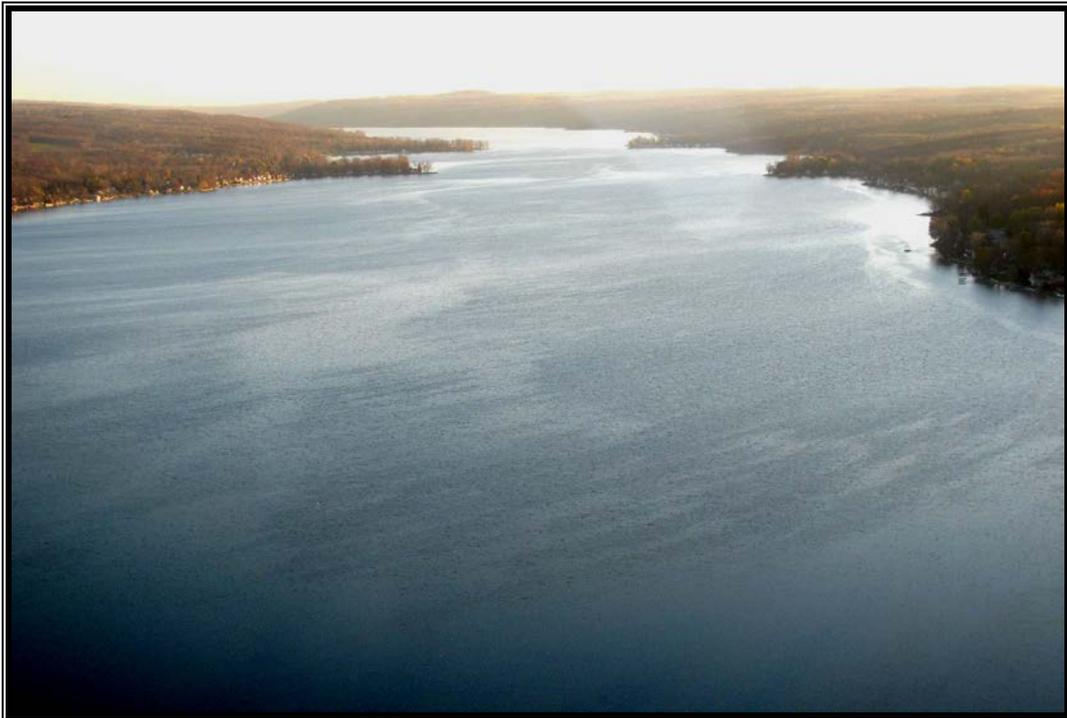


**Macrophyte Biomass and Filamentous Algal  
Cover in Conesus Lake: Long Term Trends  
for the Cottonwood Gully, Sand Point Gully,  
Sutton Point Gully and North Gully Cove  
Macrophyte Beds  
(Summer 2010)**



Report Submitted to  
The Livingston County Planning Department

by

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## I. Summary

- Macrophyte biomass, macrophyte bed surface area, total standing crop, and the % cover of filamentous algae were measured in North Gully Cove during the summer 2010. This was the third year of a monitoring program designed to test the hypothesis that northward diversion of the North Gully tributary (completed in February 2008) would bring about reductions in plant growth. Three other study sites (Sutton Point, Sand Point and Cottonwood Gully) were monitored to account for lake-wide changes in plant growth that might influence trends at North Gully Cove.
- At depths of 2-3 m in North Gully Cove where Eurasian watermilfoil is typically a dominant species, the area covered by milfoil (m<sup>2</sup>) and the total macrophyte standing crops (kg) were 22% and 53% lower than the long-term average and 82% and 54% lower than in 2009. Additionally, the percent of milfoil by weight of the macrophyte flora had decreased by about 18% compared to 2007, continuing a downward trend that began during the 2008 growing season. Coontail and Sago Pondweed have emerged as common species in the area.
- The Sand Point and Sutton Point reference beds experienced similar decreases in overall biomass and milfoil dominance. Only at the Cottonwood Gully site was the macrophyte bed appreciably larger and denser than the long-term average. The increase in biomass at the Cottonwood site is consistent with recent increases in nitrogen loading reported for Cottonwood Gully by Makarewicz and Lewis (2010). They reverse a trend of major reductions in milfoil at Cottonwood Gully that began in 2004 after management practices were implemented in the watershed as part of the U.S.D.A. project.
- Filamentous algal cover at North Gully Cove during the peak of the season was >90%, which is the highest cover recorded at this location since monitoring started in 2002. We do not believe this is evidence that the rechanneling project has failed to control filamentous algal growth. Cover was also very high in the three reference beds, indicating this was a lake-wide problem in 2010. Additionally, runoff from the South Gully stream (~450 m to the south) very likely contributed to plant growth in North Gully Cove. Residents in the McPhersons Point area reported that a large plume of water laden with sediment originating from South Gully was advected into North Gully Cove in early June. A major bloom of algae developed within a week's time and the growth was prominent in the area throughout the summer.
- Whether the North Gully diversion project has brought about reductions in plant growth in the adjacent cove remains in question. The adverse influence of South Gully runoff and the natural variability in lake plant growth have dampened any statistically significant indications of improvement in our three-year data set. Nevertheless there are signs of improvement, particularly in terms of declining standing crops and loss of dominance by Eurasian watermilfoil.
- We recommend that occasional monitoring of this site be undertaken to determine whether the trends observed after the diversion of North Gully persist or become more pronounced.

## II. Introduction

The major question addressed in this study is whether the diversion of North Gully Creek at McPhersons Point and the presumed reduction in the runoff entering North Gully Cove has brought about reductions in the growth of macrophytes, primarily Eurasian watermilfoil (*Myriophyllum spicatum*), and filamentous algae. A scientific test of this question is possible because we now have a ten-year database of plant growth and nutrient loading from multiple streams and macrophyte beds along the lake, including the North Gully Cove area. This is a valuable long-term monitoring program that has been made possible by funding and other support from the Livingston County Planning Department, the Conesus Lake Association and the U.S. Department of Agriculture.

Prior to 2008 North Gully creek drained directly into North Gully Cove, delivering large amounts of dissolved and particulate nutrients to the shoreline. North gully is a 735 ha sub-watershed that is approximately 45% in dairy and row crop agriculture (Makarewicz et al., 2001, 2002). In February 2008, the North Gully creek channel was diverted northward along the McPhersons Point shoreline, presumably allowing much of the stream effluent to drain into the open waters of Conesus Lake away from the macrophyte bed to the south. Observations of runoff plumes before and after the project indicate that the stream diversion may have been effective in reducing the amount of sediment entering North Gully Cove (Bosch *et al.* 2008). However the hydrodynamics of the area and the dispersal of the North Gully stream plume under different environmental conditions (discharge, winds, currents) have not been studied and at this time there is no certainty that diversion of the stream has significantly altered the spatial pattern of nutrient delivery to the lake.

During the summer 2008 we conducted the first post-diversion study of plant growth and distribution in the macrophyte bed at North Gully Cove (Bosch *et al.*, 2008). The results indicated that the biomass and standing crop of macrophytes (primarily milfoil) were very low when compared to previous years for this site. However, a similar decrease in biomass was documented in two reference sites and the trends were believed to be lake-wide rather than specific to North Gully Cove. The cover of filamentous algae recorded in the 2008 was high. Measurements were taken on the bottom after the collapse of the macrophytes and they were not readily comparable to

previous data but there can be no question that a substantial algal bloom had taken place.

