Hydrobiologia (2006) 567:169–181
A.R. Hanson & J.J. Kerekes (eds), Limnology and Aquatic Birds
DOI 10.1007/s10750-006-0051-1

Breeding waterbird wetland habitat availability and response to water-level management in Saint John River floodplain wetlands, New Brunswick

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Key words: waterfowl, waterbird, brood-rearing habitat, wetland, floodplain

Abstract

Wetland management by the Eastern Habitat Joint Venture (EHJV) has focused primarily on water level control to increase the amount of available brood-rearing habitat for waterfowl along the Saint John River floodplain in New Brunswick. Impounded wetlands make up approximately 13% of the Saint John River Floodplain complex. Study objectives included an evaluation of waterfowl brood, and wetland obligate bird use of impoundments and seasonally flooded wetlands within the Saint John River floodplain. Historical water level data and a GIS wetlands inventory were used to estimate the duration of flooding on seasonally flooded wetland habitats, and the distribution and relative amount of brood-rearing habitat throughout the breeding period by region. Aerial brood surveys and call response surveys were used to estimate the relative abundance of waterfowl broods and breeding wetland obligate birds respectively. The overall density of waterfowl broods was greater on impoundments than on seasonally flooded wetlands during both years of study but varied by site. Mean species richness of wetland obligate birds was significantly greater on impoundments than on seasonally flooded wetland habitat. Generally, use of seasonally flooded wetlands by wetland obligate birds during late summer declined while the use of impoundments increased. Current habitat management for waterfowl appears to be compatible with habitat requirements of wetland obligate birds by increasing the availability of interspersed open water and emergent vegetation throughout the breeding season. A watershed-based analysis of wetland habitat suggests future wetland management should focus on enhancing current impoundments within the Saint John River floodplain. Resources must be secured for maintenance and water level manipulation within existing managed wetlands rather than the construction of additional impoundments. Further evaluation of the distribution of wetland habitat types in the province is essential to identifying focus areas for waterbird conservation throughout NB.

Introduction

The lower Saint John River contains a variety of wetland habitats that are unique to Atlantic Canada and provide habitat for a high diversity of waterbird species. In addition, they comprise some of the most productive wetland habitats in New Brunswick and support large numbers of waterfowl. There are over 20,000 ha of wetlands along the main river and its tributaries below Mactaquac Dam.

The lower Saint John River wetlands have become a focus of conservation efforts under the Eastern Habitat Joint Venture (EHJV) of the North American Waterfowl Management Plan (NAWMP) in New Brunswick. Currently, over 3200 ha have been secured through acquisition and 2000 ha through stewardship. An additional

4000 ha have been secured through Environment Canada's National Wildlife Area program at Portobello Creek including upland, riparian, open lake, river and wetland habitats. Other initiatives such as provincial parks, nature reserves, and private conservation agreements also contribute to maintaining wetlands in the region.

Since 1976, Ducks Unlimited has worked within the Saint John River floodplain to improve habitat for brood-rearing waterfowl. The primary mechanism has been to increase the amount of permanently flooded habitat (shallow and deep marsh) through impoundment. By 1990, 40 impoundments had been completed, totalling 1872 ha of wetlands. Currently, impounded wetlands and seasonally flooded emergent wetlands make up 13% and 50% of the Saint John River floodplain complex, respectively. While the focus of impoundments was initially for the creation of brood-rearing habitat for waterfowl, these wetlands also provide valuable habitat for other species that prefer stable water conditions. The benefits of impoundments for many wildlife species differ and are largely unknown in this region.

With multi-agency involvement in management of wetlands through the EHJV it is important to assess the value of existing techniques and develop a plan for future activities which ensures conservation of sensitive habitats together with maximum benefits to waterfowl and other wildlife. To date, wetland management has focused primarily on water level control through impoundment to increase the amount of available brood-rearing habitat for waterfowl and other wetland dependent species. Increased proportions of permanently flooded habitat (impoundments), however result in decreased proportions of seasonally flooded habitat. To ensure that critical habitat is not lost for species dependent on seasonally flooded wetlands, it is necessary to first determine species use and abundance in seasonally flooded wetlands to assist managers in evaluating the extent of various habitat types required to maintain viable populations of wetland wildlife species.

The study objectives were an evaluation of waterbird response to impoundment creation and an analysis of historical water levels and wetland habitat availability on the Saint John River floodplain. This included a comparison of species richness of and habitat use by waterfowl broods and wetland obligate birds on seasonally flooded wetlands and impoundments, as well as an analysis of historical water levels and their influence on temporal changes in wetland habitat availability.

Materials and methods

Study area

The Saint John River is the largest river in the Maritimes, travelling 673 km before entering the Bay of Fundy at Saint John. The watershed of the Saint John River is 55,900 km^2, of which 51% is located in New Brunswick, 33% in Maine and 13% in Quebec (Department of the Environment, 1974). The landscape is primarily forested, but impacted largely by agriculture and hydroelectric power developments. The last 130 km of the river between Fredericton and the Bay of Fundy are tidal, flowing through the New Brunswick Lowlands and Caledonia Highlands topographical regions.

