J. Range Manage.
52:332–338

# Cattle grazing and avian communities of the St. Lawrence River Islands

**LUC BÉLANGER AND MARTIN PICARD**

*Luc Bélanger is habitat biologist with the Canadian Wildlife Service (Environment Canada, 1141 route de l'Église, P.O. Box. 10100, Ste. Foy, Québec, Canada, G9A 5H7). At the time of the research, Martin Picard was a consulting biologist (1121 des Fauvettes, Boucherville, Québec, Canada, J4B 5N6).*

## Abstract

**Three hundred islands are found along the St. Lawrence River in Québec. Among these islands, over 5,000 ha are used for agricultural purposes and 32% of this total is devoted to communal pasture, a traditional practice in this part of the river. In 1993 and 1994, we compared the avian communities of 500 ha natural spring flooded prairie islands subjected to different degrees of grazing pressure. Three islands were divided into 12 sectors, in which 108 sample plots of 0.5 ha were selected. Results show that the degree of visual obstruction by herbaceous vegetation and the percentage of shrub cover were higher on ungrazed and on moderately grazed prairie (<1 cow/ha/year) as compared with intensively grazed prairie (>1 cow/ha/year). More than 1,650 observations of passerines were made and 13 species were identified. The Swamp Sparrow (*Melospiza georgiana*), Savannah Sparrow (*Passerculus sandwichensis*), Red-winged Blackbird (*Agelais phoeniceus*), and Bobolink (*Dolichonyx oryzivorus*) were the 4 most abundant species, accounting for over 80% of all birds counted. Ungrazed and moderately grazed prairie contained 6 times more birds than intensively grazed prairie (10.4 birds/ha and 11.7 birds/ha vs 1.6 birds/ha). We also recorded 167 and 113 dabbling duck (anatinae) nests in 1993 and 1994 respectively. Moderately grazed and ungrazed prairies had a nest density nearly 10 times higher than that of intensively grazed prairie (0.50 ± 0.01 and 0.30 ± 0.0 1 nest/ha vs 0.05 ± 0.01 nest/ha). Our study shows that grazing pressure on prairies of the studied islands largely determined the type of bird species present. However, prairie subjected to excessive grazing pressure is not suitable for waterfowl nesting. Various recommendations are provided for integrated management of wildlife and agriculture on the St. Lawrence River communal pasture islands.**

## Resumen

**A lo largo del río St. Lawrence en Québec se encuentran trecientas islas. En estas islas más de 5,000 ha son utilizadas con fines agrícolas y 32% de este total se dedica a actividades comunales de apacentamiento la cual es una práctica común en esta parte del río. En 1993 y 1994 comparamos las comunidades de aves en 500 ha de praderas isleñas sujetas a diferentes grados de presión de apacentamiento. Tres islas se dividieron en tres sectores, en los cuales se seleccionaron 108 parcelas de muestreo de 0.5 ha. Los resultados muestran que el grado de obstrucción visual por vegetación herbácea y el porcentaje de cobertura de arbustos fueron mayores en praderas sin apacentamiento o que recibieron apacentamiento moderado (<1 vaca por año) que en las que fueron apacentadas intensivamente (>1 vaca por año). Se hicieron más de 1650 observaciones y se identificaron 13 especies.. El "Swamp sparrow" (*Melospiza georgiana*), "Savannah sparrow" (*Passerculus sandwichensis*), "Redwinged blackbird" (*Agelais phoeniceusi*) y "Bobolink" (*Dolichonyx oryzivorus*) fueron las cuatro especies más abundantes y comprendieron más del 80% del total de aves contadas Las praderas sin apacentamiento o apacentadas moderadamente tuvieron 6 veces más aves que las praderas apacentadas intensivamente (10.4 y 11.7 aves /ha vs 1.6 aves/ha). En 1993 y 1994 registramos 167 y 113 nidos de "Dabblin duck" (anatinae) En las praderas sin apacentamiento o con apacentamiento moderado la densidad de nidos fue casi 10 veces mayor que en las praderas apacentadas intensivamente (0.5 ± 0.01 y 0.30 ± 0.01 nidos/ha vs 0.05 ± 0.01 nidos/ha) Nuestro estudio muestra que la presión de apacentamiento en las praderas de las islas estudiadas determina en gran medida el tipo de especie de aves presentes en estas praderas. Sin embargo, las praderas sujetas a una presión de apacentamiento excesiva no son apropiadas para el anidamiento del "Waterfowl'. Se proveen varias recomendaciones para un manejo integrado de la fauna silvestre y agricultura para la praderas comunales de las islas del río St. Lawrence.**

**Key Words: agriculture, birds, livestock, pasture, flooded prairies, Québec, waterfowl**

Along the St. Lawrence River in Québec there are many archipelagos, individually numbering over 300 islands. Over 5,000 ha of their area is used for agricultural purposes, with 32% (1,685 ha) of this total devoted to communal pasture, a

The authors wish to thank the many people and organizations that participated in the field surveys: C. Berthiaume, A. Chrétien, S. Gagnon, S. Goupil, M. Labonté, S. Lapointe, G. Couture, as well as several members of the Association des Chasseurs et Pêcheurs de Ste-Anne-de-Sorel (ACPSAS) and the Fondation Les Oiseleurs du Québec. Special thanks also go to A. Cossette, who was in charge of the field crew. We are also grateful to Bruce Pollard of the Institute of Waterfowl and Wetlands Management, of Ducks Unlimited Canada, for lending us the radiotransmitters and for calculating the nesting success of ducks on Moine Island in 1994 using the modified version of the Mayfield method. Finally, we thank Linda Burr and Stéphane Lapointe, consulting biologists, and Charles Maisonneuve of the Ministère de l'Environnement et de la Faune du Québec, Service de la faune terrestre, for providing comments on the preliminary version of the manuscript. This study was made possible by funding granted to one of the authors (LB) under the Eastern Habitat Joint Venture and by a contribution from the St. Lawrence Action Plan in 1994 (Denis Lehoux, Canadian Wildlife Service, Quebec Region).