In 2009, the macrophyte biomass at North Gully Cove was very high and milfoil was once again the dominant species in the preferred 2-3 m growth zone (Bosch *et al.* 2009). The macrophyte canopy persisted most of the summer, yet the filamentous algal cover was relatively sparse and in fact the lowest recorded for the site in a decade of monitoring. This was a surprising trend in light of the high concentrations of nutrients in the North Gully effluent that was reported by Makarewicz and Lewis (2009) for the season.

The results of the 2010 monitoring study reported here provide mixed evidence about the changes in plant growth in North Gully Cove. The macrophyte bed was relatively sparse, particularly in terms of the dominant Eurasian watermilfoil in the 2-3 m zone, but filamentous algal cover was at an all time high for the site. One possible explanation for the profuse algal growth was the adverse influence of the South Gully tributary on the study system. It is now apparent that during major runoff events plumes from South Gully carry enough energy to move northward into North Gully Cove where they might influence the local plant community. One such event apparently occurred in early June 2010, as reported by local residents, and this one time delivery of nutrients may have fueled the initial massive bloom of filamentous algae that persisted through the summer.

### III. Methods

Our sampling protocol follows closely the procedures reported in the two previous reports for this project (Bosch *et al.* 2008, 2009). Macrophyte species composition and biomass, macrophyte bed area and filamentous algal coverage were determined for the North Gully Cove, Sutton Point, Sand Point and Cottonwood Gully macrophyte beds (**Figure 1**) during the peak of the growing season in July. North Gully Cove (**Figure 2**) was the experimental site in testing the hypothesis that diversion of the North Gully effluent to reductions in plant growth. The other macrophyte beds were monitored as reference sites to account for lake-wide changes that might influence trends at North Gully Cove. The four sites have been studied since 2000 as part of the U.S.D.A. watershed study. Consequently there is an extensive published record of nutrient delivery and plant growth for these sites (see Makarewicz *et al.*, 2009, Bosch *et al.* 2009a and 2009b). The North Gully tributary was not part of the monitoring scheme

for the SUNY Brockport study of 2010 (Makarewicz and Lewis, 2010), although data are provided for other sub-watersheds including Cottonwood Gully, which is a reference site for the present study.

Filamentous algal cover on canopied macrophyte beds was determined by taking digital photographs of replicate quadrats at the surface (Bosch *et al.* 2009b). Because the peak surface biomass depends on macrophyte canopy formation as well as algal growth, all of the beds in this study were monitored throughout the summer until peak biomass development was apparent. Monitoring of algal biomass is continued through the season in order to document declines and in some cases secondary blooms of filamentous algae.

All our procedures followed closely the guidelines set forth in the Quality Assurance Project Plan prepared by the Livingston County Planning Department (2010). The sampling protocols for macrophytes and the filamentous algae have been published in peer-reviewed journals (Bosch *et al.* 2009a, b)

#### **IV. Results and Discussion**

##### ***Macrophyte Biomass***

In 2010, the average quadrat biomass and the total surface area of the whole macrophyte bed in North Gully Cove were similar to that of the long-term averages for the site. However, there was a pronounced decrease in the amount of Eurasian watermilfoil throughout the bed.

At  $265 \pm 175$  g dry wt./ m<sup>2</sup>, the average biomass was slightly higher than the ten-year average of 255 g/m<sup>2</sup> (**Table 1, Figure 3A**). The total surface area of the macrophyte bed was > 24,000 m<sup>2</sup> or 2.4 hectares, which was similar to previous years as North Gully Cove continues to have the largest of the macrophyte beds in our monitoring program. There was however a major change in the composition of the bed. In previous years including 2009, more than 85% of the bed surface area was dominated by milfoil whereas in 2010 the milfoil dominated area was only 13 325 m<sup>2</sup> or 81% smaller than that of 2009 (**Table 2**). This areal reduction translates into a loss of approximately 49% in milfoil standing crop from 2009 (**Figure 4A**). Even within the portions of the bed where milfoil was still dominant (i.e. >50% of plants) the proportion of the biomass comprised by milfoil dropped by nearly 10% to 81% of the total weight (**Table 3, Figure 5**). Overall, the estimated standing crop of milfoil in 2010 was the third lowest since 2000, with 2008 being the second lowest. Thus in two of the last three years after the

stream diversion project was completed the biomass of milfoil in North Gully Cove has been at very low levels. While it is tempting to attribute these changes directly to the stream project, the significance of these improvements must be considered in the context of lake wide changes as indicated by trends in the three reference sites studied.

Conditions at Sutton Point Gully and Sand Point Gully, two of the U.S.D.A. study sites, mirrored those described for North Gully Cove. The Sutton Point bed in particular showed major reductions in all of the metrics used to monitor macrophytes. The quadrat biomass ( $135 \pm 47$  g dry wt.  $\cdot$  m<sup>-2</sup>) was the second lowest recorded for the site (**Table 1, Figure 3A**). The surface area covered by the whole bed was moderate yet 29% smaller than in 2009. Moreover the area dominated by milfoil decreased by 87% from 2009 and it was low overall with an estimated milfoil standing crop of 998 kg, which was second lowest on record (**Table 3, Figure 4A**). As in North Gully Cove, even in the milfoil dominated zone the representation of this species by weight was relatively low at about 70%. Nutrient loading data was not available for Sutton point in 2010, but this site is known to receive some of the lowest concentrations and loads of nutrients of any streamside location on the lake and seasons with low macrophyte biomass and sparse milfoil representation are not unusual there.

At Sand Point the macrophyte biomass was relatively moderate (**Table 1, Figure 3B**), and while the overall bed surface area increased slightly from 2009, the milfoil dominated zone decreased by about 33% to the lowest surface area, standing crop and milfoil dominance recorded at this site since monitoring began during the 2000 season (**Table 3, Figure 4B**).

Of the four beds sampled only Cottonwood Gully showed increases in milfoil growth, breaking a pattern of reduced growth and milfoil representation that had continued steadily since management practices were implemented at this site in 2004 by the U.S.D.A. project (**Figures 3B, 4B**). All of the macrophyte metrics increased in 2010 and while the magnitude of the measurements are still moderate for the site the increases from 2009 values were 87%, 46%, 171% and 30% for biomass, surface area, standing crop of macrophytes, and proportion of milfoil by weight. Why the multiyear trend of declining macrophyte biomass at Cottonwood Gully was reversed in 2010 is unknown, but one can certainly point to increases in concentrations and marginal mean loads of nitrates, total Kjeldahl nitrogen and soluble reactive phosphorus in stream runoff from May to August 2010 and over the last two previous sampling seasons (Makarewicz and Lewis 2010) as a possible cause.

### **Cover of Filamentous Algae**

As stated in an earlier report (Bosch *et al.* 2009) filamentous algae (more than macrophytes) are a reliable indicator of short-term changes in stream nutrient loading (D'Aiuto *et al.* 2006, Makarewicz *et al.* 2007, Bosch *et al.* 2009b) as they absorb nutrients directly from the water column and bloom over hours to days in response to increasing supplies.

