2014
Lake Erie Coastal VIBI Project

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Abstract

Lake Erie Coastal Wetlands were an incredibly diverse and unique environment for many plants and wildlife species until the introduction of invasive, non-native plants to the United States, which now suppress native plant species. The Ohio EPA sampled 20 plots within 15 wetlands along the coast of Lake Erie from 2000-2004 measuring plant diversity and quality utilizing the Vegetative Index of Biotic Integrity (VIBI). In 2014, these 20 sites were revisited and surveyed using VIBI to measure the change over the 10-14 year period.

The VIBI scores in the 2000-2004 survey had an average of 56.5. In 2014, the average score for these same sites was 41.9. The difference in these scores represents a 14.53 point reduction of the average VIBI score over a period of 10-14 years. One of the major causes for reduction in the quality of Lake Erie coastal marshes is a decision by many managers not to control non-native, invasive narrow-leaf cattail and hybrid cattail. Two wetlands that scored close to the 2001-2004 scores, Arcola Creek and Meadowbrook, were the only wetlands that underwent managed cattail removal.

VIBI scores would improve with widespread use of cattail control.

TABLE OF CONTENTS

Page

Abstract ii

Introduction 1

Methods 1

Results 2

Discussion 2

Conclusion 4

Recommendations 6

Literature Cited 7

Appendices 8

LIST OF APPENDICES

Page

Appendix A: Maps 9

Appendix B: VIBI Calculations Summary Information for the 2000-2004 Study 10

Appendix C: VIBI Calculations Summary Information for the 2014 Study 11

Appendix D: Summary Table of VIBI Data for 2000-2004 Study and 2014 Study 12

Introduction

Lake Erie Coastal Wetlands were an incredibly diverse and unique environment for many native plant and wildlife species until the introduction of invasive, non-native plants to the United States, which now suppress native plant species growth. From 2000-2004, the Ohio EPA sampled 20 wetlands in the Lake Erie region measuring plant diversity and quality utilizing the Vegetative Index of Biotic Integrity (VIBI) method of assessing wetland quality. In 2014, these 20 sites have been revisited and surveyed to measure the change over the 10-14 year period since the last survey (Appendix A).

Methods

The purpose of this study was to re-sample the VIBI plots which were originally sampled by the Ohio EPA between 2000 and 2004. The VIBI is a plot-based vegetative method of gathering data for use in monitoring and assessing the health of Ohio Lake Erie Coastal Wetlands. The vegetative sampling data gathered in this 2014 study was subsequently compared with the data gathered from the Ohio EPA's previous study of the Ohio coastal wetlands.

The standard method for setting up a VIBI plot is to measure a 20m x 50m plot in an area that characterizes the wetland. The plot is divided into 10 modules that are 10m x 10m, of which, four intensive modules are chosen to survey in depth. For each plot, presence and percent cover using cover classes were recorded for each plant species in the herbaceous layer and stem counts and basal area were recorded for each species in the shrub layer. Other physical variables recorded for each plot include standing biomass (eight 0.1 m2 clips plots), % open water, % litter cover, % bare ground, etc. All species were identified to the lowest possible taxonomic level. Voucher specimens were taken when necessary for identification or documentation purposes. Voucher specimens will be properly prepared and housed in the Cleveland Museum of Natural History Herbarium.

All data is entered into an automated spreadsheet which calculates the VIBI score based on the plant species surveyed in the plot. The method used in this study is outlined in the Ohio EPA's Handbook for Wetland Assessment, titled *The Integrated Wetland Assessment Program Part 9: Field Manual for the Vegetation Index of Biotic Integrity for Wetlands, v. 1.4* (Mack 2007).

The VIBI score is used to determine into which Wetland Tiered Aquatic Life Uses (WTALUs) Category the wetland falls (Mack 2004). A Superior Wetland Habitat (SWLH), or Category 3 Wetland, has a VIBI score within the range of 62-100. Category 3 Lake Erie wetlands are dominated by a high diversity of Lake Erie wetland plants and a low percentage of invasive, non-native wetland plant species. One or more rare wetland species are often present within Category 3 wetlands. These wetlands typically support several dozen native plant species and typically support a high diversity of wetland birds. A Wetland Habitat (WLH), or Category 2 wetland, has a VIBI score within the range of 50-61 (Mack 2004). Category 2 Lake Erie wetlands support a good diversity of native plant and wetland bird species, but invariably have established stands of non-native wetland plants. If invasive, non-native plants such as narrow-leaf cattail, hybrid cattail, non-native reed grass, canary grass and purple loosestrife are not controlled, the native wetland plants will eventually reduce the diversity of Category 2 wetlands to Category 1 status. A wetland with a VIBI score within the range of 25-49 is a Restorable Wetland Habitat (RWLH), or Modified

Category 2 wetland (Mack 2004). These wetlands are degraded but still considered reasonably restorable. A Limited Quality Wetland Habitat (LQWLH), or Category 1, Lake Erie wetland has a VIBI score within the range of 0-24 (Mack 2004). These wetlands are typically monocultures of non-native, invasive plant species and have experienced a severe decline in quality of native wetland species. Much effort will be required to restore a Category 1 wetland habitat.