Annual precipitation varies from 900 mm in the headwaters to over 1400 mm in the Bay of Fundy region while snowmelt usually occurs in April and run-off occurs in late April or early May. Seasonal water levels change dramatically during the spring freshet period and can reach 6 m above annual minimum daily water levels (Environment Canada, 1988). Wetlands along the Saint John River floodplain below Fredericton total approximately 20,000 ha and make up 7% of the wetland base in New Brunswick (Fig. 1). The dominant wetland type within the region is emergent marsh of varying water regimes. Impoundments create stable shallow water levels throughout the brood-rearing period while seasonally flooded wetlands are typically dry by mid summer.

The concentrations of phosphorus, pH, and levels of alkalinity suggested greater fertility in floodplain wetlands than observed in inland wetlands of New Brunswick (Clay, 1988). Hanson et al. (1998) found water chemistry data on level ditched floodplain wetlands was similar to that of other Saint John River floodplain wetlands. Based on phosphorus and chlorophyll *a* concentrations, wetlands were classified as mesotrophic to eutrophic. The mean pH of water samples collected

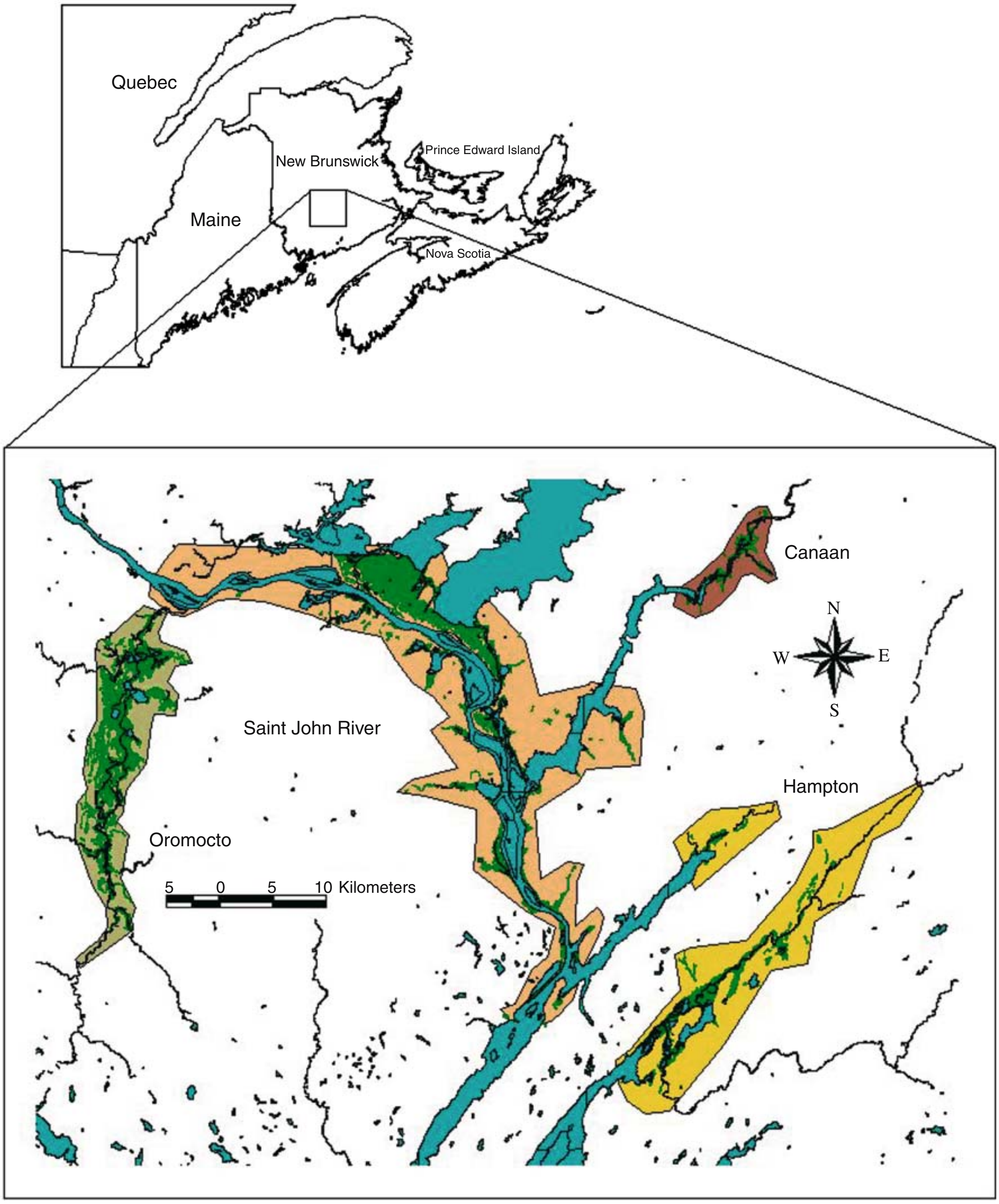

Figure 1. Location of wetlands by region (shaded areas) within the lower Saint John River floodplain, New Brunswick.

from three Saint John River floodplain wetland sites ranged from 6.4 to 6.8 (Hanson et al., 1998). Mean total phosphorus for all sites combined was 0.034, 0.035, and 0.051 mg/l in 1990, 1991 and 1992 respectively (Hanson et al., 1998). Bowes (unpublished report) found pH levels ranging from 6.1 to 7.3 and total phosphorus ranging from 0.024–0.095 mg/l in managed floodplain wetlands.