Research was funded in part by the Eastern Habitat Joint Venture.

Manuscript accepted 14 Oct. 1998.

traditional practice in this part of the river (De Koninck 1970, Pilon et al. 1981). Islands have been used as communal pasturelands by local farmers for many decades. Year-to-year, cows are brought over by a flat boat in late May or early June and taken back in mid-November. In recent years, major efforts have been made to increase our knowledge of the potential of these islands for wildlife and to devise various strategies for conserving biodiversity (Bélanger and Lehoux 1995).

Because it modifies both plant species composition and abundance, livestock grazing reduces the richness and density of avian communities that use western prairie habitat (Kirsch et al. 1978, Kantrud 1981, Taylor 1986, Bowen and Kruse 1993). It also has been shown that waterfowl nest density and nesting success are significantly reduced in grazed prairies (Glover 1956, Kirsh 1969, Higgins 1977, Kirsh et al. 1978, Klett et al. 1988, Kirby et al. 1992). However, the impact of livestock grazing in the eastern part of this continent, where the type of herbaceous natural prairie, herd management and bird populations differ, has not been studied.

The objective of our study was to compare the avian communities of natural spring flooded prairie of the St. Lawrence River islands subjected to different degrees of grazing pressure, to provide recommendations for integrated wildlife and range management.

## Study Areas and Methods

Our study was carried out on 3 islands of the Berthier-Sorel archhipelago located less than 100 km east of Montréal, namely Moine, Barques and Ronde islands. Moine Island has an area of nearly 590 ha, of which over 50% (307 ha) is covered by natural spring flooded herbaceous prairie dominated by reed canary grass (*Phalaris arundinacea*)(Marie-Victorin 1964) (Table 1). Although there are a few old wire fences that divide the island into different rough pasture units, they are obviously ineffective since livestock can easily get around them. Hence, more than 100 cows move freely around the island. Barques Island has a total area of nearly 175 ha, with herbaceous prairie covering approximately 70%, or 123 ha. Although reed canary grass is predominant, common reed grass (*Phragmites communis*) has grown extensively on dredge spoil deposited on the island when the St. Lawrence Seaway was created. Livestock was present about 30 years ago, but this island has not been used for agriculture since that time. Ronde Island has an area of about 30 ha. More than 50 animals (cows and sheep) graze from early May to late October; hence, the vegetation cover is heavily degraded. Herbaceous prairie covers more than 95% of the island. In this paper, the avian communities of natural prairie (ungrazed), moderately grazed prairie (<1 cow/ha/year) and intensively grazed prairie (>1 cow/ha/year) were compared.

### Description of the vegetation cover and bird surveys

The 3 islands were subdivided into 20 sectors, each consisting of 100 ha, according to the map mercator system (UTM). A grid made up of 0.5 ha units was then superimposed, and 108 sample plots were selected. Although distributed in proportion to the respective area of the islands, the plots were nonetheless selected randomly within each island. This approach yielded 68 sampling plots on Moine Island, 30 on Barques Island and 10 on Ronde Island. Consequently, 11%, 12% and 8% respectively, of the total area of herbaceous prairie of these islands was surveyed.

Vegetation surveys were carried out in late May and early June 1993 in all the plots. A sampling station was positioned every 10 m along a diagonal line crossing each plot from east to west, for a maximum of 10 measurements/plot. At each station, we noted the dominant and co-dominant plant species within a 1 $m^2$, the degree of visual obstruction associated with the herbaceous vegetation cover (Robel et al. 1970), and the percentage of shrub cover.

The same 108 plots were used in 1993 to conduct a survey of passerine birds following Bibby et al. (1992). A count was done within each plot as follows: the observer walked slowly, noting the position, species and sex, if possible, of all birds seen or heard. Upon reaching the middle of the plot, the observer listened for 5 minutes and then walked to the far end of the plot. It took the observer approximately 10 minutes to cover each plot. Sampling was conducted during the first 2 weeks of June. Bird counts were done between sunrise (0500 hours) and 1000 hours. Each plot was surveyed 5 times.

A duck nest survey was carried out in 1993 between mid-May and early July. This survey encompassed the entire area of herbaceous prairie on each island and was done 3 times. In the common reed grass communities on Barques Island, only the immediate periphery of the stand was surveyed, due to the excessive density of stems and the low probability of finding nests. The census and nest description procedures used follow recommendations of Klett et al. (1986). The counts were generally done between 0800 and 1400 hours (Gloutney et al. 1993), although the nest searching sometimes had to be continued until 1600 hours. Four to 12 persons walked abreast, beating the vegetation to flush hens from nests. Whenever a nest was found, the number of eggs present was noted and their incubation stage was determined by the flotation method (Klett et al. 1986). A description was