Results

The VIBI scores in the 2000-2004 survey averaged 56.2 (Appendix B). In 2014, the average VIBI score for these same sites was 41.9 (Appendix C). That is a 14.53 point reduction of the average VIBI score for these sites over the period of 10-14 years (Figure 1, Figure 2 and Figure 3). The average score of all marshes surveyed downgraded from Category 2 to the Modified Category 2. The marshes that demonstrated the severe declines in VIBI scores in 2014, compared to 2000-2004, had a dramatic increase in dominance of invasive, non-native species and a noticeable decline and loss of native wetland species. Many of these sites have been degraded significantly by increase in dominance of invasive, non-native species in the years since the initial surveys (2000-2004) were conducted (Appendix D). Expansion of the non-native wetland plants during the past ten years and replacement of native wetland plants by the invaders, caused a significant reduction of both native wetland plant species diversity and percentage cover.

Many of the wetland sites are currently being managed for non-native, invasive species with differing results. The sites managed for invasive species have improved scores (Figure 4). However, narrowleaf cattail (*Typha angustifolia*), hybrid cattail (*Typha x glauca*) and common reed grass (*Phragmites australis ssp. australis*) were seen as a widespread problem at many sites, lowering their respective VIBI scores.

Discussion

The sites surveyed have undergone many changes over the past 10 years. Many of the same species observed in the current survey were present in the past survey. The difference is the greater abundance of allelopathic species, which release toxins into the soil that suppress the growth of nearby plants, and non-native, invasive species such as *Phragmites australis ssp. australis*, *Phalaris arundinace*a, *Typha angustifolia* and *Lythrum salicaria.* As a result, most of the sites revisited have experienced damage to their plant biodiversity.

Many of the sites are being managed for invasive plants. Managing these sites can be difficult because of location, funds, and the robust nature of the invasive species involved. From surveying some of the well managed sites and seeing the plant diversity present in the seed bank, we can be hopeful that if the other sites are well managed, they can have good plant diversity in the future.