Other studies have found similar pH levels within Saint John River floodplain wetlands ranging from 6.13 to 7.03 and organic phosphorus ranging from 0.052 to 0.0027 mg/l, also suggesting greater fertility than in inland wetlands (Nelson and Clay, unpublished report).

Research was conducted at five impoundments and five seasonally flooded wetlands varying in size from 15 to 59 ha. Seasonally flooded wetlands served as controls and were of similar size and vegetative composition as paired sites prior to impoundment creation. Sites were chosen systematically to represent five geographic areas within the Saint John River complex: Grand Lake Meadows/Portobello National Wildlife area, Oromocto River system, main stem of the Saint John River between Fredericton and Gagetown, main stem of the Saint John River below Gagetown, and Kennebecasis River.

Historical water levels and wetland classification

The temporal availability of brood-rearing habitat in seasonally flooded wetlands was evaluated by linking long term river level data to elevations from a sample of seasonally flooded wetlands. Elevations of seasonally flooded wetlands were surveyed during the freshet (21 April–14 May) in 1998–1999 and compared to current and long-term river levels to determine the availability of seasonally flooded wetland habitat from 15 May to 15 August. Historical river level data were available as mean daily elevations from 1966 to 1997. At each seasonally flooded wetland, on the day of the survey, a benchmark was set in a tree above the water level and the height of this mark above the marsh was recorded prior to and following the survey. The wetlands were traversed using a boat and water depths were taken at approximately 15 m intervals with transects 65 m apart. Changes in river elevation were used to determine changes in water levels within the seasonally flooded wetlands as the wetlands are adjacent the river and do not become isolated. Long-term river water elevation data was obtained for Jemseg and Oak Point gauging stations. River level data was used from the closest gauging station. When a site fell between the stations, mean river elevations were used. The river elevation during each survey period was used to estimate the depth of water for the wetland. The extent of water depths at 15, 30 and 60 cm covering seasonally flooded wetlands were compared for each site from 15 May to 15 August. These water depths were chosen to determine the periods when the wetlands provided suitable brood-rearing habitat for waterfowl.

The digital wetland inventory of New Brunswick was based on photo interpretation of aerial photography at 1:12,500 scale. Total wetland area, the distribution of seasonally flooded wetland (SFW) and managed wetland (IMP) were determined from the provincial inventory. Analysis of the distribution and relative amount of brood-rearing habitat throughout the breeding period by region was completed by querying attributes of the wetland inventory representing emergent wetland and aquatic bed wetlands that maintained water throughout the growing season. Relative proportions of managed wetlands and the distribution of brood-rearing habitat were compared in four geographic regions of the lower Saint John River floodplain representing different ecoregions and dominant land use practices.

Waterfowl

Waterfowl brood use of floodplain wetlands and impoundments was estimated during 1997 and 1998. Aerial brood surveys were conducted during two periods; Survey 1 (29 June–8 July) and Survey 2 (26 July–31 July) each year. Surveys were conducted on impoundments ($n = 5$) and seasonally flooded wetlands ($n = 5$). Surveys were conducted from 0630 to 0900 h using a Bell Long Ranger helicopter at altitudes as low as 15 m, and at speeds ranging from 0 to 60 km/h with 3 observers. An observer in the front passenger seat navigated, recorded data and surveyed for broods. The age, species, and number of ducklings in observed broods were recorded (Gollop & Marshall, 1954). Two additional observers located in the rear of the aircraft assisted in brood detection. Complete coverage of each impoundment and seasonally flooded wetland was conducted.

Each survey period was tested separately by wetland habitat type. Species richness of and habitat use by waterfowl broods were compared between paired sites (i.e., seasonally flooded wetlands and impoundments) using Wilcoxon signed ranks tests.

Wetland obligate birds

The relative abundance of wetland obligate birds is often underestimated by point count surveys due to their secretive nature and infrequent vocalisations (Bystrak, 1981). Call responses can be elicited from wetland obligate birds by playing pre-recorded tapes of territorial birds (Glahn, 1974). Call-response surveys were conducted following methodology developed by Gibbs & Melvin (1993). Pre-recorded audio tapes were played in seasonally flooded wetlands ($n = 5$), and impoundments ($n = 5$). Surveys were completed during 3 h pre-sunset. Survey stations were established approximately 1 station/5 ha of wetland (Gibbs & Melvin, 1993). During periods of moderate to heavy precipitation, or wind conditions exceeding 30 km/h, surveys were discontinued. Each wetland was surveyed twice between 1 June and 22 July.

Observers played a series of calls composed of 30 s vocalisations of Sora (*Porzana carolina*), Pied-billed Grebe (*Podilymbus podiceps*), American Bittern (*Botaurus lentignosus*) and Virginia Rail (*Rallus limicola*) followed by 30 s periods of silence for each species from the established survey stations. Each recording session was followed by a 5-min period of silence during which all aural and visual observations were recorded on point count data sheets. Portable cassette players were located 0.75 m above ground or water and able to produce a signal in excess of 80 dB at ≥1 m (Gibbs & Melvin, 1993).