If loading data for Graywood Gully, Cottonwood Gully, and Long Point Gully can be taken as indicators of lake-wide trends, then May-August 2010 was a period of very high average loads and concentrations of soluble reactive phosphorus, nitrates and other nutrients into Conesus Lake (Makarewicz and Lewis, 2010). At Long Point Gully, the marginal mean loads of soluble reactive phosphorus and nitrate per day were the highest in seven years of summer monitoring. In Cottonwood, they were higher than even in 2003, the year that U.S.D.A. project management practices were implemented in the Cottonwood Gully watershed. By contrast in Graywood Gully the loads were only moderate to high because many of the management practices implemented during the U.S.D.A. project are still in place (Makarewicz and Lewis, 2010)

In 2010 rainfall was especially high during the first week of June. This would have been a critical period for the growth of plants as increasing light levels and warming lake temperatures created an ideal environment for growth. High pulses of nutrients delivered during this critical period could certainly have contributed to a significant bloom of algae, and this is indeed what we observed when we first began our monitoring in mid June.

Photographs of percent surface cover were taken in July starting after July 4 once the canopy had developed and continuing through the first week of August (**Figure 6, 7, 8**). In **Figure 9** the 2010 data is summarized in the context of the historical record for each of the study sites. Raw quadrat data are included as **Table 4**. One problem we experienced along some transects was the lack of a macrophyte canopy. Consequently the accumulation of filamentous algae that we normally sample was too far below the surface for photography and thus we were unable to collect data in two transects.

The results based on ten transects that were successfully sampled showed areas of very high algal cover in all of our sampling sites, as might be anticipated after a June period of heavy rains. All three transects in North Gully Cove (to the north nearest the

stream, central to bed and in the southern margin) showed very high cover with a maximum of nearly 100% and a median of 90.8%. This is an extremely high algal cover for any site on the lake and certainly the highest recorded for North Gully Cove. For Sand Point Gully the northern transect is in an area where nuisance algal growth occurs every year and in 2010 the median cover was 23% but there were maxima of nearly 96% in some quadrats. Along the central transect of the bed the median cover was 67% primarily offshore over 2m of water. Cottonwood Gully and Sutton Point Gully had the lowest median values. In Cottonwood the algal growth occurred primarily in a problem area where a pipe that drains road ditches runs onto the shoreline. In areas away from this pipe there was no cover on the macrophyte beds and the overall median cover was 0%, although much of the area was not measureable due to lack of a canopy. Finally, at Sutton Point the algal cover was low (median % = 0) with the exception of a small patch in the northern transect.

Why was the algal cover especially dense in North Gully Cove? Historically the area directly south of McPhersons Point (and nearest to the North Gully tributary) has had extensive cover, but in 2010 filamentous cover was heavy throughout the bed and it was nearly as high in the southern transect as in the north. One plausible explanation for this anomalous pattern is that runoff from the South Gully tributary could have promoted additional growth of algae, especially to the south of the cove where we normally see much reduced cover.

South Gully drains into the lake at Harston Point only 425 m south of the North Gully cove macrophyte bed. It ranks among the highest five watersheds in unit discharge per surface area and unit loads of sediments and nutrients. Agricultural land use in the watershed is more than 40% by area. McPhersons Cove residents reported that in June a large plume of sediment drifted from South Gully northward into the North Gully macrophyte bed. Such a visible plume would have delivered high amounts of sediment and nutrients to the macrophyte bed at a critical period when it would certainly have contributed to the development of an algal bloom.

## **V. Conclusions**

Over a three-year sampling period we tested the hypothesis that the northward diversion of North Gully had brought about decreases in the biomass of macrophytes and filamentous algae in North Gully Cove. The hypothesis is founded on the assumption that most of the runoff from North Gully may be discharged offshore rather

than over the macrophyte bed in North Gully Cove. There is no direct evidence that this is the case but comparisons of runoff plume trajectories before and after the diversion indicate that the project was effective at least in part (Bosch *et al.*, 2009).

An initial study conducted in 2008, six months after the diversion project, found no definitive evidence that plant growth had decreased. In 2009 macrophyte density and standing crop in North Gully cove were higher than the average for the years 2000-2007. Similarly high macrophyte biomass seen in the Sand Point Gully and Sutton Point Gully reference sites, but not in Cottonwood Gully, where macrophyte growth has declined considerably since agricultural management practices were implemented in the Cottonwood Gully watershed by the U.S.D.A. watershed project. In 2009 there was some evidence of improvement in terms of filamentous algal biomass, which was moderate to low in four reference sites and to the historical record (2001-2007) for North Gully Cove. Although information on total nutrient loading by the North Gully tributary was not available, nutrient concentrations in stream water were very high from May to August 2009 (Makarewicz *et al.* 2009). Therefore the most plausible explanation for the reduced cover of filamentous algae at North Gully Cove in 2009 is the diversion of the tributary runoff into open water and the accompanying reduction in nutrient delivery into the cove.

Taken at face value the results of the 2010 monitoring study confound our interpretation of the post-stream diversion trends. Filamentous algal cover was at a record high in the cove. However it is possible that a major delivery of sediments and nutrients from South Gully 450 m to the south of North Gully Cove may have been responsible for this bloom. The trends in terms of macrophyte biomass are more encouraging. While total bed area and standing crop were comparable to previous years, there has been a major decrease of Eurasian watermilfoil in the community. This was evident not only in terms of total milfoil coverage and biomass but also in the reduction of milfoil abundance within the areas where the species was still dominant. The same pattern of milfoil loss was seen to varying degrees at Sutton Point (large losses) and Sand Point (moderate losses), but Cottonwood Gully experienced heavy increases in milfoil biomass.

It cannot be stated unequivocally that the reduced milfoil biomass in North Gully Cove in two of the three years surveyed was caused by changes in nutrient delivery by North Gully stream. Our experience in the U.S.D.A. project was that milfoil biomass but not overall dominance changed as a result of reductions in loading achieved through

watershed management practices. Nevertheless there are indications that some improvement has taken place in North Gully Cove and it may be fruitful to continue occasional monitoring of this site to document any additional improvement as funding allows.

## **VI. Acknowledgements**

We are indebted to the Conesus Lake Association for their continued logistic, financial and moral support of SUNY Geneseo's work in Conesus Lake. Also to Liz Moran of Ecologic LLC, and Heather Ferraro and Angela Ellis of the Livingston Planning Department for their coordination and support of research activities in Conesus Lake. This research project was funded by the Livingston County Planning Department.

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## VIII. Tables and Figures

**Table 1.** Long-term record of dry weight biomass, bed surface area and total biomass (i.e. standing crop) in the milfoil-dominated zone for the four study sites.

