Marsh Bird and Amphibian Communities in the Durham Region of Lake Ontario from 1995 through 2002.

Introduction to the Great Lakes basin

The Great Lakes basin is a globally important for its freshwater resources, encompassing large concentrations of agricultural, industrial and urban activity while supporting greater than 10% of the United States and 25% of Canada's population (Government of Canada and U.S. Environmental Protection Agency 1995). The basin includes more than 534,000 km^2 of total land area and the surface area of the Great Lakes and other fresh water bodies totals more than 247,000 km^2 (Quinn 2002). Coastal wetlands act as ecological and hydrological buffers between open water and upland habitats, and are critically important in ensuring the ecological, economic and social integrity of the Great Lakes basin. Coastal wetlands are highly productive systems providing important breeding, migrating and foraging habitats for a variety of wetland dependent bird (Prince et al. 1992) and anuran species (Green 1997).

Despite their valuable functions, Great Lakes wetlands have suffered under a variety of anthropogenic stresses. Over the last century, continued draining and filling has resulted in a net loss of more than 50% of wetlands in several states in the Great Lakes basin (Dahl 1990) and several Ontario counties have lost more than 80% of their wetlands (Snell 1987). As indicators of wetland health, certain marsh bird species are believed to have experienced major population declines due to historical habitat loss and degradation (Gibbs et al. 1992, Conway 1995, Melvin and Gibbs 1996). For example, Marsh Monitoring Program (MMP) data indicates that abundance indices for six of 12 identified marsh bird indicator species (Black Tern, Blue-winged Teal, C. Moorhen/A. Coot, Pied-billed Grebe, Sora and Virginia Rail) have experienced recent declines throughout the Great Lakes basin (Timmermans and Craigie 2002). Similarly, many amphibian populations are believed to be in decline in the Great Lakes basin due to continued habitat loss and other stresses (Green 1997). For example, occurrence indices of American Toad and Chorus Frog have declined annually since the MMP was initiated in 1995 (Timmermans and Craigie 2002). Many wetland dependent species require permanent and healthy marsh habitats (Fairbairn and Dinsmore 200), thus any further reduction of natural marsh habitat diversity or loss of certain habitat components could have marked effects on wetland dependent bird and amphibian species richness and/or regional species-specific population status.

Durham Region Coastal Wetland Monitoring Project and the MMP

Many of the remaining coastal wetlands of Lake Ontario's north shore have been identified as ecologically important wetlands that supply suitable nesting and foraging habitats for a variety of wetland-dependent species. However, continual pressures of sedimentation, nutrient enrichment, water level regulation and urban sprawl are collectively subjecting remaining coastal wetlands to unnatural stresses (Craigie et al. 2003). The Durham Region Coastal Wetland Monitoring Project (hereafter Durham Region) was undertaken to assess the health of coastal wetlands in the region and to assist in identifying the impact of these stresses on wetlands in the Durham Region. The Durham Region study objectives are to monitor regional plant community health, changes in vegetative cover, health of fish communities, water quality and water level fluctuations within wetlands, and to monitor marsh bird and amphibians species population status and species richness.

The Marsh Monitoring Program (MMP) was established to provide baseline surveys of marsh bird and amphibian populations and their habitats in the Great Lakes basin. The MMP was launched in 1995 to 1) monitor populations of marsh birds and amphibians over a variety of spatial scales, 2) investigate habitat associations of marsh birds and amphibians, 3) contribute to wetland conservation initiatives, and 4) help increase awareness of conservation issues. The MMP was established in the Durham Region in its inaugural year and marsh bird and amphibian surveys have continued through to 2002.