Species richness of call responses between paired sites (i.e., seasonally flooded wetlands and impoundments) was tested using Wilcoxon signed ranks tests.

Significance levels were set at $p = 0.10$, which increases the probability of Type I error (rejecting a true null hypothesis) and decreases the probability of a Type II error (accepting a false null hypothesis). A large alpha level was chosen to maximise our probability of detecting differences in use among wetland types. We felt it was more appropriate to decrease the probability of committing a Type II error as sample sizes were relatively low.

Results

Historical water levels and wetland classification

Historical water level data from the period of 1966–1997 revealed that by May 15, all of the seasonally flooded wetlands sampled had water depths > 60 cm. By June 1, water depths in most seasonally flooded wetlands ranged from 30–60 cm. On June 15, 40% of the seasonally flooded wetlands sampled had low water levels (i.e. most of the wetland had <15 cm). From July 1 to August 15, all seasonally flooded wetlands sampled had low water levels (i.e., < 15 cm) (Table 1), some were probably completely dry. The variability in water levels at a given date was relatively low

Table 1. Percentage of area flooded (> 15 cm) on seasonally flooded wetlands during spring and summer months on the Saint John River floodplain, NB. Analyses conducted using geodetic river elevation averaged (on specific dates) from 1966–1997

Site (n^a)	Percentage of wetland flooded						
	May 15	June 1	June 15	July 1	July 15	Aug 1	Aug 15
Grand Lake Meadows (138)	100	100	9	0	0	0	0
Jemseg Flats (135)	100	100	89	26	8	1	1
Post Pond (161)	100	100	50	15	2	1	1
Scovil Point (133)	a100	100	4	0	0	0	0
Upper Musquash Is. (83)	100	100	42	10	2	0	0
Long Island Meadow (38)	100	100	13	0	0	0	0
Long Island Lake (39)	100	100	7	0	0	0	0
Johnson's Marsh (102)	100	100	20	7	1	1	1
Little River (76)	100	100	77	12	1	0	0
Evandale (50)	100	100	57	18	0	0	0

[a]Indicates the number of water level measurements taken at each site.

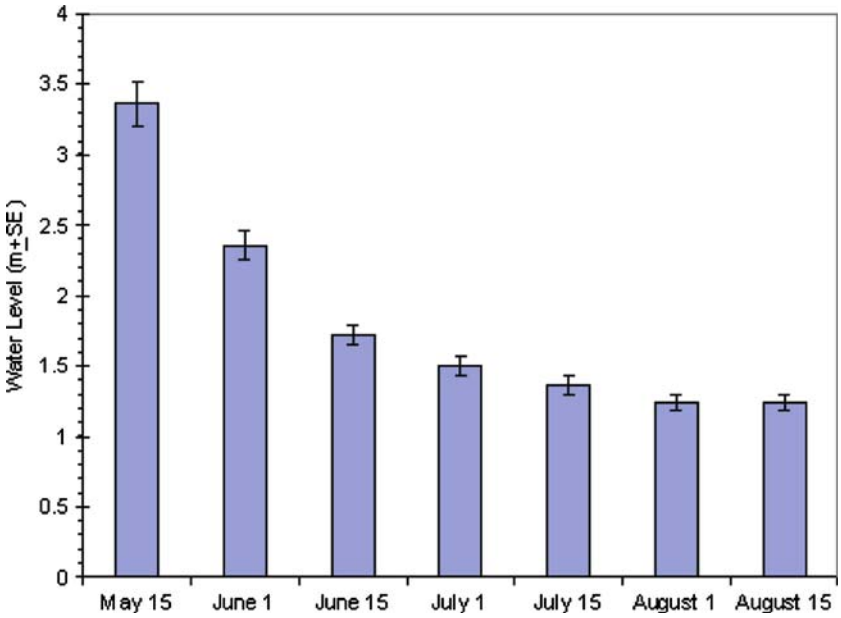

Figure 2. Mean (±SE) geodetic elevation (m) of water levels for specific dates from 1966 to 1997 at Jemseg gauging station, Saint John River, NB.

among years (1966–1997) (Fig. 2). No differences in the rate or timing of change in water levels were detected between the river and seasonally flooded wetlands. This suggests that no lag period exists for changing water levels in seasonally flooded wetlands following any changes in water levels of the river.

Overall, the total wetland area considered in this study was 14,267 ha. Seasonally flooded emergent wetland was the dominant wetland type and the proportion of seasonally flooded wetland converted to managed wetland was relatively low (15%). The distribution and extent of wetland habitat by type, the availability of brood-rearing habitat, and the proportion of managed wetland all varied by region (Table 2). Managed wetland (IMP) made up 13.1% of the total wetland area and ranged from 5.4 to 17.1% of wetland area by region. The proportion of brood-rearing habitat ranged from 11.1 to 69.0% of wetland area by region.

Waterfowl

A total of 10 species of waterfowl broods were observed during each year. American Black Duck (*Anas rubripes*) was the most common species recorded during both surveys in 1997 and 1998.

