PROGRESS REPORT OUTLINE
USEPA-Great Lakes Restoration Initiative Projects

Grant or IA Number: **_ GL-00E00612-0_____**

Project Title: **_ GLIC: Implementing Great Lakes Coastal Wetland Monitoring____**

Reporting Period Covered: **___October 1, 2011 – March 31, 2012_____**

Principal Investigator: __Dr. Donald Uzarski_____

The principal investigator of grants, cooperative agreements, and interagency agreements (IAs) is required to submit to the USEPA project officer a [quarterly or semi-annual] progress report. This report can be as brief as one page as long as you can provide the requested information. The items listed below should be addressed as appropriate:

PLEASE SEE ATTACHED SEMI-ANNUAL REPORT

1. What work was accomplished for this reporting period? Report should quantify results as measurable products, i.e. numbers, acres, contacts, improvements in water quality, habitat, etc.

   Data from the one hundred seventy six coastal wetlands sampled during the summer of 2011 were loaded into the database and QC'd. Macroinvertebrate identification, data entry, and QC is nearing completion. Sites for 2012 sampling have been selected and field preparations have begun. See attached report.

2. What, if any, changes were made from the Object Class Categories listed in Sec. B of the SF 424A or Box 29 of the IA, as applicable?

   None

3. If a problem was encountered, what action was taken to correct it?

   No major problems have been encountered so far for this project.

4. What work is projected for the new reporting period activity?

   During the next reporting period, invertebrate sampling, data upload, and QC will be completed. Sites selected for 2012 sampling will be sampled by field crews, and field-collected data will be entered into the database.

5. Is the project work on schedule? List activities from the Work Plan, and any required Quality System Documentation, and report as percent completed.

   The project is on schedule.
   (a) This reporting period
   - *PI meeting – 100%*

- *Site selection system designed – 100%*
- *Site selection implemented – 100%*
- *Sampling permits acquired – 50% (will be complete before fieldwork begins)*
- *Data entry system created – 100%*
- *Field crew training – 75% (will be complete before fieldwork begins)*
- *Wetland sampling –Year One 100%*
- *Mid-season QA/QC evaluations – N/A until next reporting period*
- *Sample processing & QC – 90%*
- *Data QC & upload to GLNPO – 90%*
- *GLAS database report – 100%*
- *Report to GLNPO – 100%*

(b) For the project

- *PI meeting – 40% (PIs will meet 1-2x/yr)*
- *Site selection system designed – 100%*
- *Site selection implemented – 100%*
- *Sampling permits acquired – 30% (needed yearly)*
- *Data entry system created – 100%*
- *Field crew training – 30% (crews will be trained yearly)*
- *Wetland sampling –20% (sampling will be done yearly)*
- *Mid-season QA/QC evaluations - 20% (will be done yearly)*
- *Sample processing & QC –19% (will be done yearly)*
- *Data QC & upload to GLNPO – 19% (will be done yearly)*
- *GLAS database report – 30% (updated quarterly)*
- *Report to GLNPO – 30% (sent semi-annually, plus a final report)*

6. Does the project funding rate support the work progress? Report as percent spent of budgeted amounts for Federal and non-Federal.

   Yes

7. Is there a change in principal investigator?

   No. There have only been minor personnel changes with co-PIs, all occurring at the beginning of the project. See Attachment 1 for details.

8. Will the project take longer than the approved project period? If so, have you formally requested an amendment in writing?

9. What is the date and amount of your latest drawdown request? If no request has been submitted, please explain.

10. What is the date of your latest entry into the Great Lakes Accountability System? If no recent entry has been submitted, please explain.

    April 2012

Please reference the USEPA project number on your report and on all correspondence.

GLIC: Implementing Great Lakes Coastal Wetland Monitoring

Semiannual Progress Report

October 1, 2011 – March 31, 2012

Prepared for:
U.S. EPA GLNPO (G-17J) 77 W. Jackson Blvd. Chicago, IL 60604-3590
Contract/WA/Grant No./Project Identifier:
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INTRODUCTION

This project began on 10 September 2010. Most subcontracts were signed and in place with collaborating universities by late December 2010 or early January 2011. This project has the primary objective of implementing a standardized basin-wide coastal wetland monitoring program that will be a powerful tool to inform decision-makers on coastal wetland conservation and restoration priorities throughout the Great Lakes basin. Project sub-objectives include 1) development of a database management system; 2) development of a standardized sample design with rotating panels of wetland sites to be sampled across years, accompanied by sampling protocols, QAPPs, and other methods documents; 3) development of background documents on the indicators, and 4) timely submission of all project reports and publications.

There have been no changes to our project's objectives.

Our primary activities in our first year involved developing our Quality Assurance Project Plan (signed March 21, 2011), developing the site selection mechanism, selecting our sites, and conducting our field work (wetland sampling), which began in late April/early May and continued through mid-September, 2011. All primary project personnel met in mid-January of 2011 to work through methods and details of all aspects of the project, and training sessions for all groups occurred from March through June of 2011. All teams passed their spring training requirements and then passed their mid-sampling QA checks.

As our second year gets under way, we have revised and updated our QAPP (signed March 28, 2012), updated our site selection system to include site revisits that will help track wetland condition through time and assess year-to-year variability at the site level, and held a meeting with all project lead personnel to discuss issues that came up during the first year and find solutions for them. Currently, sites have been selected, spring field training sessions are getting underway, and amphibian sampling crews in the southern Great Lakes are headed into the field.

PROJECT ORGANIZATION

Figure 1 shows our project organization. Please note that since our project started we have had two changes in primary personnel (both approved by US EPA). Ryan Archer of Bird Studies Canada has been replaced by Doug Tozer. At the Michigan Department of Environmental Quality, Peg Bostwick has retired and been replaced by Anne Hokanson. No major personnel changes have taken place during this reporting period.