Purpose of the Report

This report summarizes results of MMP surveys done in the Durham Region of Lake Ontario from 1995 through 2002. This report will focus on the following objectives: 1) to compare marshes within the Durham Region with Lake Ontario coastal marshes outside the area (non-Durham Region) in terms of marsh bird and anuran species relative abundance, occurrence and species richness (diversity), and 2) to evaluate species data from specific Durham Region marshes to help assess individual route, and overall Durham Region status with respect to other non-Durham Region coastal Lake Ontario marsh routes. Our results are discussed in context of understanding how marsh bird and amphibian community structure and status within these coastal marshes can help to determine how anthropogenic stresses may be affecting ecological integrity of the region's coastal marshes. Using the set of indicator species commonly used by the MMP to assess marsh quality, results herein will provide an opportunity to determine whether or not amphibian and/or marsh bird community status at Durham Region wetlands are 'impaired'.

Highlights of the MMP's Durham Region Results

Indicator Species

The presence of the following suite marsh bird and amphibian species indicates high quality marsh habitat.

A T indicates those found in the (name) AOC marshes.

Birds
T Pied-billed Grebe (PBGR)
T American Bittern (AMBI)
T Least Bittern (LEBI)
T Blue-winged Teal (BWTE)
T Black Tern (BLTE)
T American Coot (AMCO)
T Common Moorhen (COMO)
T C. Moorhen/ A. Coot (MOOT)
T Virginia Rail (VIRA)
T Sora
Common Snipe (COSN)
T Marsh Wren (MAWR)

Amphibians
T Bullfrog
T Northern Leopard Frog
T Chorus Frog
Mink Frog
T Spring Peeper

- Since the program's initiation, 14 amphibian and 12 marsh bird routes have been established in the Durham Region. From 1995 through 2002 the number of routes surveyed showed moderate annual decreases with one amphibian route and two marsh bird routes surveyed in 2000, and one amphibian route and one marsh bird route surveyed in 2001. However, increased volunteer survey effort in 2002 dramatic increased the number of routes surveyed, with nine amphibian routes and 12 marsh bird routes surveyed in 2002.

- Seven species of amphibian were present in the Durham Region, including four indicator species. In general, these species were recorded at low to moderate levels (Call Level Code 1 and 2). Relative abundance scored below average for Bullfrog, Northern Leopard Frog and Spring Peeper, and above average for Chorus Frog.

- Overall, 28 marsh nesting, six water foraging, and eight aerial foraging bird species were present in the Durham Region – a very high level of diversity. On average, densities were greater than non-Durham Region coastal routes, yet a considerable number were below average.

- Eleven of the 12 marsh bird indicator species were present in the Durham Region; only Common Snipe was not recorded, but American Bittern was present only outside of one survey station. Abundances for six of 10 marsh bird indicator species scored above average for abundances of these species among non-Durham Region coastal Lake Ontario routes.

- Marsh nesting bird diversity and marsh bird indicator species diversity in the Durham Region scored above average of those at non-Durham Region coastal Lake Ontario marshes. Total amphibian species diversity and amphibian indicator species diversity scored below average. Overall, the Durham Region is apparently not impaired in its ability to support wetland-dependent wildlife populations. However, this was due to averaging effects of above average bird species richness, and below average amphibian species richness. Some consideration should be given to further investigating sources of reduced amphibian relative abundance, occurrence, and species richness.

MMP Methods

Routes consisted of up to eight semi-circular stations (100 m radius for marsh birds and unlimited distance for amphibians) and were established in each marsh being surveyed. Stations were usually accessed by foot, but some were surveyed by canoe or boat. Marshes were a minimum or two hectares in size and if very large, may have supported more than one route. Stations were 500 m apart for amphibians and 250 m apart for marsh bird surveys. Number of marsh birds heard calling or seen in the station was recorded. At amphibian stations, one of three Call Level Codes was used to record calling intensity of each species; abundance estimates were also made. Participants were asked to identify whether they heard each amphibian inside and/or outside of their 100 m radius semi-circle survey station. Each MMP volunteer was provided with a training kit that fully explained survey methods (see Table 1). The kit also included a copy of the MMP Training Tape that aided volunteers in learning songs and calls of common marsh birds and amphibians. For further information about these methods, please refer to the 2001 edition of the *MMP Training Kit and Instructions for Surveying Marsh Birds, Amphibians and their Habitats*, which is available from Bird Studies Canada.