Table 2. The distribution and extent of wetland habitat by type, the availability of brood-rearing habitat, and the proportion of managed wetland by region in the Saint John River Floodplain, 2003

Region	Wetland area (ha)	% Brood-rearing habitat[a]	SFW area (ha)	% SFW converted[b]	IMP area (ha)[c]
Oromocto	4062.3	11.1	3609.4	16.1	693.5 (17.1)
Main stem	7754.0	21.3	6102.7	13.9	985.5 (12.7)
Hampton	1945.7	69.0	603.1	21.1	161.5 (8.3)
Canaan	504.9	45.7	274.2	9.1	27.5 (5.4)
Total	14,266.9	25.8	10,589.4	15.0	1868.0 (13.1)

[a]Represents the proportion of wetland area providing brood-rearing habitat throughout the growing season.
[b]Represents the proportion of seasonally flooded wetland converted to managed (impounded) wetland by region.
[c]Parentheses indicate the proportion of wetland area that is currently managed (impounded) wetland by region.

Table 3. Total number of broods observed during survey 1 on impoundments (IMP), and seasonally flooded wetlands (SFW) on the Saint John River floodplain, NB, 29 June to 8 July, 1997 and 1998

Species	1997		1998	
	IMP (128 ha)	SFW (160 ha)	IMP (180 ha)	SFW (231 ha)
American Black Duck	23	26	46	1
Mallard	2	4	2	1
Wood Duck	4	0	3	0
Northern Pintail (*Anas acuta*)	0	1	0	1
Hooded Merganser (*Lophodytes cucullatus*)	3	1	0	0
Common Goldeneye	5	0	1	0
American Wigeon	0	4	6	2
Green-winged Teal	0	0	3	0
Blue-winged Teal	0	0	8	0
Ring-necked Duck (*Aythya collaris*)	0	0	4	0
Unknown	0	0	0	0
Total[a]	37 (0.29)	36 (0.23)	73 (0.41)	5 (0.02)

[a]Number of broods per ha.

During survey 1, American Wigeon (*Anas americana*), Mallard (*Anas platyrhynchos*), Blue-winged Teal (*Anas discors*), Wood Duck (*Aix sponsa*) and Common Goldeneye (*Bucephala clangula*) were the next most abundant species recorded in decreasing order of abundance (Table 3). Similarly for survey 2, American Wigeon, Wood Duck, Green-winged Teal (*Anas crecca*), Common Goldeneye, Mallard, and Blue-winged Teal were the most abundant species observed following American Black Duck (Table 4).

In 1997, no difference in mean species richness of waterfowl broods was observed between seasonally flooded wetlands and impoundments during survey 1 ($df = 1$, $S = 3.5$, $p = 0.50$) or survey 2 ($df = 1$, $S = 5.0$, $p = 0.13$). Mean species richness during survey 1 was 3.0 (range 1–4) in impoundments and 2.0 (range 0–5) in seasonally flooded

Table 4. Total number of broods observed during survey 2 on impoundments (IMP), and seasonally flooded wetlands (SFW) on the Saint John River floodplain, NB, 26 July to 31 July, 1997 and 1998

Species	1997		1998	
	IMP (128 ha)	SFW (160 ha)	IMP (180 ha)	SFW (231 ha)
American Black Duck	31	7	24	8
Mallard	8	0	0	1
Wood Duck	10	1	7	0
Northern Pintail	1	0	1	0
Hooded Merganser	4	0	0	0
Common Goldeneye	8	0	7	1
American Wigeon	22	2	11	0
Green-winged Teal	9	0	8	1
Blue-winged Teal	6	0	2	0
Ring-necked Duck	0	0	0	0
Northern Shovelor (*Anas clypeata*)	0	0	0	1
Unknown	0	0	6	1
Total[a]	99 (0.77)	10 (0.06)	66 (0.37)	13 (0.05)

[a]Number of broods per ha.

wetlands. During survey 2, mean richness was 5.4 (range 0–8) in impoundments and 1.0 (range 0–3) in seasonally flooded wetlands. In 1998, mean species richness of waterfowl broods was higher in impoundments than in seasonally flooded wetlands during survey 1 ($df = 1$, $S = 7.5$, $p = 0.06$) and survey 2 ($df = 1$, $S = 7.5$, $p = 0.06$). During survey 1, mean species richness was 4.4 in impoundments (range 2–6) and 0.4 (range 0–2) in seasonally flooded wetlands. During survey 2, mean species richness was 5.2 in impoundments (range 2–7) and 1.6 (range 0–4) in seasonally flooded wetlands.

The total number of waterfowl broods observed was similar between years (Tables 3 and 4). However, the distribution of waterfowl broods between wetland habitats was not similar. There was a trend for higher densities on impoundments than on seasonally flooded wetlands.

In 1997, no significant difference was observed in total waterfowl brood densities on impoundments and seasonally flooded wetlands during survey 1 ($df = 1$, $S = 1.5$, $p = 0.81$) or survey 2 ($df = 1$, $S = 5.0$, $p = 0.13$). During survey 2, a shift from seasonally flooded wetlands to impoundments occurred, as well as an increase in brood density on impoundments. This is likely in response to reduced water levels in seasonally flooded wetlands. In 1998, total waterfowl brood densities were higher on impoundments ($df = 1$, $S = 7.5$, $p = 0.06$) than on seasonally flooded wetlands during survey 1. As well, total waterfowl brood densities were higher on impoundments ($df = 1$, $S = 7.5$, $p = 0.06$) than on seasonally flooded wetlands during survey 2.