**Table 1. Survey efforts and characteristics of the studied prairie habitats on 3 St. Lawrence River communal pasture islands, Québec, 1993–1994.**

| | Moine Island | Barques Island | Ronde Island |
|---|---|---|---|
| Grazing regime category | moderate | none | intensive |
| Cow density (animal units) | ≤ 1 cow/ha/year | 0 /ha/year | > 1 cow /ha/year |
| Total area of the island | 590 ha | 175 ha | 70 ha |
| Area (%) of the island covered by herbaceous prairie | 307 ha (52.03%) | 123 ha (70.29%) | 67 ha (95.71%) |
| Area of the surveyed sectors | 270 ha | 120 ha | 60 ha |
| Area (%) of herbaceous prairie sampled | 34 ha (11.1%) | 15 ha (12.2%) | 5 ha (7.5%) |
| Number of sample plots | 68 | 30 | 10 |

**Table 2. Plant cover characteristics of the herbaceous prairie of 3 St.Lawrence River communal pasture islands, Québec, 1993–1994.**

| Grazing Pressure | Obstruction | Shrub Cover |
|---|---|---|
| | (cm) | (%) |
| ungrazed | 27.0 ± 0.6A | 3.7 ± 0.4A |
| moderately grazed | 24.5 ± 0.6A | 2.2 ± 0.2B |
| intensively grazed | 7.2 ± 0.5B | 0.0 ± 0.0C |

also made of the vegetation present in a 1 $m^2$ quadrat around the nest (used as a central point) by assigning a percentage of cover to the different plant species present. Various other measurements were taken, such as, visual obstruction by herbaceous vegetation cover (Robel et al. 1970) and the heights of the tallest living (annual or growing vegetation) and dead (litter or residual vegetation) stems. The exact position of the nests was marked on colour aerial photos (1:1,500) of the islands, and nest locations in the field were identified by installing a marker post 15 m to the northeast of each of them at a precise angle. The nests were visited a second time to record their fate.

In 1994, another nest count was conducted on Moine Island and Ronde Island to better document the nesting success of dabbling ducks on these unmanaged islands. In contrast with the previous year, the nest search was carried out using the rope dragging method (Klett et al. 1986), which consisted of pulling a weighted rope about 10 m long stretched between 2 motorcycles. A third person followed behind to locate the exact spot from which the hens flew and to identify the species involved. Landmarks along the shore, marker stakes and a compass were used to carefully delimit the areas surveyed in each count and to ensure coverage of all the prairie habitat on the islands. The same nest location and description procedures were employed as in 1993, except that to overcome the problem of livestock trampling and knocking down the posts used to mark nest locations, a radiotransmitter was placed underneath 40 nests randomly distributed on the islands, with the antenna extending beyond the nest. Each of these nests was visited every 7 days until its fate was determined.

### Data analysis

The mean of the 10 measurements made in each plot was adopted as the evaluation of visual obstruction by herbaceous vegetation cover present. In addition, the coefficient of variation of this mean was used to document the degree of uniformity or homogeneity of the plant cover within each plot. For comparison purposes, the latter provides a better estimate than variance or the standard deviation because it is not affected by the value of the mean (Zar 1974).

In the case of the passerine bird counts, for each species, the day with the maximum number of records out of the 5 surveys conducted was used for subsequent comparisons between prairie types (Bibby et al. 1992). Hence, for each species and species group, the survey with the highest number of observations was selected. The selected day varied from 1 species to the next. Finally, the number of duck nests in each survey sector was determined by superimposing their boundaries on the colour aerial photos used in identifying the nest locations. The mean number of nests/island is actually the mean of nest density in each sector studied. A nest was considered as successful if at least 1 of the eggs had hatched. The nesting success of the different species was calculated in terms of apparent success (number of nests with hatched birds/total number of nests), and also by using a modified version of the Mayfield method (Klett et al. 1986) which takes into account the number of days the nest is exposed to predators.

Data analysis was conducted following Zar (1974), and by using the SAS program (SAS Inst. Inc, personal computer version). The vegetation characteristics were compared among sectors/islands through one-way analysis of variance followed by multiple comparison tests (SNK and Tukey). Simple Pearson correlation coefficients were used to compare relationships between the characteristics of the plant communities in the sampling sectors and, as applicable, the total density of duck nests or the abundance of passerines. An analysis of habitat selection by the different passerine species was conducted using the method of Neu et al. (1974). Finally, the standard error (SE) is given for all means presented in this text and in the tables. The probability level for statistical tests was set at 5% throughout the analyses.

## Results

### Characteristics of the vegetation cover

The degree of visual obstruction ($F = 89.4$, $df = 2$, $P<0.0001$) and the percentage of shrub cover ($F = 20.5$, $df = 2$, $P<0.0001$) differed among the 3 types of prairie (Table 2). In comparing the vegetation characteristics of various sectors surveyed on the 3 islands, a significant difference was also found in both the visual obstruction measure ($F = 59.0$, $df = 10$, $P<0.0001$) and the percentage of shrub cover ($F= 29.8$, $df = 10$, $P<0.0001$). Finally, the degree of homogeneity of the herbaceous plant cover also differed among the 3 islands studied ($F = 12.2$, $df = 2$, $P = 0.0001$).