Location	Year	Average Biomass grams . m <sup>2</sup>	Surface Area m <sup>2</sup>	Standing Crop Kg Dry Wt
North Gully	2000	262 ± 134	23,192	6,192
	2001	459 ± 202	25,783	11,834
	2002	151 ± 74	12,004	1,813
	2003	304 ± 176	19,760	6,007
	2004	186 ± 57	30,099	5,598
	2005	188 ± 105	21,798	4,098
	2006	230 ± 100	22,560	5,178
	2007	225 ± 70	27,850	6,266
	2008	266 ± 167	11,855	3,149
	2009	283 ± 108	24,267	6,874
	2010	265 ± 175	13,325	3,531
Sand Point Gully	2000	212 ± 29	9,535	2,021
	2001	484 ± 300	9,781	4,730
	2002	325 ± 82	7,354	2,390
	2003	290 ± 126	5,310	1,540
	2004	131 ± 34	8,474	1,110
	2005	191 ± 96	8,349	1,595
	2006	230 ± 92	9,775	2,246
	2007	112 ± 111	9,684	1,084
	2008	201 ± 71	6,022	1,147
	2009	222 ± 111	6,564	1,457
	2010	205 ± 19	4,939	1,012
Cottonwood Gully	2000	193 ± 85	---	---
	2001	373 ± 168	9,387	3,501
	2002	316 ± 134	7,360	2,326
	2003	146 ± 43	3,750	548
	2004	234 ± 41	9,205	2,154
	2005	273 ± 81	6,880	1,878
	2006	283 ± 61	5,605	1,589
	2007	155 ± 140	8,100	1,253
	2009	135 ± 78	4,860	657
	2010	252 ± 90	7,077	1,783
	Sutton Point Gully	2000	184 ± 43	---
2001		467 ± 183	8,592	4,017
2002		71 ± 40	3,688	262
2003		138 ± 92	11,819	1631
2004		227 ± 77	11,909	2,703
2005		197 ± 90	11,995	2,349
2006		364 ± 208	7,438	2,707
2007		295 ± 94	10,973	3,232
2008		190 ± 106	5,985	1,201
2009		224 ± 112	13,802	3,099
2010		135 ± 47	7,390	998

**Table 2.** Measurements of the total bed surface area and the surface area of the milfoil dominated zone at the four study sites for 2009 and 2010. The area of milfoil coverage has decreased by a significant amount in North Gully Cove, Sutton Point Gully and Sand Point Gully while it increased in Cottonwood Gully. The latter is a change in the long-term reduction of milfoil at this site that is consistent with recent increases in loading of nitrogen from the Cottonwood Gully watershed described by Makarewicz and Lewis (2010).

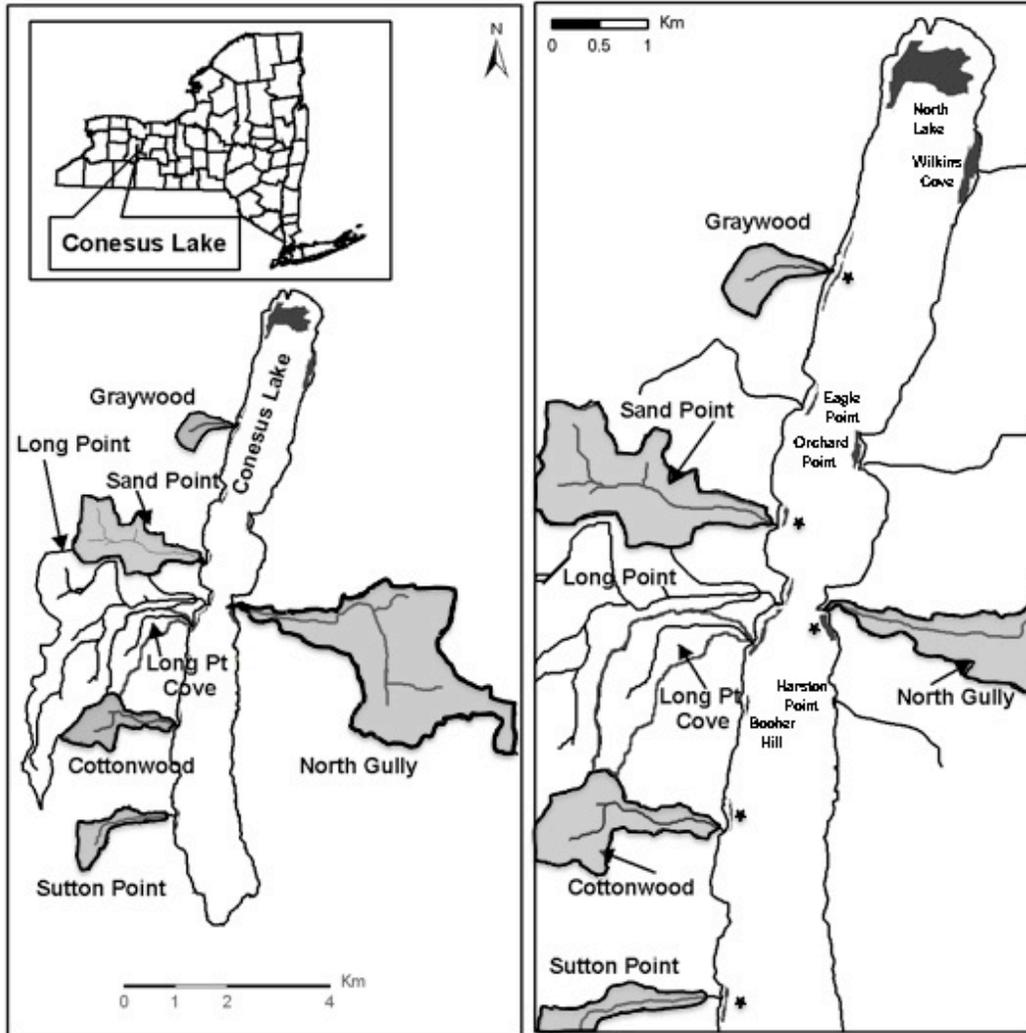
Site	Year	Surface Area	Surface Area
		(m <sup>2</sup> ) Whole bed	(m <sup>2</sup> ) Milfoil Zone
North Gully	2009	27877.00	24267.00
	2010	29421.00	13325.00
	% change	5.25	-82.12
Sutton Pt. Gully	2009	14,434	13,802
	2010	11,179	7,390
	% change	-29.11	-86.76
Sand Pt. Gully	2009	8347.00	6564.00
	2010	10185.00	4938.50
	% change	18.05	-32.91
Cottonwood Gully	2009	8091.00	4860.17
	2010	7440.00	7077.03
	% change	-8.75	31.32

**Table 3.** Long-term record of percent contribution of Eurasian milfoil to the total dry weight biomass of macrophytes within the milfoil dominated portion of each bed. These data show that in North Gully Cove after five years of high dominance milfoil has decreased steadily over the last three years. Milfoil dominance seems to have remained high at Sand Point and at Cottonwood Gully, and continued to be relatively low at Sutton Point where eelgrass and coontail are more common.