During survey 1, 18% of all broods combined were in the IA–IB category (Table 5), an age when they are extremely vulnerable to exposure to inclement weather and predation (Mauser et al., 1994). During survey 2, 13% of all broods combined were in the IA–IB age class category (Table 6). Brood backdating indicates that broods younger than age class IIA hatched on approximately 1 July.

Wetland obligate birds

Pre-recorded tapes elicited calls from four species of wetland obligate birds. A total of 91 responses

Table 5. Number of broods by species and age class for survey 1 conducted on Saint John River floodplain wetlands, NB, 29 June–8 July, 1997 and 1998

Species	Age class							Total
	IA	IB	IC	IIA	IIB	IIC	III	
American Black Duck	3	3	11	20	22	32	7	98
Green-winged teal	0	1	1	1	1	0	0	4
American Wigeon	4	6	1	1	0	0	0	12
Blue-winged Teal	3	2	3	1	0	0	0	9
Mallard	0	1	0	3	3	0	0	7
Wood Duck	1	1	2	1	2	0	0	7

Table 6. Number of broods by species and age class for survey 2 conducted on Saint John River floodplain wetlands, NB, 26 July–31 July, 1997 and 1998

Species	Age class							Total
	IA	IB	IC	IIA	IIB	IIC	III	
American Black Duck	0	4	6	11	17	21	20	79
Green-winged Teal	0	4	2	2	1	4	0	13
American Wigeon	0	7	11	12	4	4	0	38
Blue-winged Teal	2	3	1	0	1	4	0	11
Mallard	0	0	1	0	0	1	6	8
Wood Duck	0	2	4	3	3	5	2	19

were elicited during surveys from 98 plots between 1 June and 22 July, 1998. American Bittern, Pied-billed Grebe, Sora, and Virginia Rail were found in seasonally flooded wetlands and impoundments. The proportion of responses by American Bittern (17.6%) and Virginia Rail (15.4%) were second only to Soras which made up 54.9% of responses in seasonally flooded wetlands and impoundments overall (Table 7). Mean species richness was significantly higher ($df = 1$, $Z = 2.04$, $p = 0.06$) on impoundments (2.2, range 2–3) than seasonally flooded wetlands (1.3, range 0–3). Response rates were similar between surveys (Table 8). Low response rates and subsequent low power of detection precluded analysis between habitat types by species for each survey period.

Discussion

Historical water levels and wetland classification

Results suggest that water levels in seasonally flooded wetlands typically change rapidly (i.e. within a 15-day interval) in conjunction with the recession of the spring freshet and that most seasonally flooded wetlands are too deeply flooded to provide quality habitat for waterfowl broods before June 1 (i.e. > 60 cm water depth). By July 1, most of the areas within the seasonally flooded wetlands were < 15 cm, at which time some seasonally flooded wetlands are completely dry. After July 1, water levels in seasonally flooded wetlands decline considerably. Thus, by July 1, most seasonally flooded wetlands typically do not constitute brood-rearing habitat due to a lack of shallow water. However, seasonally and permanently flooded wetland habitats are not distributed evenly across the landscape.

Overall, brood-rearing habitat does not appear to be limited within the Saint John River floodplain. Approximately 25% of the total wetland area provides brood-rearing habitat throughout the growing season. Of this, 50.7% are impounded wetlands. Managed wetlands make up a large proportion of brood-rearing habitat while converting 15% of seasonally flooded wetland habitat. The proportion of brood-rearing habitat increases

Table 7. Relative abundance (% of total) of wetland obligate bird responses on impoundments (IMP), and seasonally flooded wetlands (SFW) on the Saint John River floodplain, NB, 1998

Species	SFW[a] ($n = 42$)	IMP[a] ($n = 42$)	Total[a]
American Bittern	9 (31)	7 (11.7)	17 (17.6)
Pied-billed Grebe	1 (3.4)	9 (15)	10 (11.0)
Sora	16 (55.2)	34 (56.7)	50 (54.9)
Virginia Rail	3 (10.3)	10 (16.7)	14 (15.4)
Total	29 (100)	60 (100)	91 (100)

[a]Percentages of each species indicated in parentheses.

Table 8. Total bird species recorded (call-responses) and mean/ha on impoundments (IMP), and seasonally flooded wetlands (SFW) on the Saint John River floodplain, NB, 1998

Habitat	# (x/ha)					Total
	Area (ha)	American Bittern	Pied-billed Grebe	Sora	Virginia Rail	
Survey 1[a]						
SFW	231	9 (0.04)	1 (0.004)	11 (0.05)	0 (0)	21 (0.09)
IMP	180	6 (0.03)	5 (0.03)	10 (0.05)	4 (0.02)	25 (0.13)
Survey 2[b]						
SFW	231	0 (0)	0 (0)	5 (0.02)	3 (0.01)	8 (0.04)
IMP	180	1 (0.006)	4 (0.02)	24 (0.13)	6 (0.03)	35 (0.19)

[a] 28 May–2 June. [b] 22 June–22 July.

dramatically during years with seasonal increases in precipitation or a late freshet that allows broods to use seasonally flooded wetlands later into the growing season. The distribution of brood-rearing habitat also varies dramatically by region and most wetland management appears to have occurred in appropriate regions where the availability of brood-rearing habitat is relatively low (Table 2).