### Habitat use by passerine birds

A total of 540 counts was conducted, comprising 1,659 records of birds. In all, 13 passerine species were observed: 10 species on Moine Island, 11 on Barques Island and only 2 on Ronde Island (Table 3). The Savannah Sparrow (*Passerculus sandwichensis*) was the only species observed on all 3 islands. The 4 most common species, the Swamp Sparrow (*Melospiza georgiana;* n = 592) (Gauthier and Aubry 1995), Savannah Sparrow (n = 342), Red-winged Blackbird (*Agelaius phoeniceus;* n = 203) and Bobolink (*Dolichonyx oryzivorus*; n = 196), accounted for more than 80% of the observations. Sedge Wrens (*Cistothorus platensis*) were present on Barques Island while Sharp-tailed Sparrows (*Ammodramus caudacutus*) and Brown-headed Cowbirds (*Molothrus ater*) were found on Moine Island. The Eastern Meadowlark (*Sturnella magna*) was observed only once on Ronde Island.

The 13 species observed were divided into 5 groups based on certain taxonomical and ecological characteristics. The 4 sparrow species were grouped together in the sparrow group (TOTBRU), the 2 warbler species and the American Goldfinch (*Carduelis tristis*) in the war-

**Table 3. Species composition (number of birds/species and relative abundance [%]) of passerines associated with wet meadows, according to 3 different levels of grazing on St. Lawrence communal pasture islands, Quebec.**

| Species | Grazing Pressure None (Barques 1.) | | Moderate (Moine I.) | | Intensive (Ronde I.) | | Total |
|---|---|---|---|---|---|---|---|
| | (no) | (%) | (no) | (%) | (no) | (%) | (no) |
| Red-winged blackbird | 39 | (7.33) | 164 | (14.83) | 0 | (0.00) | 203 |
| American goldfinch | 9 | (1.69) | 9 | (0.81) | 0 | (0.00) | 8 |
| Yellow warbler | 69 | (12.97) | 28 | (2.53) | 0 | (0.00) | 97 |
| Common yellowthroat | 49 | (9.21) | 57 | (5.15) | 0 | (0.00) | 106 |
| Bobolink | 21 | (3.95) | 175 | (15.82) | 0 | (0.00) | 196 |
| Song sparrow | 38 | (7.14) | 7 | (0.63) | 0 | (0.00) | 45 |
| Swamp sparrow | 239 | (44.92) | 353 | (31.92) | 0 | (0.00) | 592 |
| Savannah sparrow | 55 | (10.34) | 267 | (24.14) | 20 | (95.00) | 342 |
| Sharp-tailed sparrow | 0 | (0.00) | 13 | (1.18) | 0 | (0.00) | 13 |
| Eastern meadowlark | 0 | (0.00) | 0 | (0.00) | 1 | (4.76) | 1 |
| Sedge wren | 7 | (1.32) | 0 | (0.00) | 0 | (0.00) | 7 |
| Marsh wren | 6 | (1.13) | 29 | (2.62) | 0 | (0.00) | 35 |
| Brown-headed cowbird | 0 | (0.00) | 4 | (0.36) | 0 | (0.00) | 4 |

bler group (TOTWARB), and the 2 wren species in the wren group (TOTROG). The icterid group comprised Red-winged Blackbirds, Brown-headed Cowbirds and Eastern Meadowlarks (TOTICTE). Bobolinks (GOGL), although they are icterids, were analysed separately in view of their declining status in North America. The analysis of these 5 groups revealed significant differences in their abundance on the 3 islands under study ($x^2$ = 136.9, df = 8, P = 0.001) (Table 4). Even when paired, the significant differences mentioned earlier still existed between Barques Island and Moine Island ($x^2$ = 124.1, df = 4, P = 0.001), between Moine Island and Ronde Island ($x^2$ = 12.1, df = 4, P = 0.017) and between Barques Island and Ronde Island ($x^2$ = 9.96, df = 4, P = 0.041). The sparrow group was the largest group, mainly due to the high density of Swamp Sparrows on Moine and Barques islands. The minimum densities (all species combined) found were 10.4 birds/ha on Moine Island, 11.7 birds/ha on Barques Island and 1.6 birds/ha on Ronde Island. Thus, the ungrazed and the moderately grazed prairie had 6 times more birds than the intensively grazed prairie habitat.

An analysis of habitat selection was conducted for the different species groups (Table 5). Habitat availability was determined based on the number of plots found on each of the islands, since each plot had the same area and was surveyed 5 times in all; hence, the minimum number of observations was 54. Bobolinks, and icterids as a whole, preferred moderately grazed prairie and avoided ungrazed and intensively grazed prairie. Species in the warbler group preferred ungrazed natural prairie and shunned the other 2 types of prairie. Sparrows, too, preferred ungrazed prairie, but used moderately grazed prairie in the proportions present and avoided intensively grazed prairie. A significant difference was found between shrub cover on ungrazed and moderately grazed prairie. The wren group was not statistically analysed because of the insufficient number of observations (n = 42).

Habitat selection was then analysed for those species which had been observed in sufficient numbers. We found no significant difference between the number of birds observed on ungrazed and moderately grazed herbaceous prairie for the Common Yellowthroat, Swamp Sparrow, Marsh Wren, Savannah Sparrow, sparrows as a whole (TOTBRU), wrens as a whole (TOTROG) and passerines overall (Table 6). However, there were significantly more Red-winged Blackbirds,

