourses were conducted under ideal weather conditions. The riparian zone of the Brielle River and Côte-Lefebvre Creek contained 23 species, while that of Blondin Creek contained 18 species. A separate examination of the results for Côte-Lefebvre Creek reveals that its riparian zone was used by only 7 species. The bird density measured for this watercourse was 6.6 pairs/km, compared to 39 for the Brielle River and 37.2 for Blondin Creek.

The positive effect of the presence of trees and shrubs in vegetated riparian strips has already been demonstrated by several authors (Goupil 1995; Maisonneuve and Rioux 1998; Ministère de l'Environnement du Québec 1998; Nourry 2006). The results obtained in this study confirm this observation, since the riparian strips in which woody species were present are those that contained the highest species richness and density. In this regard, the banks of Côte-Lefebvre Creek and the south bank of the Brielle River are in very poor condition and are not fulfilling their wildlife functions, or even the other functions usually attributed to riparian strips (stabilizing the soil, trapping sediments, fertilizers and pollutants, providing shade, etc.). The Brielle River owes its diversity in part to the fact that its north bank is adjacent to a large wetland complex.

The number and density of species measured in 2012 and 2018 in the Brielle and Côte-Lefebvre watercourses were similar, which is expected as the vegetation planted in the riparian strip of these watercourses in 2012 was destroyed. Three of the six most abundant species in 2012 were also among the most abundant in 2018: the Red-winged Blackbird, the Song Sparrow and the Spotted Sandpiper. The same is true for Blondin Creek: no real differences in the composition and density of species using the watercourse were observed between 2012 and 2018.

In all cases, 2012 and 2018 were more similar than 2017 and 2018. In general, more anatidae and other water birds were noted in 2017 than in 2012 and 2018.

In 2018, the Brielle River had only one species at risk, the Eastern Wood Pewee (a species of special concern in Canada). Blondin Creek had three species at risk, i.e., the Bobolink (a species designated threatened in Canada), the Bald Eagle (a species designated vulnerable in Québec) and the Eastern Wood Pewee. Côte-Lefebvre Creek had no species at risk.

Bertco Agroforestry Plot

The surveys of the Bertco agroforestry plot were conducted under ideal weather conditions. The Song Sparrow and the Vesper Sparrow were among the most abundant species in 2012, 2017 and 2018. The Killdeer, whose nesting habitat was modified by the growth of trees interspersed crops, was not detected in the plot in 2017 or 2018. The presence of trees also helps to explain why species absent in 2012, such as the Rose-breasted Grosbeak, Cedar Waxwing, Baltimore Oriole, Northern Flicker and Great Crested Flycatcher, were observed in 2017 and 2018.

Adjacent habitats, particularly wooded areas, were home to a high diversity of species (at least 31); their importance for wildlife in intensively cultivated areas is indisputable. Fewer species used adjacent habitat occupied by annual crops than the managed plot (3 versus 10), suggesting that the presence of trees allows this habitat to support a larger number of species.

In both 2018 and 2017, two species at risk were detected in the Bertco plot surveys: the Wood Thrush (a species designated threatened in Canada) and the Eastern Wood Pewee (a species of special concern in Canada). These species were found in adjacent forested habitats.