Waterfowl

The date of peak flooding was earlier in 1998 than 1997, which resulted in seasonally flooded wetlands that were inundated for shorter periods than in 1997. Waterfowl brood densities were higher on impoundments during all periods when seasonally flooded wetlands were relatively dry and provided little open water.

Survey 1 (early July) coincided with the typical onset of low water conditions in seasonally flooded wetlands, and therefore brood habitat in seasonally flooded wetlands may be limited at this time. In general, most brood movements from seasonally flooded wetlands to impoundments, permanently flooded wetlands or river edge habitat probably occur between 15 June and 1 July. Research with radio-marked ducklings indicated that most duckling loss occurs within 10 days of hatch (i.e. 1A–1B) (Mauser et al., 1994). These young broods made up 18% of total broods observed during survey 1 and would likely have to move to other habitats at a time when they are most vulnerable.

Prior to 1 July, seasonally flooded wetlands probably provide adequate cover and foraging sites for brood-rearing waterfowl. On the Canadian Prairies, Swanson et al. (1974) found that during spring and early summer, temporary and seasonal wetlands provided abundant, readily available, high protein invertebrate foods. The positive relationship between high aquatic invertebrate abundance and waterfowl use of wetlands is well documented (Joyner, 1980; Murkin & Kadlec, 1986; Stacier et al., 1994). Swanson et al. (1974) also found that later in the summer as seasonal wetlands began to dry up, waterfowl feeding shifted to more permanent waters as insects began to emerge in semi-permanent ponds and lakes. During the same study it was also observed that this trend could be temporarily reversed following heavy precipitation that refilled seasonal wetlands and stimulated invertebrate development. Generally, the value of intermittent types of wetlands to breeding waterfowl greatly increases during years with ample precipitation and decreases during years with lower than average wetland conditions (Kantrud & Stewart, 1977). Hickey (1984) studied impoundments along the Saint John River during high water conditions and observed broods entering and leaving impoundments during the course of a brood survey which suggests that wetland habitat conditions outside the impoundments were not limiting to brood-rearing waterfowl at that time. Clay (1988) also found that duck densities on floodplain projects showed considerable variability during years when high water conditions provided alternative habitat in the surrounding area. Other studies have reported avoidance of open wetland habitats by a number of waterfowl species suggesting that cover is an important brood habitat component (Patterson, 1976; Hepp & Hair, 1977; Ringelman & Longcore, 1982; Mauser et al., 1994; Monda & Ratti, 1988). Most impoundments have a heterogeneous interspersion of emergent vegetation cover and water. Murkin et al. (1982) and Kaminski & Prince (1981) found that emergent structure of a wetland may influence waterfowl use of an area. In addition, the abundance and biomass of aquatic invertebrates in impounded wetlands along the Saint John River is considerably more than in inland wetlands (Bowes, unpublished report) and level ditches (Hanson et al., 1998) in New Brunswick. Invertebrate food supplies that are important to broods are more abundant on productive wetlands (Krull, 1970; Reinecke & Owen, 1980), therefore making them attractive to brood-rearing waterfowl. Furthermore, impoundments may be most important to brood-rearing waterfowl during years when seasonally flooded wetlands are dry earlier than normal or when renesting is substantial. Impoundments that are strategically located where few natural permanently flooded wetlands occur provide stable habitat that will minimize brood movements and optimise cover and foraging opportunities for brood-rearing waterfowl.

Habitat use by waterfowl broods was highly variable among impoundments. Variables such as elevation, juxtaposition, vegetative composition and availability of surrounding upland and wetland habitat probably influence the distribution and movement of waterfowl broods on floodplain wetlands. Staicer et al. (1994) found that a number of variables including invertebrates and macrophyte cover, affect the density and distribution of American Black Duck broods on freshwater lakes in Nova Scotia. Data is limited on brood movements and habitat use and therefore a number of variables must be carefully considered when evaluating the need and location of new impoundments created for brood-rearing waterfowl along the Saint John River floodplain.

Wetland obligate birds

During survey period 1, American Bitterns were heard in both seasonally flooded wetlands and impoundments. Only 2 responses of American Bitterns were heard during the second survey period. Gibbs & Melvin (1993) also reported decreasing trend in responses of American Bitterns from call-response surveys conducted from early May to mid-July. American Bitterns are the earliest nesters of the wetland obligate birds surveyed (Erskine, 1992). Its reclusive nature during the breeding season is reflected by its low frequency of confirmed atlas breeding reports in the region. Gauthier & Aubry (1996) also reported that American Bitterns actively seek out productive wetlands with large, well-vegetated margins of shallow water that are prolific in aquatic vegetation and wildlife such as fish and amphibians. Gibbs et al. (1991) found wetlands used by American Bitterns were dominated by emergent and aquatic bed vegetation with higher interspersion of open water and emergent vegetation and less open water than unused wetlands. Information from the study suggests that American Bitterns use seasonally flooded wetlands and impoundments equally.