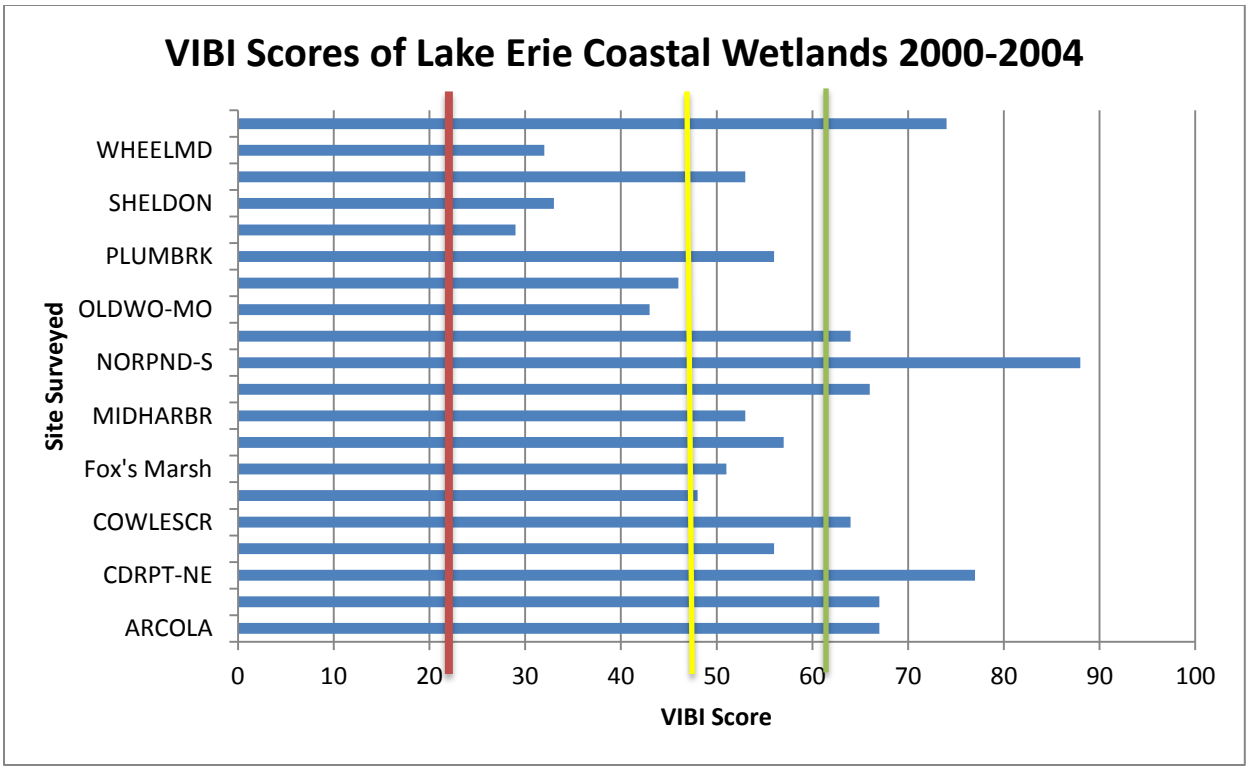

Figure 1. VIBI scores for the 2000 to 2004 study.

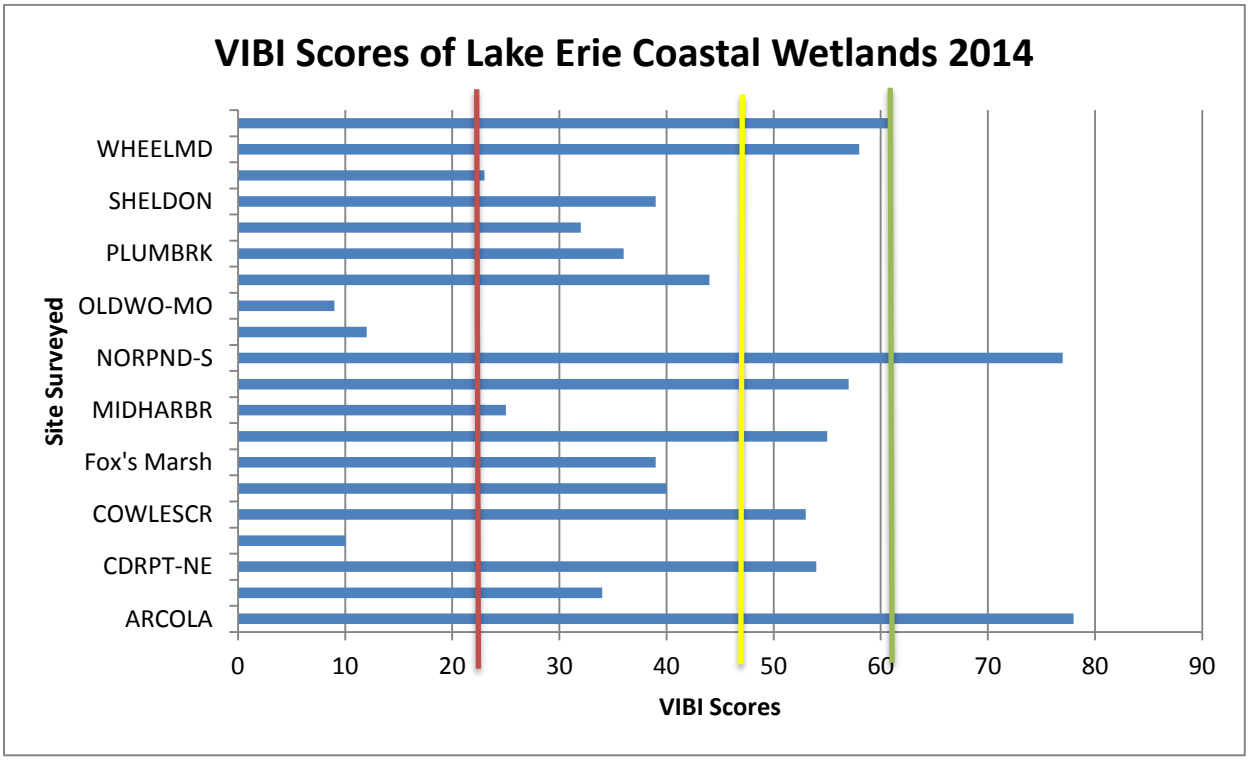

Figure 2. VIBI scores for the 2014 study.