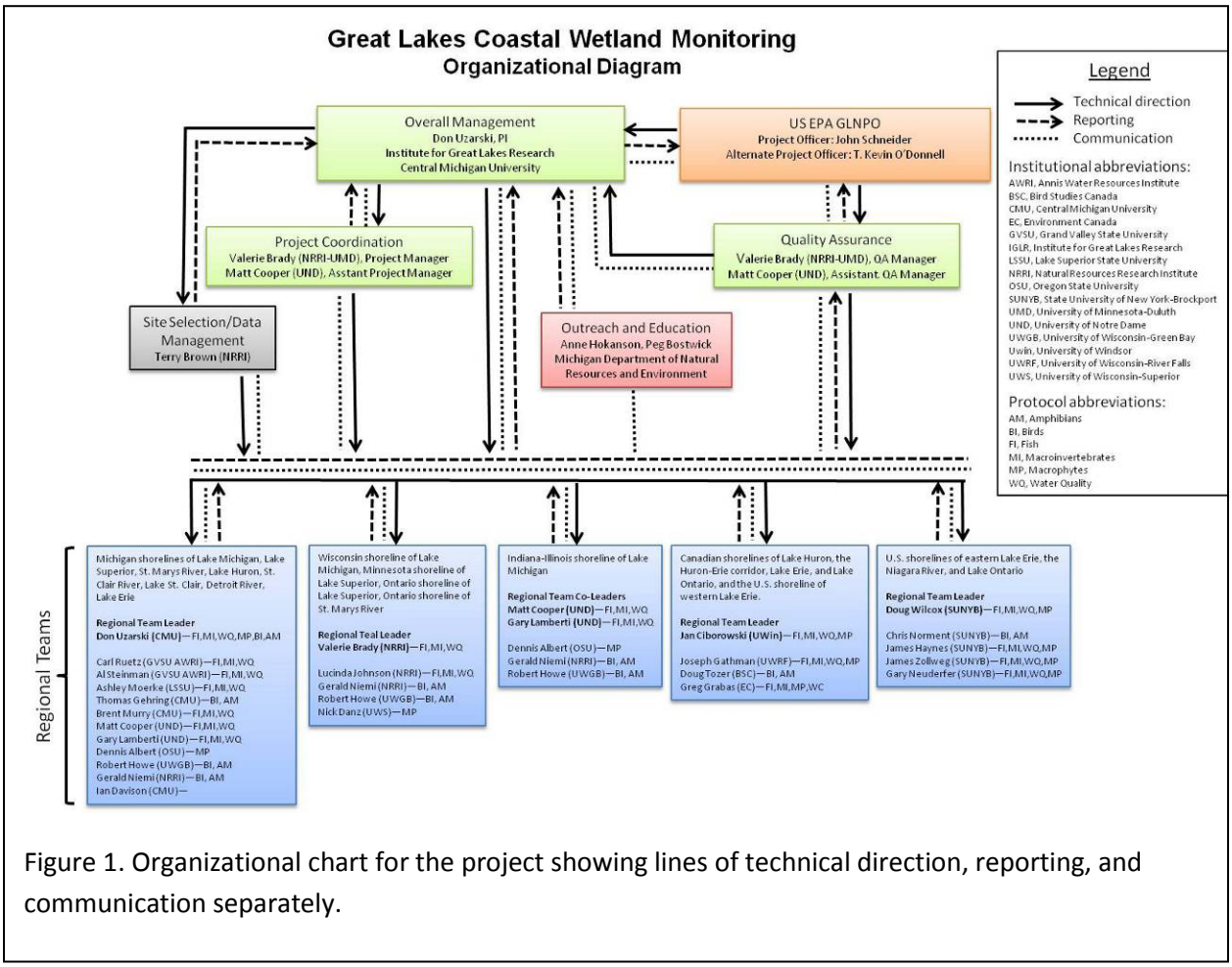

Figure 1. Organizational chart for the project showing lines of technical direction, reporting, and communication separately.

PROJECT TIMELINE

The project timeline remains unchanged and we are on-schedule (Table 1).

Table 1. Timeline of tasks and deliverables for the Great Lakes Coastal Wetland Monitoring Project.

Tasks	'10	2011				2012				2013				2014				2015			
	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F
Funding received	X																				
PI meeting		X				X				X				X				X			X
Site selection system designed		X																			
Site selection implemented			X			X				X				X				X			
Sampling permits acquired			X				X				X				X				X		
Data entry system created			X	X																	
Field crew training			X	X			X	X			X	X			X	X			X	X	
Wetland sampling			X	X			X	X			X	X			X	X			X	X	
Mid-season QA/QC evaluations				X				X				X				X				X	
Sample processing & QC					X	X			X	X			X	X			X	X			X
Data QC & upload to GLNPO						X	X			X	X			X	X			X	X		X
GLAS database report		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Report to GLNPO			X		X		X		X		X		X		X		X		X		X

SITE SELECTION

This year, site selection was completed in March, and differs from the year one site selection due to the inclusion of re-sample visits. Ten percent of sites sampled the previous year will be re-sampled this year to help us start tracking trends in wetland condition and to help assess inter-annual variability in indicator metrics.

Site Selection Tool

In 2011, a web-based database application was developed to facilitate site identification, stratified random selection, and field crew coordination for the project. This database is housed at NRRI and backed up routinely. It is also password-protected. Thirteen regional experts from

10 collaborating institutions spent many hours reviewing 2768 sites, ultimately selecting 1032 for randomized sampling over a five-year rotating panel design (Table 2).

Table 2. Summary of all wetland sites identified for sampling in this project. These are sites that meet the criteria articulated under Selection Rules.

Country	Site count	Site percent	Site area (ha)	Area percent
Canada	389	38%	35,656	25%
US	643	62%	105,845	75%
Total	**1032**		**141,501**	

Note that the number of sampleable wetlands will fluctuate year-to-year with lake level and continued human action in coastal wetlands. Based on the number of wetlands sampled in 2011 by Coastal Monitoring crews, the number of sampleable wetlands may be closer to 900 than over 1000.

The wetland coverage we are using shows quite a few more wetlands in the US than in Canada, with an even greater percent area of wetlands along the coasts of the US than of Canada (Table 2). Without further investigation into the issue, we cannot say whether this difference is due to inaccuracies in the coverage, greater loss of coastal wetlands in Canada, differences in topography and geography, or a combination of these and other factors.

Original data

The site list used was a product of the Great Lakes Coastal Wetlands Consortium (GLCWC) and was downloaded from http://www.glc.org/wetlands/data/inventory/glcwc_cwi_polygon.zip on December 6, 2010. See http://www.glc.org/wetlands/inventory.html for details.

Selection rules

The following rules are being used for site selection (quoting from the QAPP):

Wetlands selected for sampling under the random site selection met the following criteria:

1. *4 ha or larger;*
2. *have a direct, obvious, unregulated surface water connection to a Great Lake or connecting channel (this is difficult to determine using aerial photos for many wetlands);*
3. *be close enough to that lake or connecting channel to be influenced by it (e.g., seiches; again, difficult to determine using aerial photography);*
4. *contain herbaceous or standing-water wetland zones; and*
5. *have safe access for field crews (e.g., public boat launch within 5-7 km; public access).*

Distance from the lake for lake influence is difficult to quantitatively define, but may be understood by these two examples. In general, influence of the lake does not transmit more than about 1 km upstream or away from the lake, so if the wetland is less than this distance from the lake or connecting channel, and there is no major elevation gradient between the wetland and the lake (< 2 m rise in elevation), the wetland should be selected for sampling. The exceptions tend to be for drowned river mouths such as those that occur along the eastern coast of Lake Michigan where water is at the same level across these drowned river-mouth lakes. Wetlands at the inland end of the lake will be influenced by Lake Michigan and the most downstream end of these wetlands should be sampled regardless of distance from the Great Lake. All riverine systems will be sampled at the most downstream end, closest to the Great Lake. Lack of sampleable fish habitat is NOT a reason to reject a site. Also note that a wetland not selected by the fish/invertebrate/vegetation crews may be selected by the bird/amphibian group for sampling. The reverse is less likely, but allowed with justification.

*Finally, **benchmark sites** only need to meet the criteria of being/becoming a Great Lakes coastal wetland (e.g., they will have lake influence), and the crews can sample safely. We recommend that shrubby and ridge-swale sites be avoided at this point simply because we do not yet have indicators calibrated for these areas, nor have our sampling methods been tested for these wetland types (at least for fish/invertebrates/vegetation).*

Strata

Geomorphic classes

Geomorphic classes (riverine, barrier-protected, and lacustrine) were identified for each site in the original GLCWC dataset. Many wetlands inevitably combine aspects of multiple classes, with an exposed coastal region transitioning into protected backwaters dissected by riverine elements.

Regions

Existing ecoregions (Omernik 1987, Bailey and Cushwa 1981, CEC 1997) were examined for stratification of sites. None were found which stratified the Great Lakes' shoreline in a manner that captured a useful cross section of the physiographic gradients in the basin. To achieve the intended stratification of physiographic conditions, a simple regionalization dividing each lake into northern and southern components, with Lake Huron being split into three parts and Lake Superior being treated as a single region, was adopted (Figure 2). The north-south splitting of Lake Michigan is common to all major ecoregions systems (Omernik / Bailey / CEC).

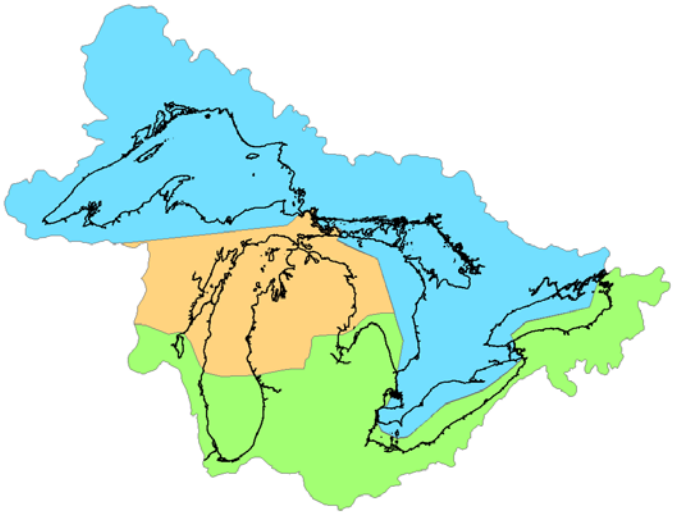

Figure 2. Divisions of lakes into regions. Note that stratification is by region *and* lake, so northern Lake Erie is not the same region as Lake Superior, etc.