Soras appeared to use seasonally flooded wetland and impoundment habitats similarly during the first survey period but appeared to be more abundant on impoundments during the second survey. Johnson & Dinsmore (1986) reported that practices used to encourage waterfowl use are compatible with habitat requirements of breeding Sora and Virginia Rails. Gibbs & Melvin (1993) stated shallow marshes with high interspersion of fine-leafed and robust emergents, flooded annuals, and patches of open water constitute optimal Sora habitat. Gibbs et al. (1991) also found that Soras preferred emergent wetlands with intermediate cover-to-water ratios but a lower percentage of open water. Impoundments appear to be beneficial to Soras primarily during the late breeding season when it is likely that the majority of seasonally flooded wetlands are dry.

Pied-billed Grebes and Virginia Rails were recorded during both survey periods with Pied-billed Grebes occurring almost exclusively on impoundments. Virginia Rails were detected on impoundments during the first survey and on seasonally flooded wetlands and impoundments during the second survey. Erskine (1992) reported observations of these species were less numerous than that of American Bitterns and Soras in the Atlantic region. Virginia Rails prefer warm, freshwater marshes with dense emergent vegetation interspersed with open water or mud flats (Conway & Eddleman, 1994). Others have reported that Virginia Rails prefer littoral sites in a wetland dominated by robust emergents (Weller & Spatcher, 1965; Johnson & Dinsmore, 1986). Gibbs et al. (1991), in Maine, found Pied-billed Grebes used emergent wetlands with more open water; aquatic-bed, and ericacious vegetation than unused wetlands. Nesting habitat of Grebes may be dependent on wetland size (Brown & Dinsmore, 1986) as they were not found on wetlands < 5 ha in size. Habitat use suggests that impoundments benefit Pied-billed Grebes and Virginia Rails through increased interspersion of open water and emergent vegetation. Other researchers have reported greatest avian species richness on wetlands approaching intermediate ratios (50:50) of open water to emergent vegetation (Weller & Spatcher, 1965; Gibbs et al., 1991).

Conclusion

Impoundments along the Saint John River floodplain provide stable water levels that benefit waterfowl broods and wetland obligate birds when seasonally flooded wetlands are dry. The creation of open water through impoundment creation and the subsequent increase in interspersion of open water to emergent vegetation benefits both waterfowl and wetland obligate birds in regions where brood-rearing habitat is not abundant. Seasonally flooded wetland habitats are used early in the growing season by waterfowl and wetland obligate birds. However, seasonally flooded wetlands provide minimal brood-rearing habitat after 1 July and therefore most broods have to move from seasonally flooded wetlands to natural permanently flooded wetlands, impoundments or river edge habitat. Impoundments may be most important to brood-rearing waterfowl during years when the spring freshet is early, resulting in prolonged dry conditions in seasonally flooded wetlands or substantial brood movements of younger age classes when they are most vulnerable.

Generally, during late summer, use of seasonally flooded wetlands by wetland obligate birds declined while the use of impoundments increased. Species richness was significantly higher on impoundments than on seasonally flooded habitats. The information suggests that current habitat management for waterfowl, which involves increasing the extent of shallow and deep marsh habitat, is compatible with breeding habitat requirements of wetland obligate birds.

Overall density of waterfowl broods was greater on impoundments than seasonally flooded wetlands during both years of study. Brood density of most species was greater on impoundments especially during dry years. Habitat use by waterfowl broods was highly variable among impoundments. The distribution of brood-rearing habitat varies by region within the Saint John River floodplain. Overall, managed wetlands make up 13.1% of the wetland base, representing a large contribution (50.7%) of brood-rearing habitat in the Saint John River floodplain. Brood-rearing habitat does not appear to be limited within the Saint John River floodplain as it currently represents 25.8% of the wetland base considered in this study. An evaluation of the factors that may influence waterfowl use of impoundments in the region should be conducted prior to construction of additional impoundments. Impoundment creation should be strategically located within the floodplain in regions of low natural permanently flooded wetland availability. A watershed-based analysis of wetland habitat suggests future wetland management should focus on enhancing current impoundments within the Saint John River floodplain. Resources must be secured for maintenance and water level manipulation within existing managed wetlands rather than the construction of additional impoundments.

Acknowledgements

The authors would like to thank Steven Barber, Barry Burke, Rob Capozi, Nadine Currie, Dion Dakins, Cheryl Darrah, Ken Eagle, Joe Harvey, Keith McAloney, Jacqueline Murdock, Cam Rust, Tina Smith, Bev Stuckless, Deanna Prest, and Lisa White for efforts during various surveys and data collection. Comments from Sue Bowes, Graham Forbes, Mark Gloutney, Al Hanson, and Andrew MacInnis greatly improved project development and earlier drafts of this manuscript. This research was funded by the New Brunswick Department of Natural Resources, Ducks Unlimited Canada, Earth Works NB, and the Eastern Habitat Joint Venture.

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