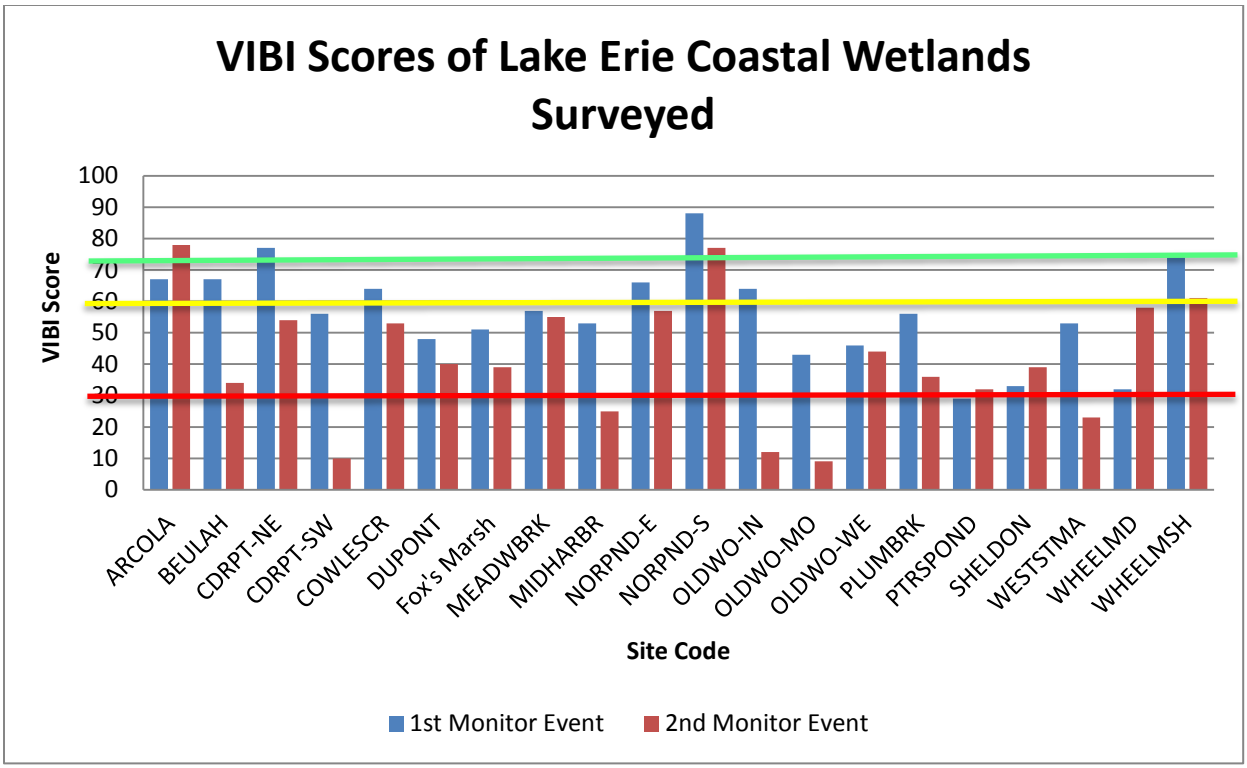

Figure 3. VIBI Scores of Lake Erie Coastal Wetlands Surveyed.

Conclusion

Comparing the VIBI data collected in 2000-2004 and the VIBI data collected in 2014, a majority of Lake Erie Coastal Wetlands are being populated and degraded by invasive species that lower biodiversity. A greater effort is needed to control and manage these sites to prevent further damage to native plant habitats. However, since most Lake Erie wetland plants have a remarkable seed bank life, as much as 100 years or more, restoration of the low scoring marshes, by removal of the non-native, invasive species, should trigger release of the missing marsh species from the seed bank and increase in VIBI scores to the 2000-2004 scores or even higher. In conclusion, even wetlands that showed the greatest drop in VIBI scores could be restored by removal of the invasive plant cover and release of the native seed bank.