Panelization

Randomization

The first step in randomization was the assignment of selected sites from each of the project's 30 strata (10 regions x 3 geomorphic classes) to a random year or panel in the five-year rotating panel. Because the number of sites in some strata was quite low (in a few cases less than 5, more in the 5-20 range), simple random assignment would not produce the desired even distribution of sites within each strata over time. Instead it was necessary to assign the first fifth of the sites within a stratum, defined by their pre-defined random ordering, to one year, and the next fifth to another year, etc.

Starting this year (2012), sites previously assigned to panels for sampling have been assigned to sub-panels for re-sampling. The project design's five year rotation with a 10% re-sampling rate requires five panels, *A*-*E*, and ten sub-panels, *a*-*j*. If 10% of each panel's sites were simply randomly assigned to sub-panels in order *a*-*j*, sub-panel *j* would have a low count relative to other sub-panels. To avoid this, the order of sub-panels was randomized for each panel during site-to-sub-panel assignment, as can be seen in the random distribution of the '20' and '21' values in Table 3.

For the first five-year cycle, sub-panel *a* will be re-sampled in each following year, so the 20 sites in sub-panel *a* of panel *A* are candidates for re-sampling in 2012. The 20 sites in sub-panel *a* of panel *B* will be candidates for re-sampling in 2013, and so on. In 2016, when panel *A* is being sampled for the second time, the 21 sites in sub-panel *a* of panel *E* will be candidates for

re-sampling, and in 2017, when panel *B* is being sampled for the second time, the 21 sites in sub-panel *b* of panel *A* will be candidates for re-sampling.

Table 3. Sub-panel re-sampling, showing year of re-sampling for sub-panels *a-c*.

	Subpanel										
Panel	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**TOTAL**
A: 2011 2016 2021	20/2012	21/2017	21/2022	20	21	20	21	21	21	21	207
B: 2012 2017 2022	20/2013	20/2018	20/2023	21	20	21	21	20	21	21	205
C: 2013 2018 2023	21/2014	21/2019	21/2024	21	21	20	21	21	21	21	209
D: 2014 2019 2024	22/2015	21/2020	21/2025	21	21	21	21	21	21	21	211
E: 2015 2020 2025	21/2016	20/2021	21/2026	21	21	21	20	21	21	21	208

Workflow states

Each site was assigned a particular 'workflow' status. During the field season, sites selected for sampling in the current year moved through a series of sampling states in a logical order, as shown in Table 4. The *data_level* field is used for checking that all data have been received and their QA status. Values have the following meanings: -1: site will not generate data, 0: site may or may not generate data, 1: site should generate data, 2: data received, 3: data QA'd. Users set the workflow state for sites in the web tool, although states 2 and 3 can also be updated by querying the various data entry databases.

Table 4. Workflow states for sites listed in the Site Status table within the web-based site selection system housed at NRRI. This system tracks site status for all taxonomic groups and teams for all sites to be sampled in any given year. Values have the following meanings: -1: site will not generate data, 0: site may or may not generate data, 1: site should generate data, 2: data received, 3: data QA'd.

Name	Description	Data_level
too many	Too far down randomly-ordered list, beyond sampling capacity for crews	-1
listed	Place holder status; indicates status update needed.	0
web reject	Rejected based on regional knowledge or aerial imagery in web tool.	-1
will visit	Will visit with intent to sample.	0
could not reach	Proved impossible to access.	-1
visit reject	Visited in field, and rejected (no lake influence, etc.)	-1
will sample	Interim status indicating field visit confirmed sampleability, but sampling has not yet occurred.	1
sampled	Sampled, field work done.	1
entered	Data entered into database system.	2
checked	Data in database system QA-checked.	3

Team assignment

With sites assigned to years and randomly ordered within years, specific sites were then assigned to specific teams. Sites were assigned to teams initially based on expected zones of logistic practicality, and the interface described in the 'Site Status' section was used to exchange sites between teams for efficiency and to better assure distribution of effort matching team sampling capacity. The web tool generates a KMZ file viewable in GoogleEarth to assist with site exchange (Figure 3).

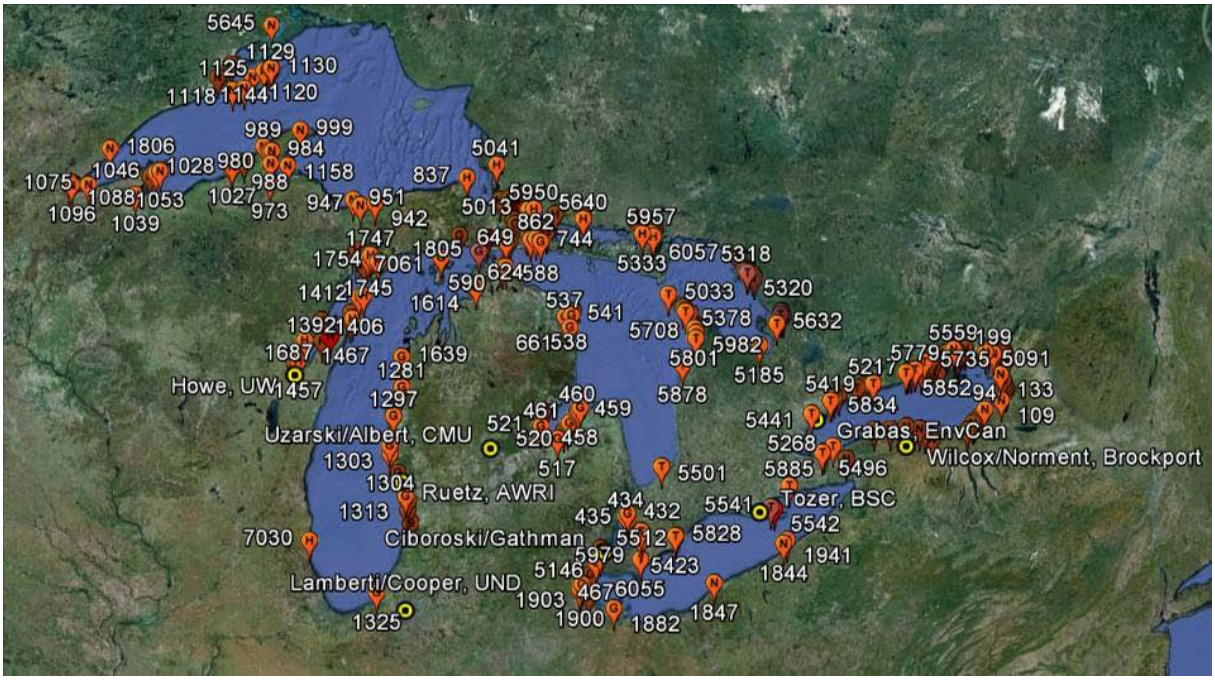

Figure 3. 2012 wetland site distribution (orange teardrops) versus regional team bases (yellow circles, one obscured at Ste. St. Marie, Michigan). The Google Earth view is shown.

Field maps

Three-page PDF maps for field crews have been generated for each site. The first page depicts the site using aerial imagery and a road overlay with the wetland site polygon boundary (using the polygons from the original GLCWC file, as modified by PIs in a few cases). The image also shows the location of the waypoint provided for navigation to the site via GPS. The second page indicates the site location on a road map at local and regional scales. The third page lists information from the database for the site, including tags, team assignments, and the history of comments made on the site, including information from previous field crew visits.