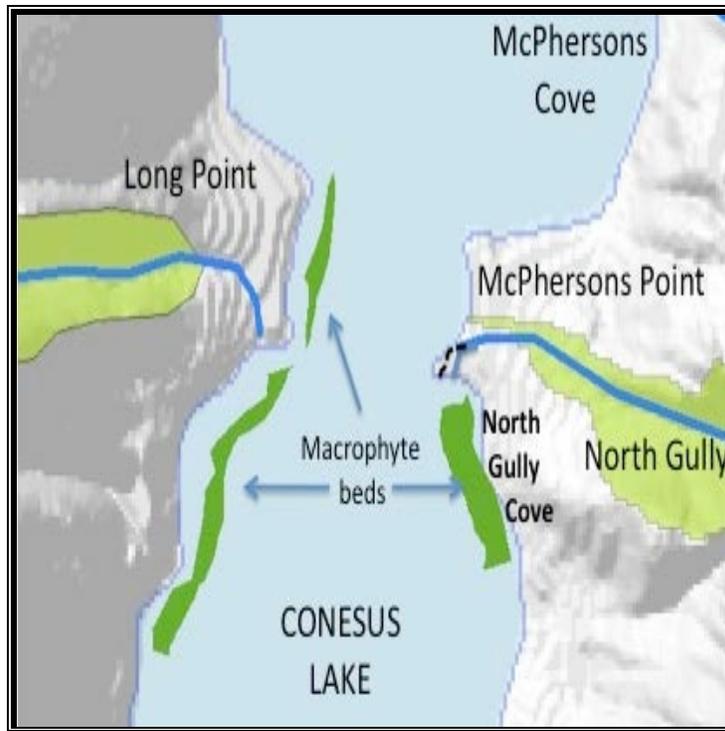
<b>STUDY SITES</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>North Gully</b>	99.6 ± 0.1	99.4 ± 0.8	95.9 ± 5.8	99.5 ± 0.7	100.0 ± 0.8	92.3 ± 11.8	91.4 ± 12.9	81.7 ± 29.5
<b>Sutton Pt. Gully</b>	66.6 ± 5.8	65.4 ± 27.5	85.1 ± 15.8	85.1 ± 21.0	81.6 ± 14.0	54.6 ± 35.1	77.4 ± 39.8	66.9 ± 35.5
<b>Sand Point Gully</b>	98.6 ± 1.4	91.4 ± 11.4	95.8 ± 5.9	99.5 ± 0.7	95.7 ± 7.4	98.0 ± 4.3	92.4 ± 6.2	85.4 ± 5.2
<b>Cottonwood Gully</b>	95.8 ± 7.4	100.0 ± 0	95.4 ± 9.2	100.0 ± 0	95.7 ± 4.8	No Data	93.4 ± 5.0	100 ± 0

**Table 4.** Raw transect data for digital quadrat measurements of filamentous algae percent cover.

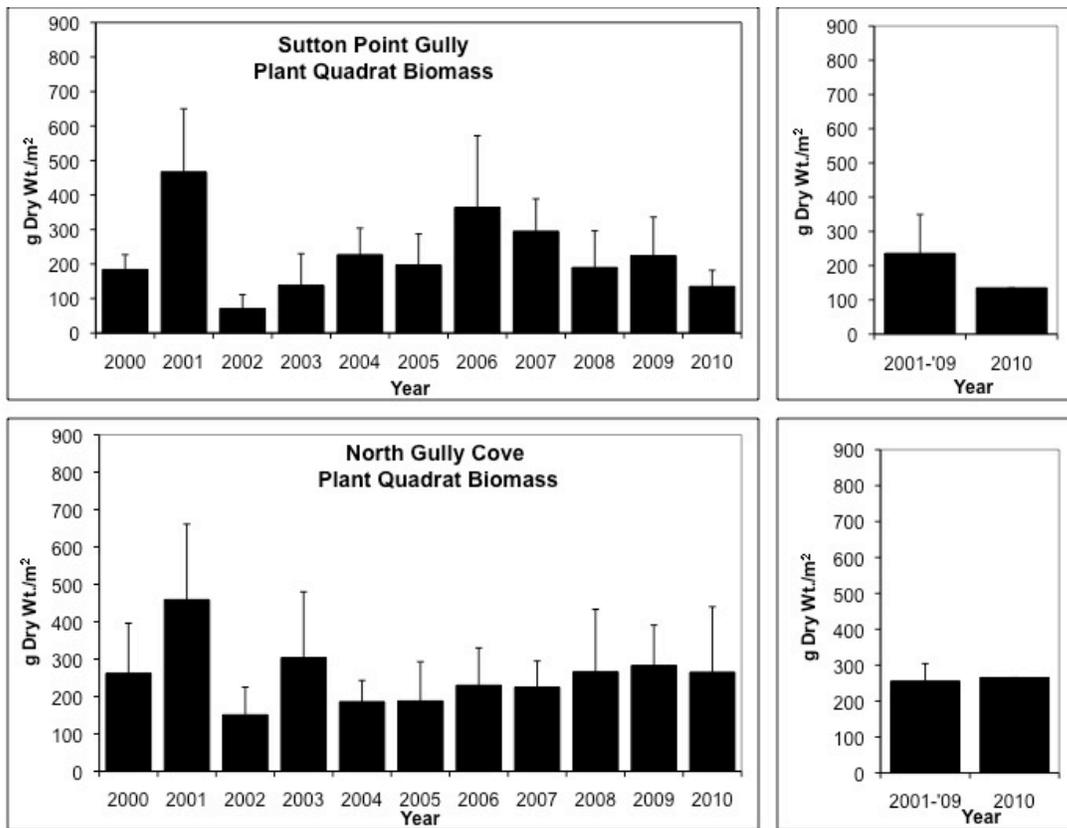
Transect Sites	Percent Cover		Percent Cover		Transect Sites	Percent Cover		Percent Cover	
	1 m	1 m	2 m	2 m		1 m	1 m	2 m	2 m
<b>North Gully</b>					<b>Cottonwood Gully</b>				
North Transect	No	Canopy	90.5	88.7		87.5	86	0	0
			95.3	95.8	North Transect	86.3	66.4	0	0
			95.9	80.3		87.5	25.9	0	0
			97.1	39.9		93.1		8.5	
			65.1			92.2		7.7	
Central Transect	69.5	86.8	91.9	97.4	Central Transect	0		0	
	90.8	93.4	94.9	99.6		0		0	
	84.9		90.3	96.4		0		0	
	82.6		93.1			0			
	97.0		98.1			0			
South Transect	13.3		No	Canopy	South Transect			0	0
	20.9							0	No
						No	Canopy	0	Canopy
	85.3							0	
	92.5							0	
	87.3							0	
<b>Sand Pt. Gully</b>					<b>Sutton Pt. Gully</b>				
North Transect	2.4	18.0	0.0	12.8		0.0	No	5.4	0.9
	2.2	21.3	0.0	50.2	North Transect	7.5	Canopy	2.7	4.7
	1.0	17.0	8.4	51.6		8.2		0.0	0.0
	9.1	19.6	25.8	94.6		7.7		5.0	
	23.0	25.7	52.6	95.8		15		83.7	
Central Transect			67.2	86.7	Central Transect				
	0.0	No	84.7	91.3		No	Canopy	No	Canopy
	0.0	Canopy	23.1	88.7					
	0.0		84.4						
			24.2						
South Transect	No	Canopy	No	Canopy	South Transect	0	0	0	0
						0	0	0	0
						0	0	0	0
						0	0	0	0
						0	0	0	0