**Table 4. Maximum number of observations and bird densities found on each of the 3 islands studied in relation to the different grazing levels.**

| Species and Species Group | Moderate Grazing (Moine Island) | | No Grazing (Barques Island) | | Intensive Grazing (Ronde Island) | |
|---|---|---|---|---|---|---|
| | Maximum | Density | Maximum | Density | Maximum | Density |
| | (no. obs.) | (no./ha) | (no. obs.) | (no./ha) | (no. obs.) | (no./ha) |
| Total No. of Birds | 355 | 10.44 | 176 | 11.73 | 8 | 1.60 |
| TOTBRU | 187 | 5.50 | 103 | 6.87 | 7 | 1.40 |
| GOGL | 58 | 1.71 | 8 | 0.53 | 0 | 0.00 |
| TOTICTE | 60 | 1.76 | 14 | 0.93 | 0 | 0.20 |
| TOTWARB | 41 | 1.21 | 45 | 3.00 | 0 | 0.00 |
| TOTROG | 9 | 0.26 | 6 | 0. 40 | 0 | 0.00 |
| Red-winged blackbird | 57 | 1.68 | 14 | 0.93 | 0 | 0.00 |
| American goldfinch | 7 | 0.21 | 8 | 0.53 | 0 | 0.00 |
| Yellow warbler | 12 | 0.35 | 19 | 1.27 | 7 | 0.00 |
| Common yellowthroat | 22 | 0.65 | 18 | 1.20 | 0 | 0.00 |
| Song sparrow | 3 | 0.09 | 10 | 0.67 | 0 | 0.00 |
| Swamp sparrow | 103 | 3.03 | 74 | 4.93 | 0 | 0.00 |
| Savannah sparrow | 72 | 2.12 | 19 | 1.27 | 7 | 1.40 |
| Sharp-tailed sparrow | 9 | 0.26 | 0 | 0.00 | 0 | 0.00 |
| Eastern meadowlark | 0 | 0.00 | 0 | 0.00 | 1 | 0.20 |
| Sedge wren | 0 | 0.00 | 3 | 0.20 | 0 | 0.00 |
| Marsh wren | 9 | 0.26 | 3 | 0.20 | 0 | 0.00VA |
| Brown-headed cowbird | 3 | 0.09 | 0 | 0.00 | 0 | 0.00 |

**Table 5. Number of birds/species, relative importance (%) of groups of passerine species and degree of selection of herbaceous prairie according to 3 different levels of grazing (see Table 1) on St. Lawrence communal pasture islands, Quebec. For the meaning of the abbreviations, see text. The wren group was not analysed due to the extremely small number of them observed (n <54 records). A "–" sign denotes habitat avoidance, a "+" sign indicates habitat selection, and a "0" indicates that the habitat was neither preferred nor selected.**

| Species Group | Grazing Intensity None | Moderate | Intensive | Total |
|---|---|---|---|---|
| | No. (%) | No. (%) | No. (%) | No |
| TOTBRU | 332 (33.47) + | 640 (64.52) 0 | 20 (2.02) – | 992 |
| GOGL | 21 (10.71) – | 175 (89.29) + | 0 (0.00) – | 196 |
| TOTICTE | 39 (18.75) – | 168 (80.77) + | 1 (0.48) – | 208 |
| TOTPARU | 127 (57.47) + | 94 (42.53) – | 0 (0.00) – | 221 |

Bobolinks, and icterids overall (TOTICTE) on moderately grazed prairie than on ungrazed prairie. Finally, there were significantly more Yellow Warblers, Song Sparrows, warblers overall (TOTWARB) and American Goldfinches on ungrazed prairie than on moderately grazed prairie.

The effect of the vegetation cover on the distribution of the different passerine species was also examined. The 2 variables considered (visual obstruction and shrub cover) were not significantly associated with total use of the habitat by passerines (Table 7). However, a significant positive association was found between the percentage of shrubs and the presence of American Goldfinches, Yellow Warblers and Song Sparrows; a positive correlation was also found between the degree of visual obstruction and the presence of Common Yellowthroats and Swamp Sparrows.

## Waterfowl nesting and nesting success

In all, 167 dabbling duck nests were found on the 3 islands in 1993. This represents a density of 0.34 nests/ha, taking into account only the area of prairie habitat on the islands. More specifically, we found 129 nests on Moine Island, 36 on Barques Island and only two nests on Ronde Island. This is equivalent to densities of 0.50 ± 0.01, 0.30 ± 0.01 and 0.05 ± 0.01 nests/ha for moderately grazed, ungrazed and intensively grazed prairie, respectively ($F = 135.7$, $df = 2$, $P<0.0001$).

In 1993, the Northern Pintail (*Anas acuta*) (26%), Gadwall (*Anas strepera*) (31%) and Mallard (*Anas platyrynchos*) (17%) dominated the list of species censused. The Black Duck (*Anas rubripes*) accounted for only 1% of all nests found, whereas a total of 6 Blue-winged Teal (*Anas discors*) nests were found. The species composition of the nesting ducks was fairly similar for Moine Island and Barques Island, whereas the Northern Pintail was the only species found nesting on Ronde Island. Of the 167 nests counted in spring 1993, 67 were later revisited to determine their fate. Of these, only 11 had hatched eggs, for an apparent nesting success of about 16%. The apparent nesting success varied among the islands, from 22.9% (n = 48) on Moine Island to 0% on Barques Island (n = 18). The very small number of nests on Ronde Island made it difficult to assess this aspect of duck nesting ecology there.