MMP in the Durham Region

Since the program's initiation, 14 amphibian and 12 marsh bird routes have been established in the Durham Region of Lake Ontario (Table 2). From 1995 through 2002 the number of routes surveyed showed moderate annual decreases with one amphibian route and two marsh bird routes surveyed in 2000, and one amphibian route and one marsh bird route surveyed in 2001. However, increased volunteer survey effort in 2002 caused dramatic increases in the number of routes surveyed, with nine amphibian routes and 12 marsh bird routes surveyed in 2002.

A number of habitat rehabilitation projects have been proposed in the Durham Region that address loss of marsh habitat, in addition to shoreline and riverine habitats. Such sites should be monitored by the MMP.

There are additional marshes in the Durham Region where routes could be established and existing routes where complementary marsh bird or amphibian surveys would permit a more definitive evaluation of the region's wetland-dependent wildlife. Volunteer recruitment to fill these needs is ongoing.

Results

Number of amphibians in Durham Region MMP routes ranged from one to five per route (Table 3). Overall, seven species were recorded, including four amphibian indicator species (Bullfrog, Chorus Frog, Northern Leopard Frog, Spring Peeper). Maximum number of amphibians recorded per route was lower at Durham Region routes than at non-Durham region coastal Lake Ontario routes for all amphibian species, except Wood Frog. Mean number of amphibian indicator species per route at Durham Region routes was higher only for Chorus Frog when compared to non-Durham Region routes (Table 4), however Chorus Frog occurred at only one route. Similarly, Bullfrog occurred at only one route during only one of the eight survey years in the Durham Region. According to the Ontario Herpetofaunal Summary, the species range of Mink Frog does not include the Durham Region. In general, species were recorded at low to moderate levels (Call Level Codes 1 and 2).

Number of marsh nesters at Durham Region routes ranged from six to 22 (Table 5). Overall, 28 species of marsh nesters were recorded in Durham Region MMP routes, which is a very high level of diversity. Eleven of 12 marsh bird indicator species were recorded in the Durham Region – Common Snipe was the only specie not present. However, Pied-billed Grebe was present only at one route and American Bittern was present only outside of one Durham Region route. Durham Region abundances (mean number per 10 stations) for six of 10 marsh bird indicator species scored above average for those at non-Durham Region coastal Lake Ontario routes. Red-winged Blackbird was the most abundant marsh nesting species, followed by Swamp Sparrow, Marsh Wren, Yellow Warbler and Canada Goose. Mean number of marsh bird indicator species per station (among routes where species occurred) in the Durham Region was above or equal to that of non-Durham Region coastal Lake Ontario routes for five of 11 marsh indicator species (Table 6).

Six water foragers and eight aerial foragers were recorded in the Durham Region (Table 5), which is a high level of diversity. One species of conservation interest in Ontario (Black-crowned Night Heron) was also present. Common Tern was the most abundant water forager species, and Tree Swallow was the most abundant aerial forager. Seven of 14 water and aerial forager species had higher densities at Durham Region routes than at non-Durham Region routes.

Conclusions

Abundances of three marsh bird indicator species at Durham Region routes (American Coot, Marsh Wren and Common Moorhen/American Coot) scored above average on non-Durham routes, and abundance of seven indicator species (Black Tern, Blue-winged Teal, Common Moorhen, Least Bittern, Pied-billed Grebe, Sora and Virginia Rail) scored within average compared to that of non-Durham Region coastal Lake Ontario routes (Table 7). However, Common Snipe never occurred, American Bittern occurred only outside of one survey station, and Pied-billed Grebe only occurred at only one Durham Region coastal route. Of the four amphibian indicator species present, status of three amphibian species' relative abundance (Bullfrog, Chorus Frog and Northern Leopard Frog) scored within average of non Durham coastal Lake Ontario routes, and status of Spring Peeper relative abundance scored below that of non-Durham Region coastal Lake Ontario routes. However, mean route occurrence of both Bullfrog and Chorus Frog was considerably lower in the Durham Region (i.e., each species occurred once at only one route over the eight-year survey period) in the Durham Region (see Table 8).