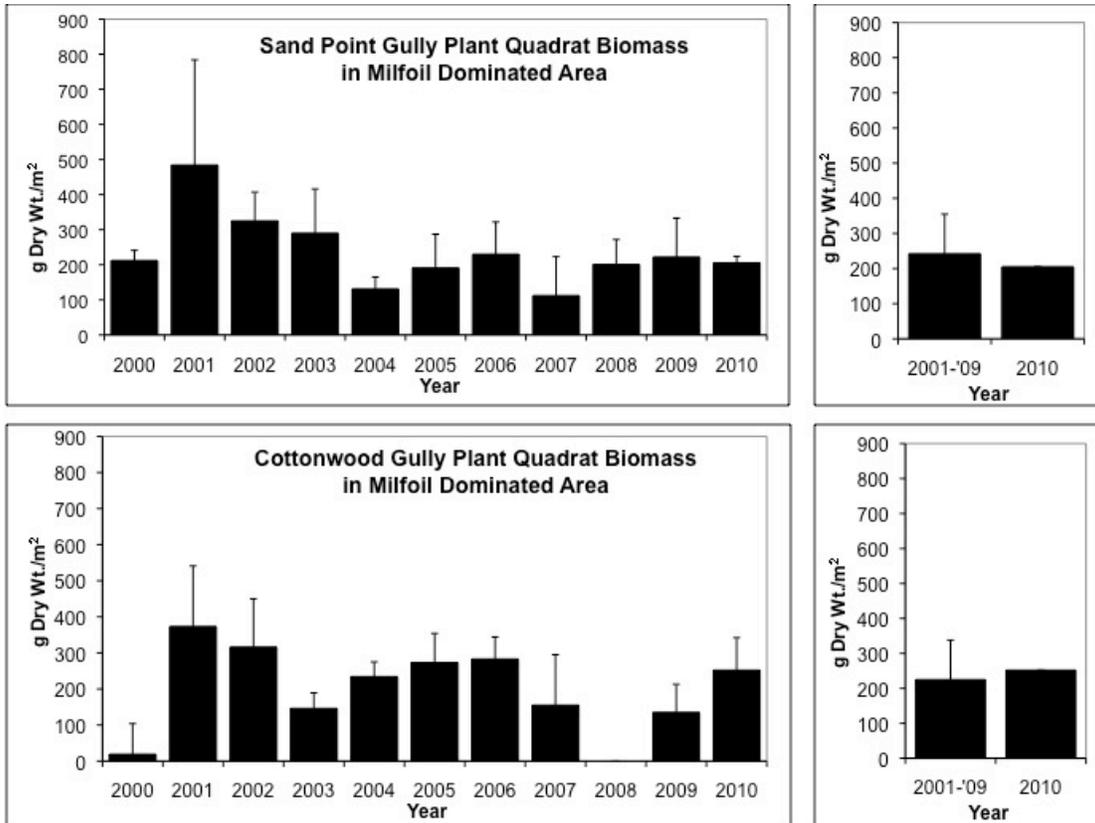
**Figure 1.** Map showing some of the largest macrophyte beds in Conesus Lake in their geo-referenced positions. The macrophyte beds studied in 2010 were associated with the North Gully, Cottonwood, Sutton Point and Sand Point sub-watersheds.



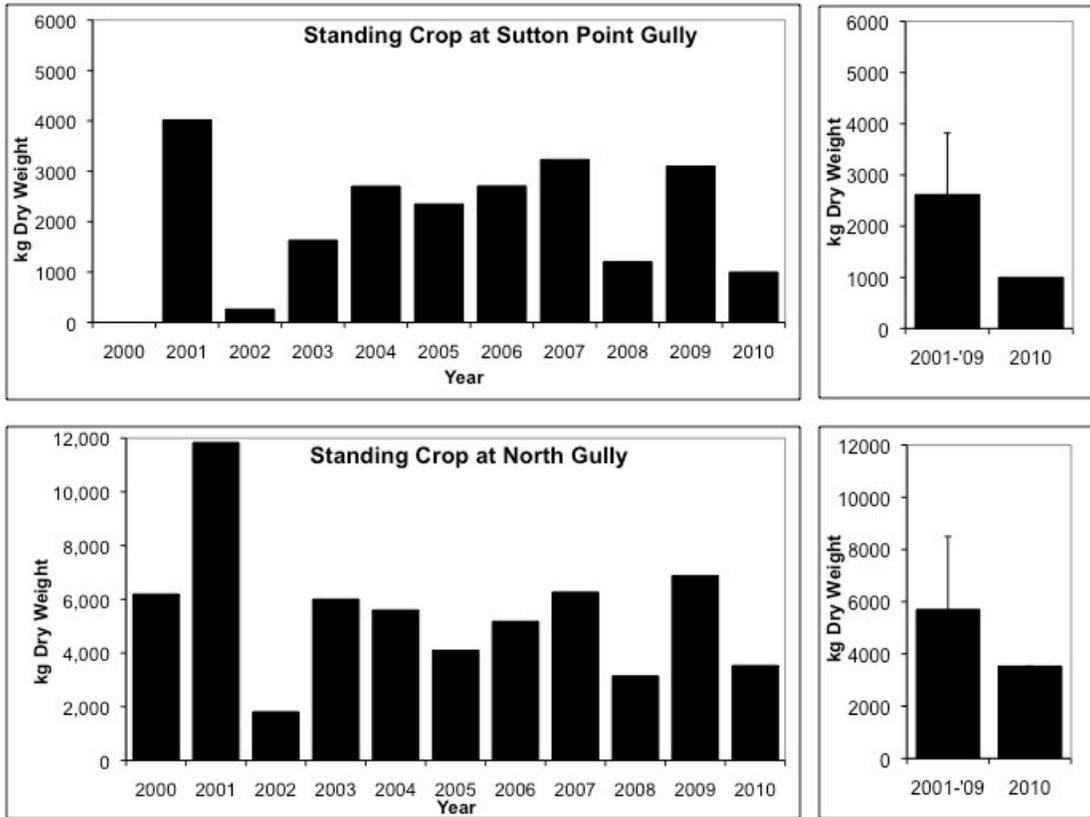
**Figure 2.** Map of the general area around McPhersons Point and North Gully Cove showing nearby milfoil dominated areas in geo-referenced positions. The previous (solid line) and current (dashed line) positions of the North Gully stream mouth are drawn in by hand.