In 1994, despite the use of a different census technique, similar results to those of 1993 were obtained: 113 nests were found on Moine Island, for a density of 0.39 nests/ha, and no nests were found on Ronde Island. The Gadwall, Northern Pintail and Mallard were still the dominant species but, however, the Northern Shoveler (*Anas clypeata*), made up 16% of the records. Once again, the Black Duck and the Blue-winged Teal accounted for only a small percentage of the nests found, 2 and 4% respectively. On Moine Island an apparent nesting success of 32.3% were calculated in 1994, compared with 22.9% in 1993. The apparent nesting success ranged from 20% for Mallards to 47% for Northern Shovelers. Using the modified Mayfield method, mean nesting success was 14.4% for all species combined, with a confidence interval ranging from 8.9 to 23.2%. Nesting success varied widely among the different species, from a low of 3.8% for Northern Pintails to a high of 30.7% for Northern Shovelers. Examining only those sectors for which the fate of at least 5 nests was known, we did not find any significant relationship between the ducks' apparent nesting success and the degree of visual obstruction by herbaceous vegetation cover ($r = –0.44$, $p = 0.32$) or shrub cover ($r = –0.24$, $P = 0.60$). However, the number of sectors considered was relatively low (n = 7) to shed much light on such relationships.

On the islands' prairie habitat, 86% of the surveyed nests were located in vegetation cover dominated by reed canary grass. Various sedge (3.0%) (*Carex* spp.) and goldenrod (1.1%) (*Solidago* spp.) species were the other dominant vegetation types found at nests. With respect to the main codominant species,

**Table 6. Comparison of the mean (± SE) number of birds per sample plot for the survey with the maximum number of observations on 2 St. Lawrence communal pasture islands with different levels of grazing intensity, Quebec, 1993. The survey date may vary among the species and species groups. Only the species for which the total number of observations for both islands is >10 were retained.**

| Species/Group | Moderate Grazing | No Grazing | P |
|---|---|---|---|
| Red-winged blackbird | 0.75 ± 1.06* | 0.20 ± 0.48 | 0.0077 |
| American goldfinch | 0.03 ± 0.24 | 0.27 ± 0.69 | 0.0136 |
| Yellow warbler | 0.13 ± 0.38 | 0.53 ± 0.86 | 0.0018 |
| Common yellowthroat | 0.25 ± 0.74 | 0.40 ± 0.67 | 0.3451 |
| Bobolink | 0.68 ± 1.14* | 0.20 ± 0.48 | 0.0302 |
| Song sparrow | 0.03 ± 0.17* | 0.33 ± 0.92* | 0.0098 |
| Swamp sparrow | 1.38 ± 1.64 | 1.90 ± 1.75 | 0.1613 |
| Savannah sparrow | 0.96 ± 1.49 | 0.37 ± 1.30 | 0.0642 |
| TOTBRU | 2.32 ± 2.11 | 2.30 ± 1.70 | 0.9571 |
| TOTICTE | 0.76 ± 1.09* | 0.20 ± 0.48 | 0.0081 |
| TOTWARB | 0.41 ± 1.07* | 1.20 ± 1.73* | 0.0070 |
| TOTROG | 0.12 ± 0.51 | 0.10 ± 0.31 | 0.8595 |
| Total No. of Passerines | 3.82 ± 2.53 | 3.73 ± 2.23 | 0.8667 |

*Significant differences (P<O.05)

**Table 7. Pearson correlation coefficients between the maximum number of birds/survey/plot and certain plant cover characteristics. For the latin names of the species or the meaning of the abbreviations see text.**

| Species or Species Group | Mean Visual Obstruction/Plot | | Mean Shrub Cover/Plot | |
|---|---|---|---|---|
| | (r) | (p) | (r) | (p) |
| Total Number of Birds | 0.37 | 0.12 | 0.24 | 0.32 |
| TOTBRU | 0.25 | 0.30 | 0.24 | 0.31 |
| GOGL | 0.43 | 0.07 | -0.24 | 0.32 |
| TOTICTE | 0.22 | 0.36 | -0.06 | 0.81 |
| TOTPARU | 0.29 | 0.22 | 0.52 | 0.02 |
| TOTROG | 0.35 | 0.15 | -0.10 | 0.69 |
| Red-winged blackbird | 0.23 | 0.35 | -0.10 | 0.68 |
| American goldfinch | -0.11 | 0.66 | 0.52 | 0.02 |
| Yellow warbler | 0.14 | 0.55 | 0.68 | 0.002 |
| Common yellowthroat | 0.60 | 0.007 | 0.12 | 0.62 |
| Song sparrow | -0.07 | 0.78 | 0.66 | 0.002 |
| Swamp sparrow | 0.57 | 0.01 | 0.11 | 0.66 |
| Savannah sparrow | -0.37 | 0.12 | 0.03 | 0.91 |
| Sharp-tailed sparrow | -0.14 | 0.57 | -0.24 | 0.32 |
| Eastern meadowlark | -0.34 | 0.15 | -0.17 | 0.50 |
| Sedge wren | 0.18 | 0.47 | -0.06 | 0.82 |
| Marsh wren | 0.31 | 0.19 | -0.09 | 0.72 |
| Brown-headed cowbird | 0.23 | 0.35 | 0.36 | 0.13 |

the most common were horsetail species (40%) (*Equisetum* spp.), sedge species (18%) and bird vetch (14%) (*Vicia cracca*). The plant species composition differed little among the various duck species, with reed canary grass being the dominant plant in over 70% of cases. The mean height of growing vegetation was 62.0 ± 2.0 cm, compared with 27.9 ± 1.3 cm for litter. We obtained a mean visual obstruction measure of 49.8 ± 1.9 cm.