Browse map

The *browse map* feature allows the user to see sites in context with other sites, overlaid on either Google Maps or Bing Maps road or aerial imagery (Figure 4). Boat ramp locations are also shown when available (we have been working throughout the winter to update and improve boat ramp location information). The *browse map* provides tools for measuring linear distance and area. When a site is clicked, the tool displays information about the site, the tags and comments applied to it, the original GLCWC data, links for the next and previous site (see *Shoreline ordering* and *Filter sites*), and a link to edit the site in the site editor.

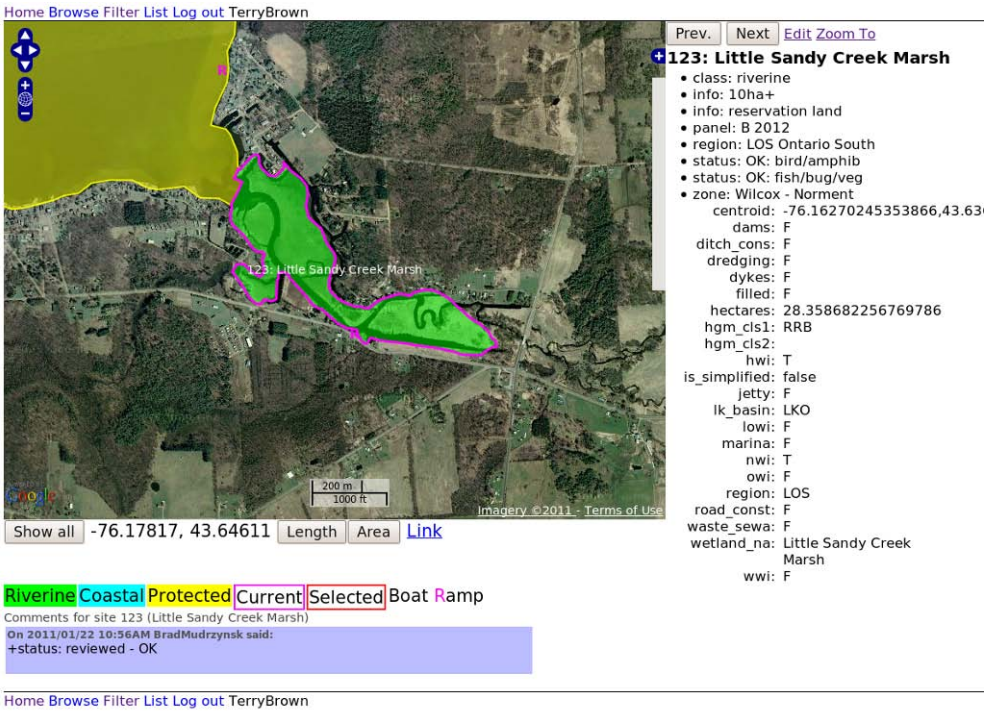

Figure 4. Screen capture of the site selection tool in use for site 123. This level shows the site, adjacent sites, and a panel of information about the site.

2012 Site Selection

Wetlands have a "clustered" distribution around the Great Lakes due to geological differences. As happened in 2011, and will likely happen in coming years, several teams ended up with fewer sites than they had the capacity to handle, while other teams' assigned number of sites exceeded their sampling capacity. Within reason, teams with excess sampling capacity have been asked to expand their sampling boundaries to assist neighboring over-capacity teams in order to maximize the number of wetlands that will be sampled. The site selection and site status tools were used to make these swaps. The final distribution of 2012 sites by teams is shown in Figure 5.

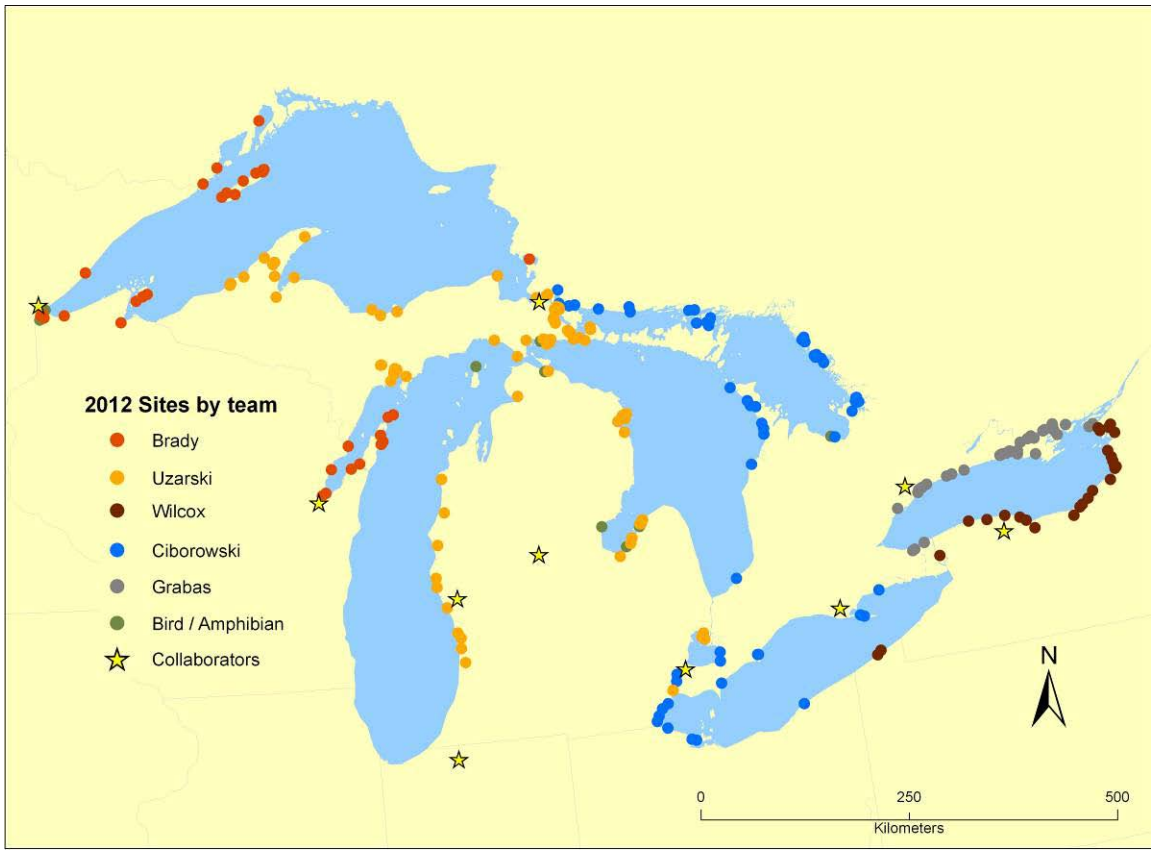

Figure 5. Wetland polygons assigned to be sampled in 2012, color-coded by regional team leader. Sites assigned only to bird and amphibian crews (due to their greater sampling capacity) are shown in green. Field crew bases of operation are also shown.

PIs have also identified a number of important sites that should either be sampled more than once in 5 years, or that would not be sampled at all because of size or because a wetland no longer exists at the site. These "benchmark" sites typically are either sites that are being restored, sites that are very regionally important, sites that represent unusually undisturbed or disturbed conditions, or sites that are especially data-rich. Twenty-one benchmark sites will be sampled in 2012. The agencies and groups working on many of these wetlands are happy to have pre-restoration data provided to them at no cost, and are hopeful that we can return and re-sample some of these sites after restoration is complete (see attached letters).

TRAINING

All personnel responsible for sampling invertebrates, fish, macrophytes, birds, amphibians, and water quality received training and were certified prior to sampling in 2011. During that first

year, teams of experienced trainers held training workshops at several locations across the Great Lakes basin to ensure that all PIs and crews were trained in Coastal Wetland Monitoring methods. Now that all PIs, crew chiefs, and most crew leaders have had a year of experience, field crew training will be handled by each PI at each regional location. All crew members will still have to pass all training tests, and PIs will still do mid-season QA. The trainers are available via phone and email to answer any questions that arise during any of the multiple training sessions.