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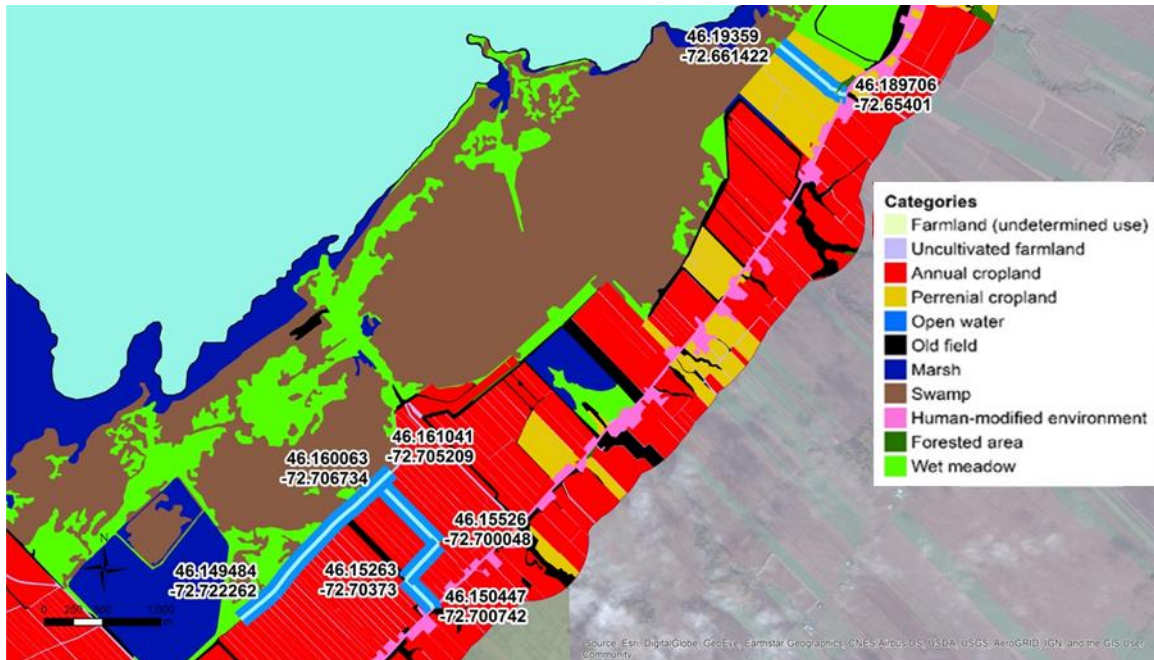
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- TABLE DE CONCERTATION RÉGIONALE DU LAC SAINT-PIERRE (TCRLSP). 2017. *Cohabitation agriculture-faune en zone littorale au lac Saint-Pierre*, Fiche Synthèse, 28 p. et annexes.

Appendix A. Field datasheet used for watercourses (available in French only)

INVENTAIRE DES OISEAUX CHANTEURS DES COURS D'EAU - ÉTÉ 2018									
NOM DU COURS D'EAU :		OBSERVATEUR : AN			TEMPÉRATURE :				
N° VISITE (1 ou 2) :		Nbre PAGES POUR CE COURS D'EAU :			VENT :				
DATE : JUN 2018					PRÉCIPITATIONS :				
HEURE (DÉBUT-FIN) :					ENNUAGEMENT :				
ESPECE	Nbre INDIVIS	TYPE DE RECENSEMENT	SEXE	LOCALISATION (E, R, B ou M)	SI BANDE RIVERAINE HABITAT (H, U, O)	MILIEU ADJACENT (1 ou E vs 1 ^{er} 25 m)	MILIEU ADJACENT - HABITAT	REMARQUES	