Marsh nesting bird species diversity and marsh bird indicator species diversity at Durham Region routes both scored above average of non-Durham Region coastal Lake Ontario routes (Table 9). This would indicate that marsh bird species diversity in the Durham Region is healthier than marsh bird species diversity in other coastal MMP routes occurring in the Lake Ontario basin. In contrast, total amphibian species diversity and amphibian indicator species diversity at Durham Region routes both scored below average of non-Durham region coastal routes. Therefore, amphibian species diversity in the Durham Region is of poorer quality than amphibian species diversity in other coastal routes occurring in the Lake Ontario basin. Overall, even though when averaged across bird and amphibian guilds the Durham Region marshes are apparently not impaired in their ability to support marsh dependent wildlife, MMP results for amphibians clearly indicate that Durham Region marshes are highly impaired in their ability to support healthy and diverse amphibian communities.

Recommendations

Efforts should be made to continue to rehabilitate marsh habitat and to monitor marsh bird and amphibian populations to properly address loss of habitat. MMP routes should be established at all marsh rehabilitation projects. Efforts should be made to encourage all MMP volunteers surveying routes within the Durham Region to rigorously collect habitat information at their survey stations. Complementary amphibian and marsh bird surveys should be conducted at all new existing routes to permit a more definitive quantitative analysis of the Durham Region's wetland-dependent wildlife.

Further investigation is warranted to better determine how frog and toad amphibian species at Durham Region marshes are being negatively influenced by their highly altered and heavily anthropogenic influenced landscape. Initial insight indicates that amphibians may be a better candidate species guild for use as a bio-indicator of Durham Region coastal wetland health.

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Table 1. Marsh Monitoring Program Survey Methods

Survey	Time commitment	Skills Required	Survey Duration	Weather conditions
Birds	2 evenings, 10 days apart, between May 20 and July 5	ability to identify about 50 common birds	10 minutes at each station	warm, dry weather with little or no wind
Amphibians	3 nights, 1 days apart, between April 1 and July 15	ability to learn about 10 frog calls	3 minutes at each station	warm, dry weather with little or no wind

Table 2. Marsh Monitoring Program Routes in the Durham Region.

Year	Route Type	# Routes	# Volunteers
1995	Amphibian	6	3
	Bird	7	5
	Both	6	2
1996	Amphibian	4	2
	Bird	7	3
	Both	3	1
1997	Amphibian	3	2
	Bird	6	4
	Both	3	2
1998	Amphibian	4	2
	Bird	6	3
	Both	0	0
1999	Amphibian	2	2
	Bird	3	2
	Both	1	1
2000	Amphibian	1	1
	Bird	2	1
	Both	1	1
2001	Amphibian	1	1
	Bird	1	1
	Both	1	1
2002	Amphibian	9	7
	Bird	10	8
	Both	6	5
Total	Amphibian	12	12
	Bird	14	15
	Both	8	7

Table 3. Amphibian species composition and abundance (maximum Call Level Code[1]) at Durham Region and non-Durham Region coastal MMP routes from 1995 through 2002. Shading denotes indicator species.

	Route Number[2]															
Amphibian Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Durham Region (maximum)**	**non-Durham Region (maximum)**
American Toad	1	1	2	2	2	1	-	1	-	2	2	-	2	1	2	3
Bullfrog	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	3
Chorus Frog	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	3
Gray Treefrog	-	-	-	-	-	-	-	-	-	-	-	-	-	-	—	3
Green Frog	-	1	1	-	1	-	1	-	2	2	2	-	-	1	2	3
Northern Leopard Frog	-	1	1	-	2	1	-	-	-	1	1	-	1	-	2	3
Spring Peeper	-	-	1	-	1	2	-	-	-	1	1	-	-	1	2	3
Wood Frog	1	1	-	-	3	1	-	-	2	1	2	-	1	-	3	3

[1] Call Level Code 1: Individuals can be counted; calls not simultaneous. Call Level Code 2: Calls distinguishable, some simultaneous calling. Call Level Code 3: Full chorus; calls continuous and overlapping.