The following is a synopsis of the training to be conducted by PIs this spring: Each PI will train all field personnel on meeting the data quality objectives for each element of the project; this includes reviewing the updated QAPP, covering site verification procedures, providing hands-on training for each sampling protocol, and going over record-keeping and archiving requirements, data auditing procedures, and certification exams for each sampling protocol. All field crew members must pass all training certifications before they are allowed to work unsupervised. Those who have not yet passed all training aspects may work under the supervision of a crew leader who has passed all training certifications.

Training for bird and amphibian field crews are being tested on the amphibian call test, the bird vocalization test, and the bird visual test that was established on the web site. The test is based on an on-line system established at the University of Wisconsin, Green Bay – see http://www.birdercertification.org/GreatLakesCoastal. In addition, individuals will be tested for proficiency in completing field sheets, and audio testing will be completed to insure their hearing is within the normal ranges. Field training will also be completed to ensure guidelines in the QAPP are followed: rules for site verification, safety issues including caution regarding insects (e.g., Lyme's disease), GPS and compass use, and record keeping.

Fish, macroinvertebrate, and water quality crews will be trained on field and laboratory protocols. Field training includes selecting appropriate sampling locations, setting fyke nets, identifying fish, sampling and picking invertebrates and water quality, and collecting covariate data. Laboratory training includes preparing water samples, titrating for alkalinity, and filtering for chlorophyll. Other training includes GPS use, safety and boating issues, field sheet completion, and GPS and records uploading. All crew members need to be certified in each respective protocol.

Vegetation crew training also includes both field and laboratory components. Crews will be trained in field sheet completion, transect and point location and sampling, GPS use, and plant curation. Plant identification will be tested as phenology allows. All crew members will be certified in all required aspects of sampling before starting in the field unless supervised.

Additional training on data entry and data QC was provided by Valerie Brady and Terry Brown through a series of conference calls/webinars during the late summer, fall, and winter of 2011. All co-PIs and crew leaders responsible for data entry participated in these training sessions.

Certification

To be certified in a given protocol, individuals must pass a practical exam. Certification exams will be conducted in the field in most cases, either during training workshops or during site visits early in the season. When necessary, exams will be supplemented with photographs (for fish, vegetation) or audio recordings (e.g., bird and amphibian calls). Passing a given exam certifies the individual to perform the respective sampling protocol(s). Since not every individual is responsible for conducting every sampling protocol, participants will be tested on the protocols for which they are responsible. Personnel who are not certified (e.g., part-time technicians, new students, volunteers) will not be allowed to work independently nor to do any taxonomic identification except under the direct supervision of certified staff members. Certification criteria are listed in the project QAPP. For some criteria, demonstrated proficiency during the field training workshops or during site visits is considered adequate for certification. Training and certification records for all participants are collected by regional team leaders and copied to Dr. Don Uzarski at Central Michigan University. Note that the training and certification procedures explained here are separate from the QA/QC evaluations explained in the following section. However, failure to meet project QA/QC standards requires participants to be re-trained and re-certified.

Documentation and Record

All site selection and sampling decisions and comments are archived in the site selection system created by Dr. Terry Brown (see “site selection”). These include comments and revisions made during the QA oversight process.

Regional team leaders archive copies of the testing and certification records of all field crew members. Summaries of these records are also archived with the lead PI (Uzarski), and the QA managers (Brady and Cooper).

WEB-BASED DATA ENTRY SYSTEM

A web-based data entry system was developed in 2011 to collect data from field sheets. The open source Django web application framework was used with the open source postgresql database as the storage back end, with a separate application for each taxonomic group. Forms for data entry are generated automatically based on an XML document describing the data structure of each taxonomic group’s observations. Part of the vegetation data entry section is shown in Figure 6. Each data entry web form is password-protected, with passwords assigned and tracked on an individual basis.

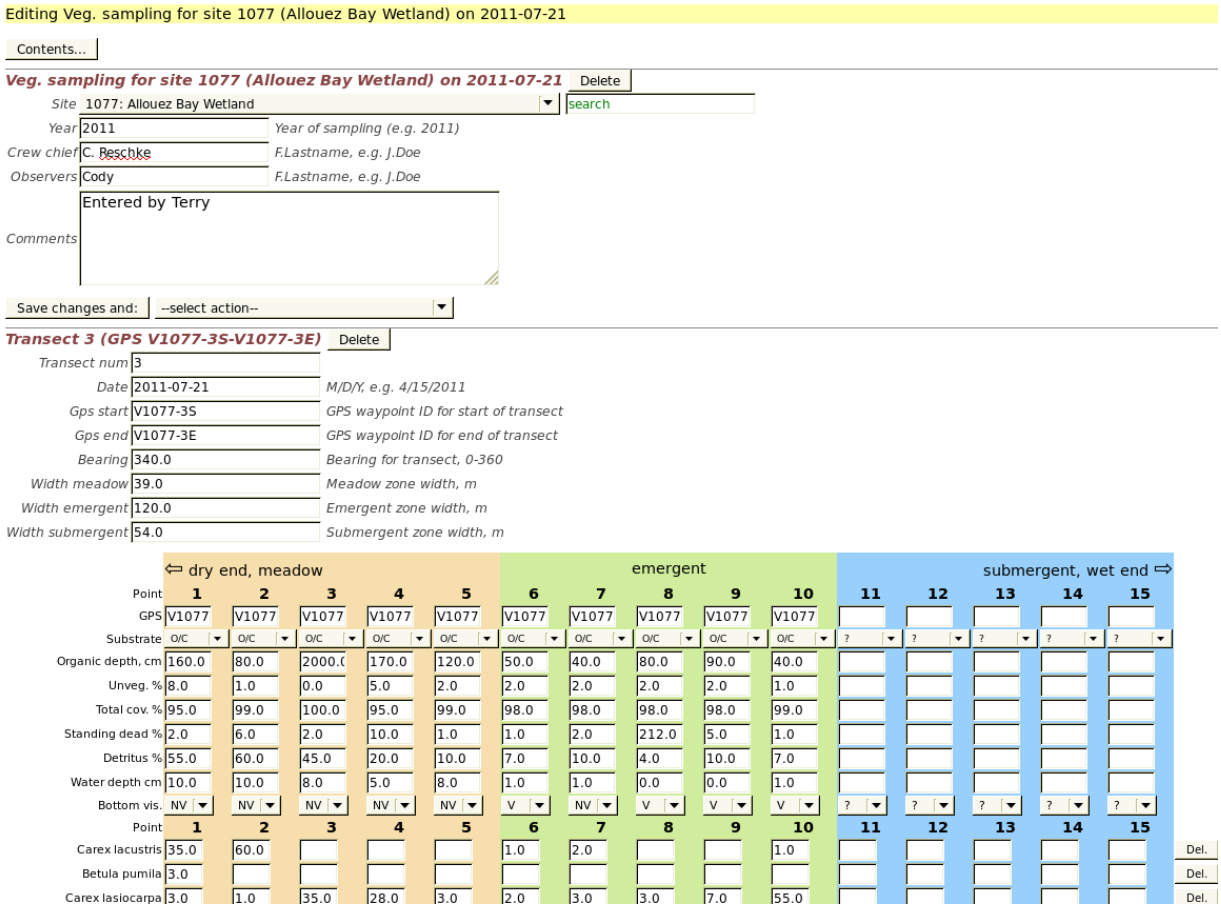

Figure 6. Screen shot of a section of the web-based data entry system set up to contain the vegetation data and based on the vegetation group's field data sheet. All data entry areas are password-protected.

Features of note include:

- fine-grained access control with individual user logins, updated every winter
- numerous validation rules of varying complexity to avoid incorrect or duplicate data entry
- custom form elements to mirror field sheets, e.g. the vegetation transects data grid
- domain-specific utilities such as generation of fish length records based on fish count records
- dual-entry inconsistency highlighting for groups using dual-entry for quality assurance
- user interface support for the highly hierarchical data structures present in some groups' data

The web-based data retrieval system that we have been building is now much more complete. It uses the same technologies as the data entry system. The data retrieval system allows PIs, graduate students, and lead technicians to download data for the taxonomic group they are working on (Figure 7). Password access is tracked separately for the data retrieval system, and is again tracked individually.