Site Code	VIBI Scores 1st Monitor Event	2nd Monitor Event	Percent Change	Managed	Managed For	Type of Management
ARCOLA	67	78	**11.00%**	Yes	Purple Loosestrife	Beatles
BEULAH	67	34	-33.00%	No		
CDRPT-NE	77	54	-23.00%	Yes	*Phragmites*, water levels	Herbicide, dike valves
CDRPT-SW	56	10	-46.00%	No		
COWLESCR	64	53	-11.00%	No		
DUPONT	48	40	-8.00%	Yes	*Pharmites*	Herbicide
Fox's Marsh	51	39	-12.00%	Yes	*Phragmites*	Herbicide
MEADWBRK	57	55	-2.00%	Yes	*Phragmites*	Herbicide, controlled burn
MIDHARBR	53	25	-28.00%	Yes	*Phragmites*	Herbicide
NORPND-E	66	57	-9.00%	Yes	*Phragmites*	Herbicide
NORPND-S	88	77	-11.00%			
OLDWO-IN	64	12	-52.00%	Yes	*Phragmites*	Herbicide
OLDWO-MO	43	9	-34.00%	Yes	*Phragmites*	Herbicide
OLDWO-WE	46	44	-2.00%	Yes	*Phragmites*	Herbicide
PLUMBRK	56	36	-20.00%	No		
PTRSPOND	29	32	**3.00%**	Yes	*Phragmites*, water levels	Herbicide, dike valves
SHELDON	33	39	**6.00%**	Yes	*Phragmites*, erosion	Herbicide, dredging
WESTSTMA	53	23	-30.00%	No		
WHEELMD	32	58	**26.00%**	No		
WHEELMSH	74	61	-13.00%	No		
Average	56.2	41.8	-14.40%			

Figure 4. Comparison of Managed to Unmanaged Sites.

Recommendations

Management for narrow-leaf cattail (*Typha angustifolia*), hybrid cattail *(Typha x glauca*), non-native reedgrass (*Phragmites australis* ssp. *australis*) and canary grass (*Phalaris arundinacea*) would improve the condition of all the marshes that received much lower scores in 2014 than in 2000-2004. The only wetland without narrow-leaf cattail was Foxes Marsh on North Bass Island. The decrease in diversity of Foxes Marsh was caused by an infestation of non-native reed grass (*Phragmites*). All three plots at Old Woman's Creek National Wildlife Sanctuary were completely invaded by narrow-leaf cattail. The Sheldon's Marsh State Nature Preserve plot was choked by non-native cattail. Both narrow-leaf cattail and hybrid cattail were present at North Pond on Kelleys Island. Narrow-leaf cattail is present within both Wheeler Creek Marsh and Cowles Creek Marsh at Geneva State Park. Two of the three plots at Little Cedar Point National Wildlife Refuge were choked by a continuous cover of non-native *Phragmites* and narrow-leaf cattail.

Removal of narrow-leaf cattail at Presque Isle State Park north of Erie, Pennsylvania released large stands of greater bur-reed throughout the 3,000-acre Presque Isle Peninsula since restoration efforts were initiated in 2004. As a result of management, one of the rare plants no longer present within any Lake Erie marshes in Ohio, leafy tussock sedge (*Carex aquatilis*), returned in large numbers from the seed bank at Presque Isle State Park. Museum inventories of coastal marshes between 1973 and 1988 documented leafy tussock sedge within Cowles Creek Marsh in Geneva State Park, Old Woman's Creek National Estuarine Sanctuary and Dupont Marsh State Nature Preserve. Ohio Natural Areas and Preserves Chief Botanist Rick Gardner collected leafy tussock sedge within Potter's Pond at Little Cedar Point National Wildlife Refuge in 2001. When John Mack and his interns conducted the VIBIs in 2000-2004, leafy tussock sedge had already been choked out by non-native cattail and *Phragmites*.

Managers should attempt to increase the dominance of greater bur-reed (*Sparganium eurycarpum*) within all coastal marshes. Many native marsh plants such as arrowheads, umbrella sedges, spikerushes, sedges, rushes, pickerel-weed and bulrushes thrive in association with greater bur-reed. Because greater bur-reed is a non-persistent marsh plant, it declines and disappears within coastal ponds as the level of Lake Erie drops during middle and late summer. As the bur-reed drops out, a great diversity of sedges, arrowhead species, umbrella sedges, rushes and smartweeds emerge from the seed bank on the open, exposed sand or silt within coastal wetlands dominated by greater bur-reed. This ephemeral plant community remains within the seed bank through the natural fluctuation of Lake Erie levels within marshes dominated by canary grass, non-native cattails and non-native reed grass (*Phragmites*). The ephemeral wetland communities also thrive within coastal marshes dominated by native *Phragmites* (*Phragmites australis* ssp. *americanus*) because the dead stems of native *Phragmites* quickly rot after the growing season. Rare ephemeral wetland plants, sedges, rushes, bulrushes and smartweeds, thrive within native reedgrass stands.

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