[2]

Marsh Name	Route Number
Corbett Creekmouth Marsh	1
Cranberry Marsh	2
Duffins Creek Marsh	3
Frenchman's Bay #1	4
Frenchman's Bay #2	5
Pickering Nuclear Marsh	6
Lynde Creek Marsh #1	7
Lynde Creek Marsh #2	8
McLaughlin Bay Marsh	9
Oshawa Second Marsh #1	10
Oshawa Second Marsh #2	11
Port Darlington Marsh	12
Rouge River Marsh	13
Wilmot Rivermouth Wetland	14

Table 4. Mean number of stations with amphibian indicator species (among routes where species occurred), from 1995 through 2002. Values in parentheses are actual number of stations where species occurred within routes. Mean and actual number of stations where species occurred for Durham Region and non-Durham Region coastal MMP routes combined are given for comparison.

	Route Number[1]															
Amphibian Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Durham Region (mean)**	**non-Durham Region (mean)**
Bullfrog	0	0	0	0	0	0	0	0.50 (1)	0	0	0	0	0	0	0.50 (1)	0.65 (160)
Chorus Frog	0	0	0	0	0	0	0	0	0	0	0	1.00 (1)	0	0	1.00 (1)	0.52 (92)
Northern Leopard Frog	0	0.25 (3)	0.46 (6)	0	0.38 (3)	0.50 (2)	0	0	0	0.18 (8)	0.31 (11)	0	0.33 (2)	0	0.35 (35)	0.60 (217)
Spring Peeper	0	0	0.08 (1)	0	0.13 (1)	0.25 (1)	0	0	0	0.02 (1)	0.03 (1)	0	0	1.00 (1)	0.25 (6)	0.71 (249)
Total Number of Stations	2	12	13	3	8	4	1	2	1	45	35	1	6	1	134	473

[1]Marsh Name — Route Number

Corbett Creekmouth Marsh	1
Cranberry Marsh	2
Duffins Creek Marsh	3
Frenchman's Bay #1	4
Frenchman's Bay #2	5
Pickering Nuclear Marsh	6
Lynde Creek Marsh #1	7
Lynde Creek Marsh #2	8
McLaughlin Bay Marsh	9
Oshawa Second Marsh #1	10
Oshawa Second Marsh #2	11
Port Darlington Marsh	12
Rouge River Marsh	13
Wilmot Rivermouth Wetland	14

Table 5. Marsh bird species composition and abundance (mean number per 10 stations) in the Durham Region from 1995 through 2002. Means for Durham Region, non-Durham Region and all Lake Ontario coastal routes combined (i.e., Durham and non-Durham) are given for comparison. Shading denotes indicator species and ' p ' indicates that a species was present only outside of the sample stations.