Figure 7. Basic categories available under the data retrieval section of the web site. All queries except those under the "General Summaries" section are password-protected until data QC are completed each year.

Features of note include:

- fine grained access control with individual user logins
- queries returning data at various levels, including cross-taxa overview, summary data, taxonomic group specific reports, and database internal tables
- in-browser sorting and cross-tabulation of tables

EPA GLNPO has been given access to the retrieval system and data, located at http://beaver.nrri.umn.edu/glrimon/dv/folder/. User-specific logins were sent to the project officers via email. The public, if they access this site, can see summaries of numbers of sites sampled by the various crews for the different taxonomic groups (Figure 8). Other features are only visible to those with a password.

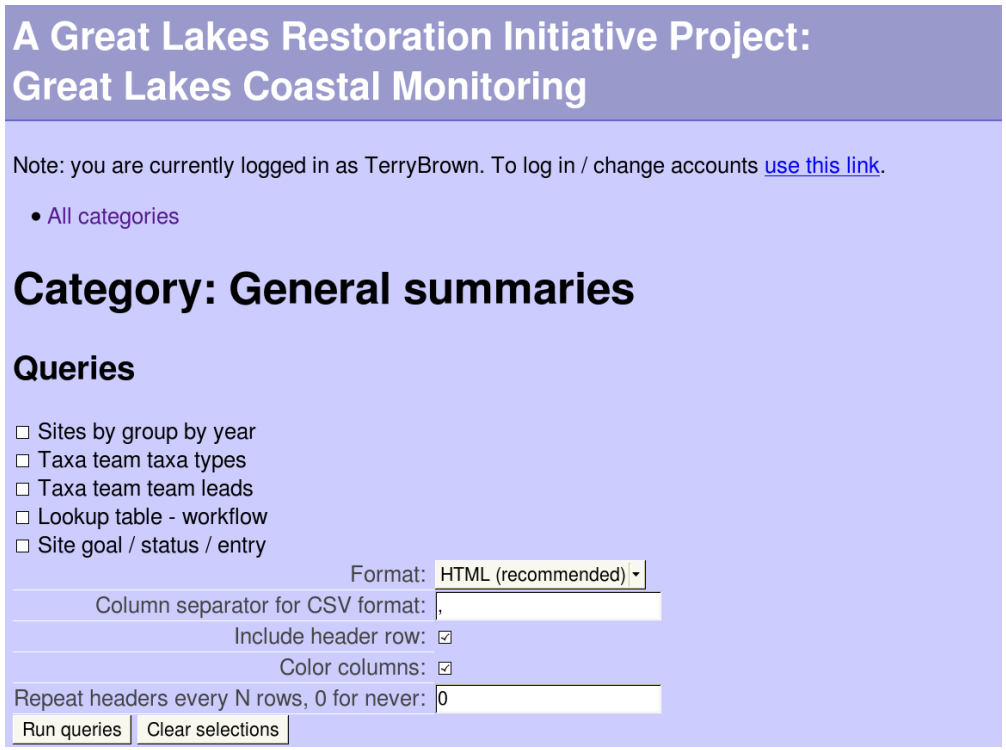

Figure 8. The General Summaries queries are available to all on the data retrieval section of the website. Retrievals of actual data are password-protected until data QA/QC is complete.

There are now 90 reports available in 23 categories. The data download system has been expanded with the capability of serving static files as well as tabular data queried on demand for the database server. Static file serving is used to deliver a new type of data packaging: Excel and Access-ready primary data. These data sets are intended to give fine-grained access for analysis / indicator calculation by Principle Investigators, not as a product for other users. These files also provide a complete backup of the project data in a format that does not require the database server to be running to allow access.

The Excel format is a multi-sheet document containing all data for a given taxonomic group with a summary sheet. Figure 9 shows an example of the summary sheet for the fish group.

	A	B	C	D	E	F
1	Coastal Monitoring Fish/Invert/WQ data dumped Thu Apr 19 02:01:17 2012					
2						
3	This is an *export* of data from the project's online database					
4						
5	Data CAN NOT BE ENTERED into the project database using this spreadsheet					
6						
7	Table	Fields	Records	Description		
8	Fi_sampling	20	126	Top level fish sampling record		
9	Fi_hab_types	2	20	Habitat types present		
10	Fi_recreation	2	5	Recreation activities visible		
11	Fi_water_level	2	6	Water level modifications		
12	Fi_sampling_lc_nearshore	4	320	Nearshore landcover percents		
13	Fi_sampling_shore_struct	4	269	Shoreline structure types seen		
14	Fi_sampling_zone	4	231	Zone		
15	Fi_rep_wq	22	738	Rep. level WQ data		
16	Fi_zone_fyke	21	576	Fyke data		
17	F_fish_obs	9	22924	Fish lengths		
18	F_fish_total	8	3833	Fish counts		
19	Fi_zone_habitat	15	687	Habitat data		
20	Fi_zone_dom	6	930	Quadrat dominant taxa		

Figure 9. An example of an Excel spreadsheet format data download for the fish data. Shown is the summary sheet.

Further down the summary sheet are details for each table (Figure 10).

	A	B	C	D	E	F
202	Fi_zone_lab_wq: Whole zone level LABORATORY WQ data					
203		Field	Units	Type	Description	
204		sampling_	N/A	link	to table Fi_sampling_zone	
205		qa_done	N/A	true/false	QA completed for this record	
206		date	N/A	date	mm/dd/yyyy	
207		wq_dupe	N/A	text	Primary or duplicate (QA rep	
208		chl	ug/L	real num	Chl (ug/L)	
209		phaeo	ug/L	real num	Phaeophytin (ug/L)	
210		tp	mg/L	real num	Total P (mg/L)	
211		op	mg/L	real num	Ortho P (mg/L)	
212		tn	mg/L	real num	Total N (mg/L)	
213		nh4n	mg/L	real num	Ammonia-N (mg/L)	
214		no2no3	mg/L	real num	NO2/NO3-N (mg/L)	
215		anc	mg/L	real num	CaCO3 (mg/L)	
216		ph	pH	real num	pH	
217		color	color pt un	real num	color (color pt units)	
218		turb	NTU	real num	Turbidity (NTU)	
219		cl	mg/L	real num	Chloride (mg/L)	
220		notes	N/A	text	Include any problem codes c	
221						
222	Fi_zone_size: Zone / patch dimensions (1 line for contiguous, 2 or 3 for patches)					
223		Field	Units	Type	Description	
224		sampling_	N/A	link	to table Fi_sampling_zone	
225		size_a	m	real num	Dimension A (m)	
226		size_b	m	real num	Dimension B (m)	

Figure 10. The fish data download in Excel format; shown is summary information about water quality data.

Finally the sheet for each individual table contains the expected data (Figure 11). These metadata and data are generated automatically on a nightly basis.

	A	B	C	D	E	F	G	H	I	J
1	site	site_date	zone	rep_wq_date	qa_done	rep	wq_dupe	wq_file_id	diss_o2	diss_o2_sat
2	10	2011-06-30	SAV	2011-06-30	False	1	pri		8.45	100
3	10	2011-06-30	SAV	2011-06-30	True	2	pri		7.2	97
4	10	2011-06-30	SAV	2011-06-30	True	3	pri		7.13	95.3
5	16	2011-06-29	SAV	2011-06-29	True	1	pri		5.36	62.8
6	16	2011-06-29	SAV	2011-06-29	True	2	pri		4.65	53.9
7	16	2011-06-29	SAV	2011-06-29	True	3	pri		7.43	84.7
8	23	2011-07-05	SAV	2011-07-05	True	1	pri		2.84	35.2
9	23	2011-07-05	SAV	2011-07-05	True	2	pri		4.08	51.7
10	23	2011-07-05	SAV	2011-07-05	True	3	pri		3.42	32.1
11	27	2011-07-07	Button Bu	2011-07-07	False	1	pri		6.03	59.3
12	27	2011-07-07	Button Bu	2011-07-07	False	2	pri		1.03	11.4
13	27	2011-07-07	Button Bu	2011-07-07	False	3	pri		1.07	12.3

Figure 11. The fish data download in Excel format; shown is water quality data collected at several sites.