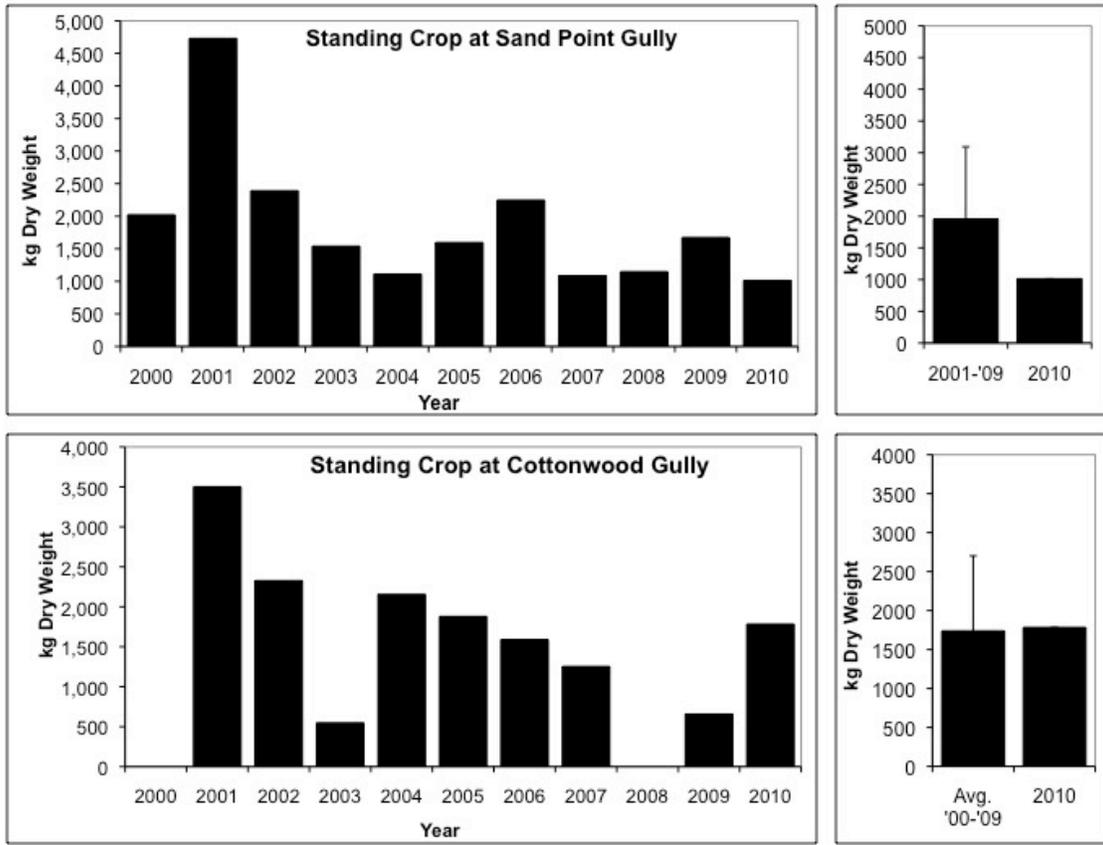
**Figure 3 A.** Trends in macrophyte biomass for the Sutton Point Gully and the North Gully Cove shoreline areas are shown as per grams dry weight per m<sup>2</sup>. The graphs on the left show the average and standard deviation for individual years. The graphs on the right compare the 2010 data to long-term trends from 2001-2009 for each site. The data are for the 2-3 m zone dominated by Eurasian watermilfoil.



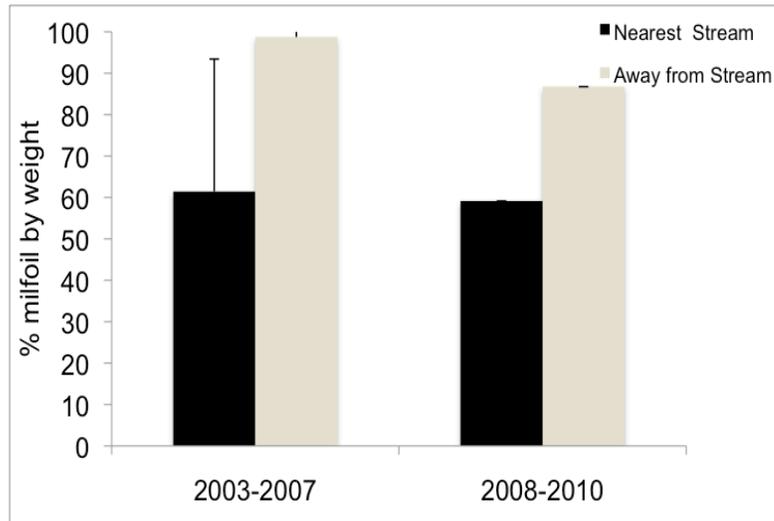
**Figure 3 B.** Trends in macrophyte biomass are shown for the Sand Point Gully and the Cottonwood Gully shoreline areas. The comparisons made are as in Figure 3A.



**Figure 4 A.** Standing crops as Kg Dry Weight of macrophytes in areas of Sutton Point and North Gully cove dominated by Eurasian watermilfoil at depths of 2 and 3 m. Standing crops were calculated by multiplying the mean quadrat biomass times the surface area covered by milfoil in each bed as determined by GPS.



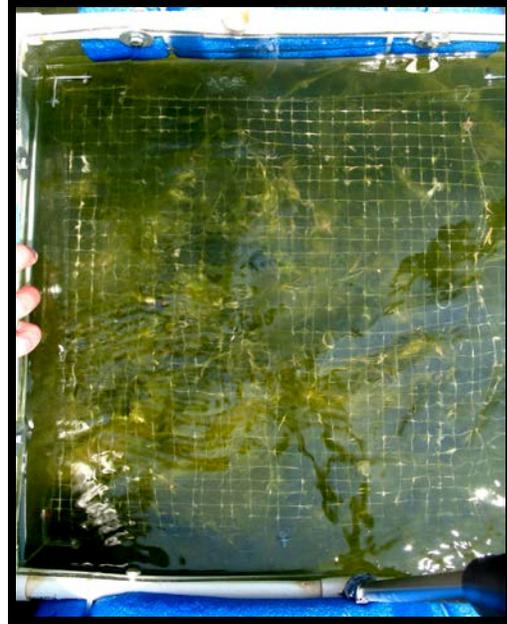
**Figure 4 B.** Standing crops as Kg Dry Weight of macrophytes in the Sand Point Gully and Cottonwood Gully study sites.



**Figure 5.** Comparison of relative milfoil biomass for the North Gully Cove bed at depths of 2-3 m that are typically dominated by this species. Data are the average of 2003-2007, before diversion of the North Gully tributary, and 2008-2010 after the stream was diverted. In addition to this slight decrease in biomass dominance shown here for the areas away from the stream, the surface area of the milfoil-dominated zone (i.e. where milfoil represents more than 50% of the biomass) has decreased in the last two years, as shown in Table 2.



**A**



**B**

**Figure 6.** Photographs of quadrats held by diver show the high cover of filamentous algae covering macrophyte plants in North Gully. The macrophyte in A is eelgrass and in B most of the macrophytes are Sago pondweed.

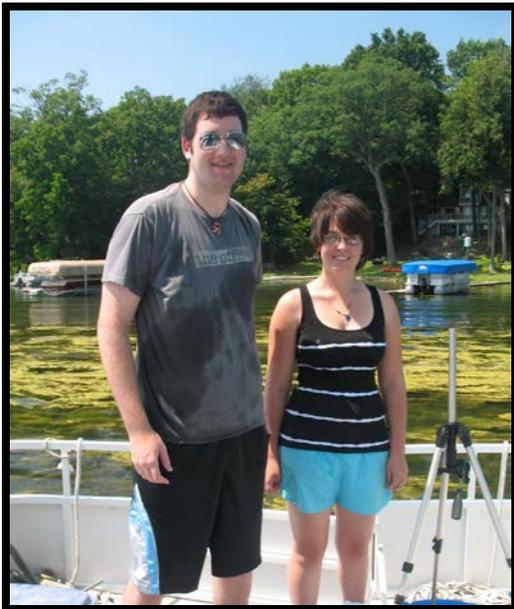


**A**



**B**

**Figure 7.** Underwater photographs showing milfoil plants covered by filamentous algae at a depth of 1.5 m in Cottonwood Cove (A) and without algal cover at a similar depth along the north end of Conesus Lake. (B).