	Route Number[1]														
Marsh Bird Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Durham routes only**	**non-Durham routes only**	**Lake Ontario coastal routes**
Marsh Nesters															
Alder Flycatcher								0.2					0.03	0.24	0.19
American Bittern		p											p	0.41	0.32
American Coot		12.1											1.64	0.12	0.44
Black Tern		1.4		1.7				5.7					1.01	1.43	1.34
Blue-winged Teal		3.6		0.7				0.5					0.60	0.25	0.32
Canada Goose		32.1	p	17.8	4.4	3.3	5.0	1.4		10.0			7.23	4.59	5.15
Common Grackle	2.5	2.1	6.8	13.5	2.8		10.0	6.9	p	10.0	p	p	4.49	11.02	9.65
Common Moorhen		1.4		8.0	1.7			1.9					1.28	1.72	1.63
Common Yellowthroat	5.0	2.1	5.4	p			p	7.9			12.5		3.17	4.38	4.12
Eastern Kingbird		4.3	1.3	1.7	1.1		p	3.6					1.36	0.73	0.87
Gadwall		3.6		0.3	1.1			1.7					0.77	0.13	0.27
Green-winged Teal		1.4						0.2					0.22	0.03	0.07
Least Bittern								0.2	1.7				0.22	0.44	0.39
Mallard	5.0	25.0	1.1	5.7	1.1		p	1.4	1.7	15.0		6.7	5.52	4.75	4.91
Marsh Wren	5.0	4.3	7.9	6.7	12.2		12.5	21.9		5.0	30.0		9.12	6.70	7.21
Moorhen/Coot				2.2	1.1							16.7	1.24	0.22	0.43
Mute Swan		2.1		p	1.1	6.7		0.7		10.0			1.01	0.73	0.79
Northern Harrier						p	p	0.2					0.03	0.42	0.34
Northern Shoveler		4.3											0.58	p	0.12
Pied-billed Grebe				0.7									0.06	0.83	0.67
Red-winged Blackbird	37.5	29.3	46.8	41.0	58.3	56.7	55.0	52.9	71.7	45.0	40.0	46.7	48.04	53.21	52.12
Sedge Wren								0.5					0.06	0.01	0.02
Song Sparrow	2.5	9.3	2.6	2.2	p		2.5	7.4			2.5		3.20	4.15	3.95
Sora		1.4	0.4	0.4			2.5				5.0	6.7	1.24	0.70	0.81
Swamp Sparrow	5.0	7.9	8.1	1.3	1.7	6.7	15.0	34.0	10.0	15.0	17.5		10.85	13.09	12.62
Virginia Rail	5.0	3.6	7.2	3.6	2.8		5.0	3.6	1.7		10.0	6.7	4.35	2.50	2.89
Willow Flycatcher		0.7	0.4	p			2.5	11.9					1.71	0.45	0.71
Yellow Warbler	5.0	15.7	6.4	0.7		3.3	12.5	24.5		p	12.5		8.25	6.16	6.60
Water Foragers															
Black-crowned Night Heron		p	0.4	6.8	15.6		p	2.1	p				1.85	0.40	0.70
Belted Kingfisher	5.0	p	0.4	0.4		10.0		0.2	p			p	1.08	0.58	0.68
Caspian Tern			1.4	0.3				p			p		0.19	0.45	0.40
Common Tern		p	4.2	20.3	2.2		p	3.8	3.3	5.0			3.48	0.65	1.25
Green Heron	5.0	1.4				3.3		1.0					0.88	0.51	0.59
Great Blue Heron	p	p	0.4	1.0	1.1	p	p	1.0	p				0.32	1.55	1.29
Air Foragers															
Bank Swallow		5.0	4.2	17.7	8.3			4.3			35.0	33.0	8.44	4.41	5.26
Barn Swallow		3.6	14.3	11.5	5.0	10.0		3.1	30.0	10.0			8.12	13.71	12.53
Chimney Swift		0.7		p				0.2			p		0.12	0.94	0.76
Cliff Swallow			0.6										0.06	0.46	0.38
Common Nighthawk			p										p	0.07	0.05
N. Rough-winged Swallow		0.7	0.8					1.2					0.33	0.81	0.71
Purple Martin				34.0			p	p					3.27	1.49	1.86
Tree Swallow	35.0	60.7	82.6	105.6	149.4		17.5	14.3	41.7	20.0	5.0	276.7	63.71	23.56	32.01

[1]Marsh Name — Route Number

Corbett Creekmouth Marsh	1
Cranberry Marsh	2
Duffins Creek Marsh	3
Frenchman's Bay	4
Pickering Nuclear Marsh	5
Lynde Creek Marsh #1	6
Lynde Creek Marsh #2	7
Oshawa Second Marsh	8
Port Darlington Marsh	9
Rouge River Marsh	10
Westside Beach Marsh	11
Wilmot Rivermouth Wetland	12

Table 6. Mean number of stations with marsh bird indicator species (among routes where species occurred), from 1995 through 2002. Values in parentheses are actual number of stations where species occurred within routes. Mean and actual number of stations where species occurred for Durham Region and non-Durham Region coastal MMP routes are given for comparison.