We related the variation in nest density to the degree of visual obstruction by vegetation. Mean nest density was associated with the obstruction measure ($r = 0.58$, $n = 19$, $P = 0.009$) but the mean percentage of shrubs was not associated with nest density ($r = 0.13$, $n = 19$, $P = 0.60$). It should be kept in mind, however, that shrub coverage varied little among the different sectors of the studied islands. No significant relationship was observed between the measure of the homogeneity of the vegetation cover, and nest density; however, there did appear to be a slight trend ($r = 0.38$, $n = 19$, $P = 0.108$).

## Discussion

### Use of prairie habitat by passerines

Various studies conducted in the western part of North America have shown that livestock grazing, since it modifies both plant species composition and abundance, reduces bird species richness and density of the avian communities of prairie habitat (Bowen and Kruse 1993). The species richness observed on the prairie habitats of the islands in this study is nonetheless lower than that reported in other studies done in western prairies (Owens and Myers 1973, Kantrud and Koligiski 1982, Zimmerman 1992). However, our results are fairly consistent with other eastern bird data since 11 to 18 species are generally observed on the herbaceous prairie of the islands along the St. Lawrence River (Pilon et al. 1981).

Intensively grazed prairie is shunned by most prairie-associated passerine birds. No species and no species group for which habitat selection was analysed showed a preference for the heavily grazed island. The diminished quality of plant cover resulting from intensive grazing leads to a decline in the number and diversity of bird species. Similar observations have been made elsewhere in North America (Kantrud 1981, Kirsh et al. 1978). With respect to the other types of prairie (ungrazed and moderately grazed), very few differences were noted in the species composition of the avian communities, although the relative importance of the various species and/or species groups differed significantly among them. Thus, livestock grazing on prairie habitats of the communal pasture islands of the St. Lawrence River largely determines the bird species that are present. For example, species in the warbler group preferred ungrazed prairie, as did sparrows, although the sparrow's preference was less pronounced. This muted preference may be related to the fact that some sparrows preferred ungrazed prairie (Swamp Sparrow), while others selected moderately grazed prairie (Savannah Sparrow). The Savannah Sparrow is known to avoid heavily grazed areas (Bock et al. 1993), although once established, it may return to the same site regardless of its nesting success (Bédard and Lapointe 1984).

The presence of shrubs and dense emergent reed beds (particularly cattails; *Typha* spp.) near temporary ponds in natural ungrazed prairie habitat on Barques Island is probably an important factor in the selection of this habitat by some bird species (the warbler group overall and the Swamp Sparrow). Song Sparrows also seemed to prefer ungrazed prairie, although the number of observations was relatively low. The presence of shrubs that birds can use as song perches to mark their territory may explain this preference. The positive associations found in this study between shrub cover and the presence of species in the warbler group and Song Sparrows tend to bear this out.

### Waterfowl nesting

The various North American studies on the impact of livestock grazing on prairie habitat have shown that waterfowl nest density and nesting success are generally higher in locations where there is no disturbance caused by cattle (Higgins 1977). Hence, natural prairie that is not grazed or is subjected to light grazing pressure should support more nests and have a higher nesting success than pastureland. This situation cannot be attributed solely to trampling of nests by livestock; instead the major cause is degradation of the vegetation cover (Sayler 1962, Klett et al. 1988).

The results obtained in this study are fairly consistent with the findings reported for the western part of the continent. Clearly, the mean nest density observed (0.34 nests/ha) is fairly similar to that found on other islands along the St. Lawrence River (see Bélanger and Lehoux 1995), but well below the densities generally reported for lake islands in the Canadian Prairies (Giroux 1981, Duebbert 1982, Wills and Crawford 1989).

## Conclusion

This study shows that grazing exceeding one cow/ha/year, is detrimental to the presence of birds that frequent the herbaceous spring flooded prairies of the islands along the St. Lawrence River, both quantitatively (number of individuals) and qualitatively (number of species). However, there is little overall difference between ungrazed and moderately grazed prairie. Certain species seem to prefer natural prairie, while others select moderately grazed ones. These findings have important implications for management, given that the mean nest density for ducks was also found to be positively associated with the vegetal cover obstruction measure, with little differences between moderately and ungrazed prairies. Thus, efforts aimed at improving the quality and composition of plant cover, such as delayed grazing, controlled burning (Fritzell 1975) or even short-term livestock grazing (Holechek et al. 1982), could serve to increase bird density in some prairie habitats. Furthermore, recent research by Barker et al. (1990) demonstrated that integration of wildlife and agriculture is possible on prairie subjected to livestock grazing. They noted that there were more duck nests in prairie habitat where specialized grazing systems had been implemented.

Consequently, with a view to pursue traditional farming activities along the St. Lawrence river and to preserving ground and shrub-nesting bird species (other than waterfowl) that frequent prairie habitats of the St. Lawrence River islands, electric fences or other structures, should be used to protect shrub zones and marsh shorelines with emergent plants. This would help to ensure the presence of the passerine species associated with older prairies and riparian habitats.

## Literature Cited


**Barker, W. T., K. K. Sedivec, T. A. Messmer, K. F. Higgins, and D. R. Hertel. 1990.** Effects of specialized grazing systems on waterfowl production in southcentral North Dakota. Trans. N. A. Wildl. & Nat. Res. Conf. 55:462–474.

**Bédard, J. and G. Lapointe. 1984.** The savannah sparrow territorial system: can habitat features be related to breeding success? Can. J. Zool. 1819–1829.

**Bélanger, L. and D. Lehoux. 1995.** L'utilisation de divers habitats par les anatinés en période de nidification: les îles du St-Laurent situées entre Montréal et Trois-Rivières. Service Canadien de la Faune. Environnement Canada. Rapport 87. 27 pp.