An automatically-generated image showing the structure of the data is also available for download. This is a two-page PDF with the first page showing fields, and the second showing only a table linking fields, a useful overview for the more complex data sets. Figure 12 shows an example for the amphibian data.

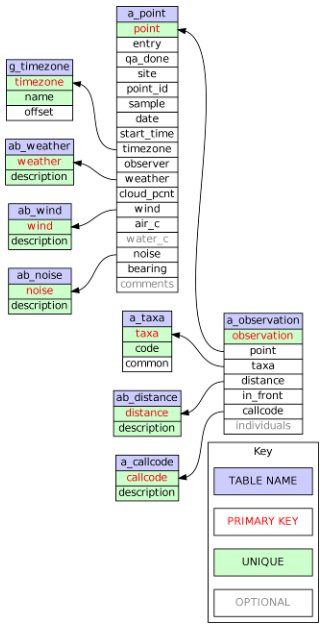

Figure 12. Diagram showing relationships between tables in database holding amphibian data.

The Access-ready data consists of a ZIP file containing the database contents in CSV and DBF formats, and an Access template file with some VisualBasic code to import the DBF files. The relationships between tables are automatically re-created within Access during the import, which is very valuable given the complexity of some of the data sets. The CSV files are useful for analysis with tools such as SAS and R.

Additional features for eventual data download identified at a stakeholder meeting at the Michigan Wetlands Association Annual Conference, Aug. 30-Sep. 2, 2011, include:

- metadata reporting
- map-based interface for selection of sites of interest
- reports relative to range of values seen in identified sites of interest
- multi-level views of data, allowing the user to "drill down" from overall status reports to variables driving condition for particular wetlands

Data is continuously backed up using a live backup system (Write Ahead Log storage from the database backend), with nightly mirroring of the backup system to a separate location (from NRRI to the UMD campus).

2011 RESULTS SUMMARY

Most teams are still working on data analyses and summaries (see a few tidbits in team reports in the next section). However, from the database we have been able to run a few standard queries to summarize basin-wide findings and summary statistics. In some cases, results have been split by country at the request of US EPA GLNPO.

A total of 176 wetlands were sampled in 2011, with many more sampled on the US side, mostly due to the uneven distribution of wetlands between the two countries, rather than any deliberate attempt to sample more wetlands on the US side. The wetlands on the US side also tend to be larger (see area percents). When compared to the total number of wetlands targeted to be sampled by this project (Table 5), we achieved our goals of sampling at least 20% of US wetlands in our first year, both by count and by area.

Table 5. Wetlands sampled in 2011 by country. Statistics provided both as counts and by area.

Country	Site count	Site percent	Site area	Area percent
Canada	50	28%	3,303	13%
US	126	72%	22,008	87%
Total	**176**		**25,311**	

Wetlands contained about 25 bird species, and no sampled wetland had fewer than 8 bird species (Table 6). Some wetlands contained 50 or more bird species. There are many fewer frog species in the Great Lakes, and coastal wetlands averaged about 4 species per wetland, with some wetlands containing only a single calling species (Table 6). However, there were wetlands with as many as 8 frog species heard over the three sampling dates.

Table 6. Bird and frog species in wetlands; summary statistics by country.

Country	Site count	Mean	Minimum	Maximum	Std deviation
Birds					
Canada	50	26.6	11	49	10.2
US	103	25.5	8	53	11.5
Frogs					
Canada	49	4.4	1	8	1.8
US	99	4.2	1	7	1.2

A mean of about 13 fish species were collected in Great Lakes coastal wetlands. Some wetlands had as few as 3 species, while 27 fish species was the most collected in any wetland (Table 7).

Table 7. Fish species in wetlands; summary statistics for the whole Great Lakes.

Site count	Mean	Minimum	Maximum	Std deviation
108	13.4	3	27	4.7

The majority of Great Lakes coastal wetland sites sampled in 2011 were found to contain at least one non-native fish species (66% of wetlands) (Figure 13). Forty-two percent of the 108 sites contained only a single non-native fish species, and the number of sites with more than a single non-native species was many fewer. It is important to note that the sampling effort at sites was limited to a single night's set of nets, so these numbers are likely quite conservative.

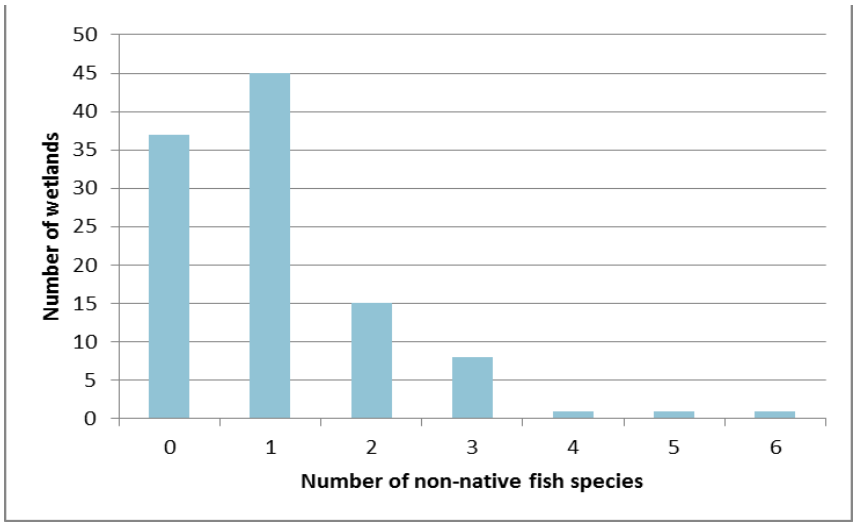

Figure 13. Number of Great Lakes coastal wetlands containing non-native fish species.

Wetlands were also highly invaded by non-native and invasive plant species (Figure 14). Only 12% of 123 wetlands were not found to contain invasive plants, leaving a full 88% containing at least one invasive species. Sites were often found to be invaded by multiple plant species. Twenty percent of sites contained two invasive plant species, and 15% of sites contained 6 invasive species. Because plants do not have to be "captured", detection of invasive species is more likely for plants than for fish and other mobile organisms.

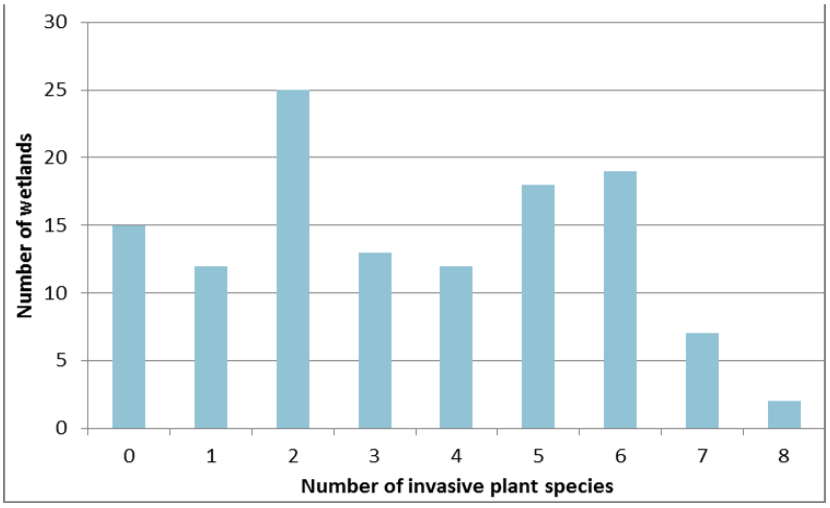

Figure 14. Number of Great Lakes coastal wetlands containing invasive plant species.