	Route Number[1]													
Marsh Bird Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Durham routes only**	**non-Durham routes only**
American Bittern	0	0	0	p	0	0	0	0	0	0	0	0	0	0.19 (22)
American Coot	0	0.58 (7)	0	0	0	0	0	0	0	0	0	0	0.58 (7)	0.14 (5)
Black Tern	0	0.08 (1)	0	0.08 (2)	0	0	0	0.24 (10)	0	0	0	0	0.14 (13)	0.22 (31)
Blue-winged Teal	0	0.17 (2)	0	0.08 (2)	0	0	0	0.02 (1)	0	0	0	0	0.09 (5)	0.28 (10)
Common Moorhen	0	0.17 (2)	0	0.38 (9)	0.17 (1)	0	0	0.17 (7)	0	0	0	0	0.22 (19)	0.27 (70)
Least Bittern	0	0	0	0	0	0	0	0.02 (1)	0.17 (1)	0	0	0	0.10 (2)	0.15 (22)
Marsh Wren	0.25 (1)	0.33 (4)	0.58 (11)	0.54 (13)	1.00 (6)	0	0.50 (2)	0.71 (30)	0	0.50 (1)	1.00 (4)	0	0.60 (72)	0.55 (207)
Moorhen/Coot	0	0.58 (7)	0	0.50 (12)	0.33 (2)	0	0	0.17 (7)	0	0	0	1.00 (3)	0.52 (31)	0.30 (80)
Pied-billed Grebe	0	0	0	0.08 (2)	0	0	0	0	0	0	0	0	0.03 (2)	0.17 (23)
Sora	0	0.17 (2)	0.05 (1)	0.04 (1)	0	0	0.25 (1)	0	0	0	0.50 (2)	0.67 (2)	0.28 (9)	0.25 (53)
Virginia Rail	0.50 (2)	0.33 (4)	0.47 (9)	0.42 (10)	0.33 (2)	0	0.25 (1)	0.33 (14)	0.17 (1)	0	1.00 (4)	0.33 (1)	0.44 (48)	0.35 (123)
Total Number of Stations	4	12	19	24	6	3	4	42	6	2	4	3	129	534

'Marsh Name	Route Number
Corbett Creekmouth Marsh	1
Cranberry Marsh	2
Duffins Creek Marsh	3
Frenchman's Bay	4
Pickering Nuclear Marsh	5
Lynde Creek Marsh #1	6
Lynde Creek Marsh #2	7
Oshawa Second Marsh	8
Port Darlington Marsh	9
Rouge River Marsh	10
Westside Beach Marsh	11
Wilmot Rivermouth Wetland	12

Table 7. Assessment of the status of marsh bird and amphibian indicator species abundance in the Durham Region from 1995 through 2002. ' – ' denotes values below the non-Durham Region average. ' 0 ' denotes values within the non-Durham Region average. ' + ' denotes values above the non-Durham Region average. Blank indicates that the species was not present and ' p ' indicates that a species was present only outside of the sample stations.

	Marsh Bird Indicator Species											Amphibian Indicator Species			
Marsh Name	**AMBI**	**AMCO**	**BLTE**	**BWTE**	**COMO**	**LEBI**	**MAWR**	**MOOT**	**PBGR**	**SORA**	**VIRA**	**BULL**	**CHFR**	**NLFR**	**SPPE**
Corbett Creekmouth							0				0				
Cranberry Marsh	p	+	0	+	0		0	+		0	0			0	
Duffins Creek							+			0	+			0	-
Frenchman's Bay #1			0	0	+		+	+	0	0	+				
Frenchman's Bay #2														0	-
Pickering Nuclear Marsh					0		+	0			0			0	0
Lynde Creek #1															
Lynde Creek #2							0			0	0	0			
McLaughlin Bay															
Oshawa Second Marsh #1			+	0	0	0	+	0			+			-	-
Oshawa Second Marsh #2														-	-
Port Darlington						0					0		0		
Rouge River							0							0	
Westside Beach							+			+	+				
Wilmot Rivermouth								+		+	0				0
Durham Overall Assessment		+	0	0	0	0	+	+	0	0	0	0	0	0	-