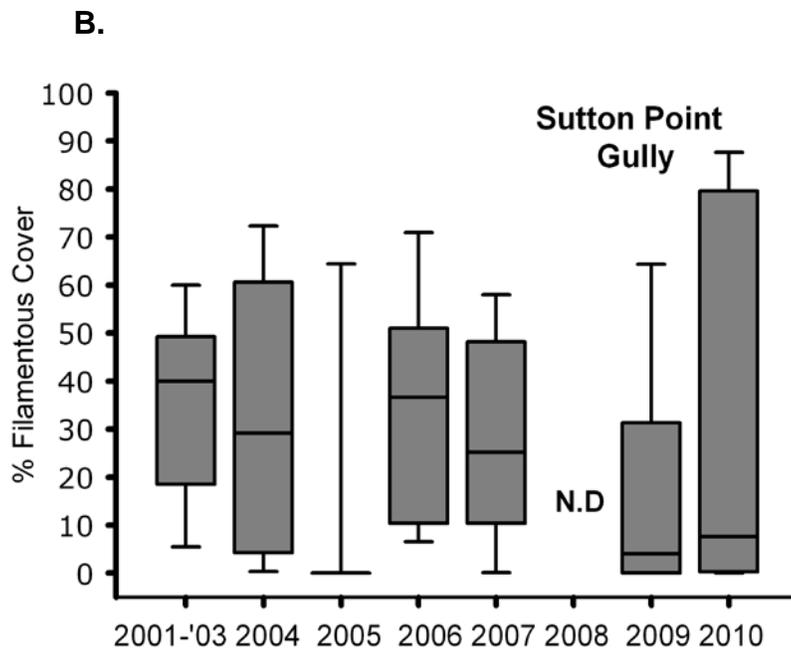
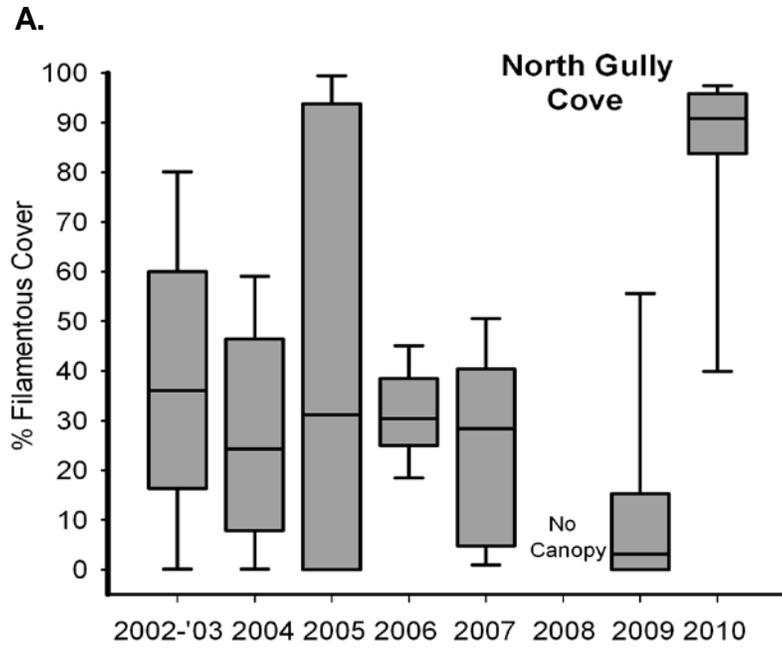


**A**



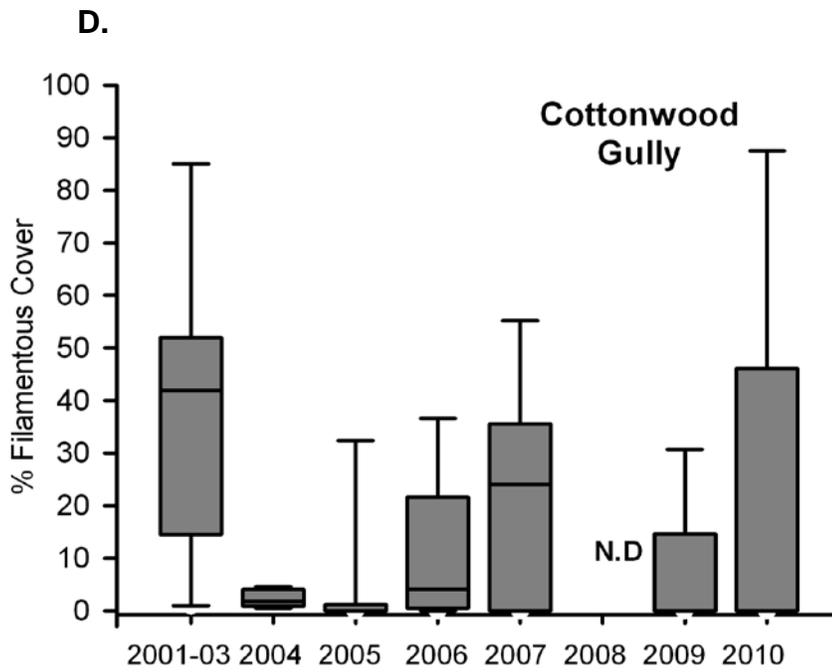
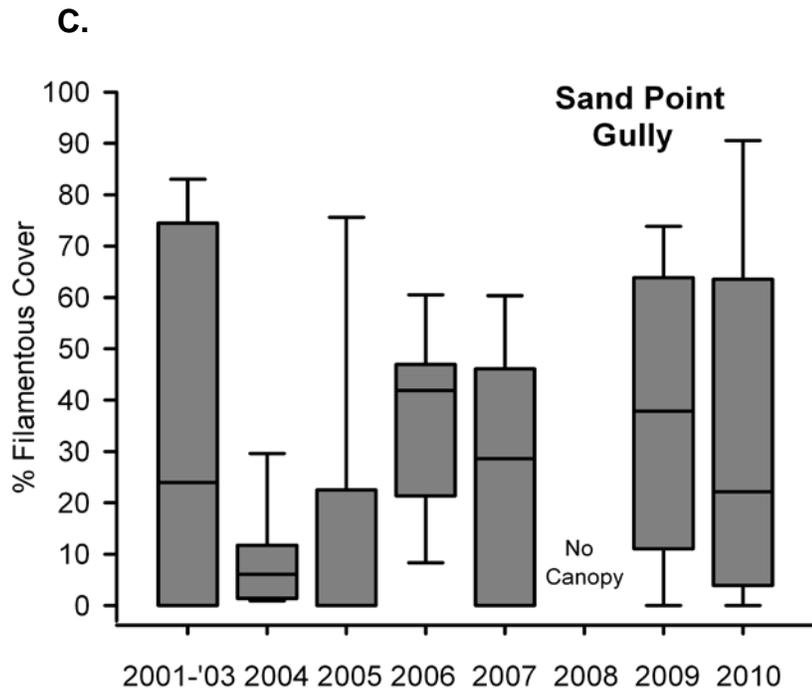
**B**

**Figure 8.** A. Students Grace Savoy-Burke and Matthew Coyle with canopy of filamentous algae in the background at Sand Point. B. Close up of the canopy taken from a boat. Clumps and clouds of filamentous algae as well as macrophytes (eelgrass and Sago pondweed) can be seen in the photograph.



**Figure 9.** Historical trends in the percent cover of filamentous algae growing on the macrophyte canopy at our four study sites. Cover was moderate to high at all sites in 2010 compared to the historical record. North Gully Cove experienced the highest cover of the sites with a median value was more than double that of any previous year.

Figure 9 Continued



**Figure 10.** Google Earth map showing Harston Point to the south of McPhersons Point and North Gully Cove. Long Point can be seen across the lake (northwest).