**Bibby, C. J., N. D. Burges, and D. A. Hill. 1992.** Bird Census Techniques. Academic Press, Toronto, Canada, 257 pp.

**Bock, C. E., V. A. Saab, T. D. Rich, and D. S. Dobkin. 1993.** Effects of livestock grazing on neotropical migratory landbirds in western North America. U. S. Forest Serv. Rocky Mountain Forest and Range Exp. Sta., Fort Collins, Colorado. p. 296–309

**Bowen, B.S. and A.D. Kruse 1993.** Effects of grazing on nesting by upland sandpipers in Southcentral Dakota. J. Wildl. Manage. 57:291–301.

**De Koninck, R. 1970.** Les cent-îles du lac Saint-Pierre. Les presses de l'Université Laval, Ste-Foy, Canada. 125 pp.

**Duebbert, H.F. 1982.** Nesting of waterfowl on islands in Lake Audubon, North Dakota. Wildl. Soc. Bull. 10:232–237.

**Fritzell, E.K. 1975.** Effects of agricultural burning on nesting waterfowl. Can. Field-Nat. 89:21–27.

**Gauthier, J. and Y. Aubry. 1995.** Les oiseaux nicheurs du Québec: Atlas des oiseaux nicheurs du Québec méridional. Édité par l'Association québécoise des groupes ornithologiques, la Société Québecoise de protection des oiseaux et le Service Canadien de la Faune, Environnement Canada, région du Québec. Montréal. 1295 pp.

**Giroux, J.F. 1981.** Use of artificial islands by nesting waterfowl in southeastern Alberta. J. Wildl. Manage. 45:669–679

**Glover, F.A. 1956.** Nesting and production of the blue-winged teal (*Anas discors*) in northwest Iowa. J. Wildl. Manage 20:28–46.

**Gloutney, M.L., R.G. Clark, A.D. Afton, and G.J. Huff 1993.** Timing of nest searches for upland nesting waterfowl. J. Wildl. Manage. 57:597–601.

**Higgins, K.F. 1977.** Ducks nesting in intensively farmed areas of North Dakota. J. Wildl. Manage. 41:232–242.

**Holechek, J.L., R. Valdez, S.D. Schemnitz, R.D. Pieper, and C.A. Davis 1982.** Manipulation of grazing to improve or maintain wildlife habitat. Wildl. Soc. Bull. 10:204–210.

**Kantrud, H.A. 1981.** Grazing intensity effects on the breeding avifauna of North Dakota native grasslands. Can. Field Nat. 404–417

**Kantrud, H.A. and R.L. Kologiski 1982.** Effects of soils and grazing on breeding birds of uncultivated upland grasslands of the northern Great Plains. U.S.F.W.S., Wildlife Res. Rep. 15, 33p.

**Kirby, R.E., J.K. Ringelman, D.R. Anderson, and R.S. Sodja 1992.** Grazing on National Wildlife Refuges: do the needs outweigh the problems? Trans. N. A. Wildl. & Nat. Res. Conf. 57:611–626.

**Kirsch, L.M. 1969.** Waterfowl production in relation to grazing. J. Wildl. Manage. 33:821–828.

**Kirsch, L.M., H.F. Duebbert, and A.D. Kruse 1978.** Grazing and haying effects of habitats on upland nesting birds. Trans. North Amer Wildl. and Nat. Res. Conf., 43:486–497.

**Klett, A.T., H.F. Duebbert, C.A. Faanes, and K.F. Higgins 1986.** Techniques for studying nest success of ducks in upland habitats in the Meadow Pothole Region. U. S. Dept. of the Interior, Fish and Wildl. Service, Res. publ. no. 158, 24 pp.

**Klett, A.T., T.L. Shaffer, and D.H. Jonhson 1988.** Duck nest success in the meadow pothole region. J. Wildl. Manage. 52:431–440.

**Marie-Victorin, F. 1964.** Flore laurentienne. Les Presses de l'Université de Montréal, Montréal, 925pp.

**Neu, C.W, C.R. Byers and J.M. Peek, 1974.** A technique for analysis of utilization-availability data. J. Wildl. Manage. 38:541–545.

**Owens, R. A. and M. T. Myres. 1973.** Effects of agriculture upon population of an Alberta fescue grassland. Can. J. Zool. 697–713.

**Pilon, C., J. Champagne, and P. Chevalier 1981.** Environnement biophysique des Iles de Berthier-Sorel.Centre de Recherches Ecologiques de Montréal, 203pp.

**Robel, R.J., J.N. Briggs, A.D. Dayton, and I.C. Hulbert 1970.** Relationships between visual obstruction measurements and weight of grassland vegetation. J. Range. Manage. 23:295–297.

**Sayler, J.W. 1962.** Effects of drought and land use on meadow nesting ducks. Trans. North Amer. Wildl. and Nat. Res. Conf., 27:69–79.

**Taylor, D.M. 1986.** Effects of cattle grazing on passerine birds in riparian habitat. J. Range. Manage. 254–258.

**Wills, M. A. and R. D. Crawford 1989.** Use of earthen islands by nesting ducks in North Dakota. J. Wildl. Manage. 53:411–417.

**Zar, J.H. 1974.** Biostatistical Analysis. Prentice-Hall Inc., New Jersey, United States, 619 pp.

**Zimmerman, J. L. 1992.** Density-independent factors affecting the avian diversity of the tallgrass meadow community. Wilson Bull. 104:85–94.