<p>- VENT : 0 : PAS DE VENT 1 : VENT FAIBLE (LES FEUILLES BOUGENT) 2 : VENT MOYEN (LES BRANCHES BOUGENT) 3 : VENT FORT (LES BRANCHES PLIENT) 4 : VENT VIOLENT (LES BRANCHES CASSENT)</p> <p>- PRÉCIPITATIONS : 0 : PAS DE PRÉCIPITATIONS 1 : BRUINE 2 : PLUIE LÉGÈRE 3 : PLUIE FORTE 4 : ORAGE</p> <p>- ENNUAGEMENT : 0 : CLAIR, DÉGAGÉ 1 : PARTIELLEMENT COUVERT 2 : COUVERT</p> <p>REMARQUES :</p>	<p>- TYPE DE RECENSEMENT : T : COMPORTEMENT TERRITORIAL (CHANT) C : CRI H : OBSERVATION VISUELLE DANS L'HABITAT V : VOL S : SURVOL AU DESSUS DE L'HABITAT (HAUT DANS LES AIRS) N : NID F : FAMILLE</p> <p>- SEXE : ♂ : MÂLE ♀ : FEMELLE</p> <p>- LOCALISATION DE L'OISEAU : E : EAU LIBRE R : RIVE B : BANDE DE VÉGÉTATION RIVERAINE M : MILIEU ADJACENT</p> <p>- BANDE DE VÉGÉTATION RIVERAINE - HABITAT UTILISÉ : H : HERBACÉES U : ARBUSTES O : ARBRES (ARBORÉ)</p> <p>- MILIEU ADJACENT - POSITION DE L'OISEAU VS LE 1^{ER} 25 MÈTRES : I : À L'INTÉRIEUR E : À L'EXTÉRIEUR</p> <p>- MILIEU ADJACENT - HABITAT UTILISÉ PAR L'OISEAU : CA : CULTURE ANNUELLE CP : CULTURE PÉRENNE NC : AGRICOLE NON CULTIVÉ HA : HAIE AGRICOLE EL : EAU LIBRE FR : FRICHE MA : MARAIS MG : MARÉCAGE MQ : MILIEU ANTHROPIQUE MF : MILIEU FORESTIER UM : PRAIRIE HUMIDE</p>
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Appendix B. Geographic coordinates of transects for inventoried watercourses



Appendix D. Bertco agroforestry plot transect coordinates



Appendix E. Breeding indices from the Québec breeding bird atlas (QBBA, 2017)



BREEDING EVIDENCE CODES, LEVELS OF CERTAINTY AND DEFINITIONS

Code	Level of certainty	Definition
X	Species observed	Species observed during its breeding season, but not in suitable nesting habitat (no breeding evidence found).
H	Possible breeding	Species observed in suitable nesting habitat during its breeding season.
S	Possible breeding	Individual singing or producing other sounds associated with breeding (e.g., calls or drumming) in suitable nesting habitat during the species' breeding season.
M	Probable breeding	At least 7 individuals singing or producing other sounds associated with breeding (e.g., calls or drumming), heard during the same visit to a single square and in suitable nesting habitat during the species' breeding season.
P	Probable breeding	Pair observed in suitable nesting habitat during the species' breeding season.
T	Probable breeding	Presumed territory based on the presence of an adult bird, whether producing sounds associated with breeding (e.g., song, other calls or drumming) or not, at the same place, in suitable nesting habitat, on at least two visits, one week or more apart, during the species' breeding season.
C	Probable breeding	Breeding behaviour involving a male and female (e.g., display, courtship feeding and copulation) or antagonistic behaviour between two or more individuals (e.g., territorial disputes or chases), in suitable nesting habitat during the species' breeding season.
V	Probable breeding	Bird visiting a probable nest site in suitable nesting habitat during the species' breeding season.
A	Probable breeding	Agitated behaviour or alarm call of an adult in suitable nesting habitat during the species' breeding season.
B	Probable breeding	Brood patch or cloacal protuberance on an adult individual caught in suitable nesting habitat during the species' breeding season.
N	Probable breeding	Nest-building by wrens or nest hole excavation by woodpeckers.
CN	Confirmed breeding	Nest building, including the carrying of nesting material, by all species except wrens and woodpeckers.
DD	Confirmed breeding	Individual attempting to draw attention away from a nest or young by feigning injury or by using any other distraction display.
NU	Confirmed breeding	Empty nest used during the atlas survey period, or the shells of eggs laid during the same period.
JE	Confirmed breeding	Recently fledged (nidicolous species) or downy (nidifugous species) young incapable of sustained flight.
NO	Confirmed breeding	Adult occupying, leaving or entering a probable nest site (visible or not) and whose behaviour suggests the presence of an occupied nest.
FE	Confirmed breeding	Adult carrying a fecal sac.
AT	Confirmed breeding	Adult carrying food for young.
NF	Confirmed breeding	Nest containing one or more eggs.
NJ	Confirmed breeding	Nest with one or more young (seen or heard).



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