Table 8. Mean number of routes where amphibian and marsh bird indicator species (separate tables) occurred from 1995 through 2002. Values in parentheses are actual number of stations where species occurred within routes. Mean and actual number of stations where species occurred for Durham Region and non-Durham Region coastal MMP routes are given for comparison.

	Amphibian Indicator Species			
	BULL	CHFR	NLFR	SPPE
Durham routes	0.07 (1)	0.07 (1)	0.50 (7)	0.43 (6)
non-Durham routes	0.56 (31)	0.42 (23)	0.65 (36)	0.60 (33)

	Marsh Bird Indicator Species										
	AMBI	AMCO	BLTE	BWTE	COMO	LEBI	MAWR	MOOT	PBGR	SORA	VIRA
Durham routes	p	0.08 (1)	0.25 (3)	0.25 (3)	0.33 (4)	0.17 (2)	0.75 (9)	0.42 (5)	0.08 (1)	0.50 (6)	0.83 (10)
non-Durham routes	0.21 (12)	0.07 (4)	0.22 (13)	0.07 (4)	0.33 (19)	0.19 (11)	0.57 (33)	0.12 (7)	0.12 (7)	0.31 (18)	0.50 (29)

Table 9. Status of Durham Region marshes from 1995 to 2002[1]. ' – ' denotes values below the non-Durham Region average. ' 0 ' denotes values within the non-Durham Region average. ' + ' denotes values above the non-Durham Region average.

				Assessment of Marsh Bird and Amphibian Species Diversity				
Marsh Name	**Survey Type**	**Year**	**Number of Stations**	**Marsh Nesting Bird Diversity**	**Marsh Bird Indicator Species Diversity**	**Amphibian Species Diversity**	**Amphibian Indicator Species Diversity**	**Overall Assessment[2]**
Corbett Creekmouth	Amph Bird	2002	3 4	-	0	-	-	1
Cranberry Marsh	Amph Bird	1996, 2002	5 7	+	+	-	-	4
Duffins Creek	Amph Bird	1996 -1998, 2002	4 5	0	0	-	-	2
Frenchman's Bay #1	Amph	1995	3			-	-	0
Frenchman's Bay #2	Amph Bird	1996 - 1999, 2002	2 5	0	+	-	-	3
Pickering Nuclear Marsh	Amph Bird	1996 - 1997, 2002	2 2	0	+	-	-	3
Lynde Creek #1	Amph Bird	2002	3 3	-	-	-	-	0
Lynde Creek #2	Amph Bird	2002	0 4	0	0	-	-	2
McLaughlin Bay	Amph	2002	2			-	-	0
Oshawa Second Marsh #1	Amph Bird	1996, 1998, 2001, 2002	6 6	+	-	-	-	3
Oshawa Second Marsh #2	Amph	1996, 1998	6			-	-	0
Port Darlington	Amph Bird	2002	3 6	-	-	-	0	1
Rouge River	Amph Bird	1997 - 1999	2 1	+	0	-	-	3
Wilmot Rivermouth	Amph Bird	2002	1 6	-	+	-	-	2
Durham Region Overall Assessment				+	+	-	-	4

[1] See the Marsh Monitoring Program's 1997 Final Technical Report for a detailed description of the scoring system.

[2] A score of 0, 1 or 2 indicates impairment, a score of 3, 4 or 5 indicates no apparent impairment and a score of 6, 7 or 8 indicates an above average marsh.