Dr. Denny Albert calculated the mean Conservatism Index scores for wetland plant species for selected wetlands on each of the Great Lakes, and used this to do a quick comparison of wetland vegetative quality (Figures 15-17). A *Conservatism Index* evaluates the ecological conditions in which a plant is found. A species with a high Conservatism Index is found within a narrow range of ecological conditions, and the index score would be close to 10. In contrast, a species that occupies a broad range of conditions, including highly degraded sites, would have a low score of 0 or 1. A *Mean C* score is the average of the Conservatism Indices for all of the species at a site. Mean C can be calculated for all plants found at a site, including invasive plant species, or just for native species. Since the Mean C score for invasive species is zero, the Mean C score for the total species at a site will be lower than that of just native species (unless there are no invasive species).

For several Lake Huron wetlands sampled in 2011 (Figure 15), Crooked Island (Site #548) and Grand Marais Lake (Site #767) were the highest quality sites, with few signs of disturbance. For

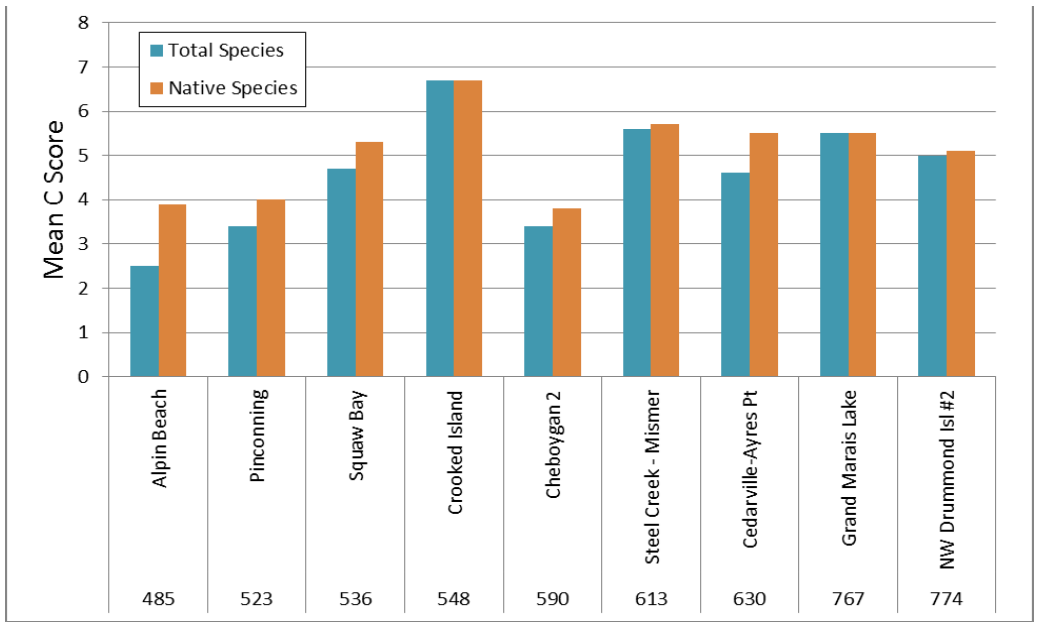

Figure 15. A comparison of mean Conservatism scores for all vegetation species versus only native species for selected Lake Huron coastal wetlands.

both sites there were no invasive species, and therefore the Total Species and the Native Species Mean C scores were identical. For all other sites the Native Mean C score was higher than the Total Mean C score. The strongest difference between scores was seen at Alpin Beach (Site #485), where landowners regularly plowed or disked the coastal wetlands, resulting in the loss of many native species and the increase in the number of invasive species, and, thus, the lowest Mean C score recorded on Lake Huron. Other disturbed sites were Pinconning (Site #523) on Saginaw Bay and Cheboygan (Site #590) at the edge of the marina and sewage

treatment plant of the city of Cheboygan, both with Mean C scores below 4. However, six of the nine sites for which Mean C scores were computed had native Mean C scores greater than 5.0.

For Lake Ontario wetlands, the lowest Mean C scores were encountered at East Creek (Site #23), found in a highly agricultural landscape with farming up to the margins of the wetland (Figure 16). The Mean C scores on Lake Ontario were generally low, with six of seven sites computed having scores less than 5.0. The highest score was 6.3 for South Pond (Site #7051), a site long recognized for its ecological integrity and high native plant diversity. Lake Ontario wetlands have low Mean C scores due to both water level control and high levels of agricultural land use.

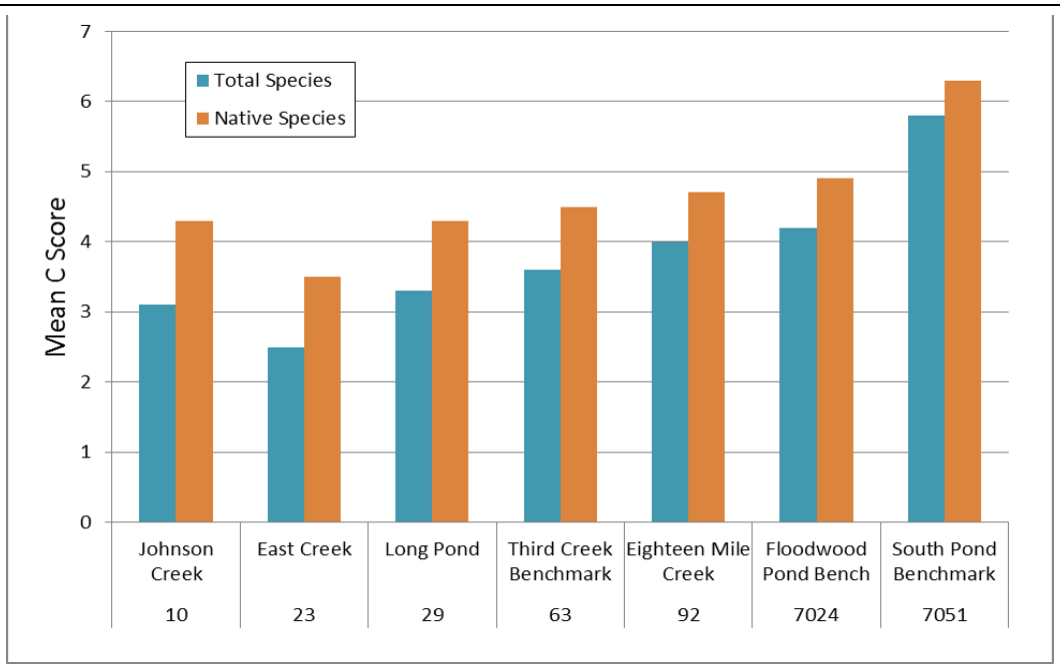

Figure 16. A comparison of mean Conservatism scores for all vegetation species versus only native species for selected Lake Ontario coastal wetlands.

Mean C scores for sites on southern Lake Michigan, Lake Erie, Lake St. Clair, the St. Marys River, and Lake Superior are shown in Figure 17. All of the sites on southern Lake Michigan (Galien River, Site #1325), Lake Erie (Elba Island, Site #422; Woodtick Peninsula, site #1898; and Otter Creek, Site #1904), and Lake St. Clair (Camp Farwell, Site #473) are degraded by urban or agricultural development. Camp Farwell (Site #473) on Lake St. Clair was the most degraded site as the result of aggressive plant removal by landowners, which has eliminated all or most vascular plants from the shore, leaving only algae on the fine silt and sand.

The Mean C scores are higher for the St. Marys River (Munuscong Lake 2, Site #792) and Lake Superior (Cranberry Creek, Site #5210, and Fortieth Avenue West, Site #7048). Cranberry

Creek, a creek isolated from intensive human land use which supports bog plants, has the highest Mean C score (6.1) and supports no invasive species. Munuscong Lake suffers from enrichment due to agricultural runoff, while Fortieth Avenue West is degraded by urban land use.

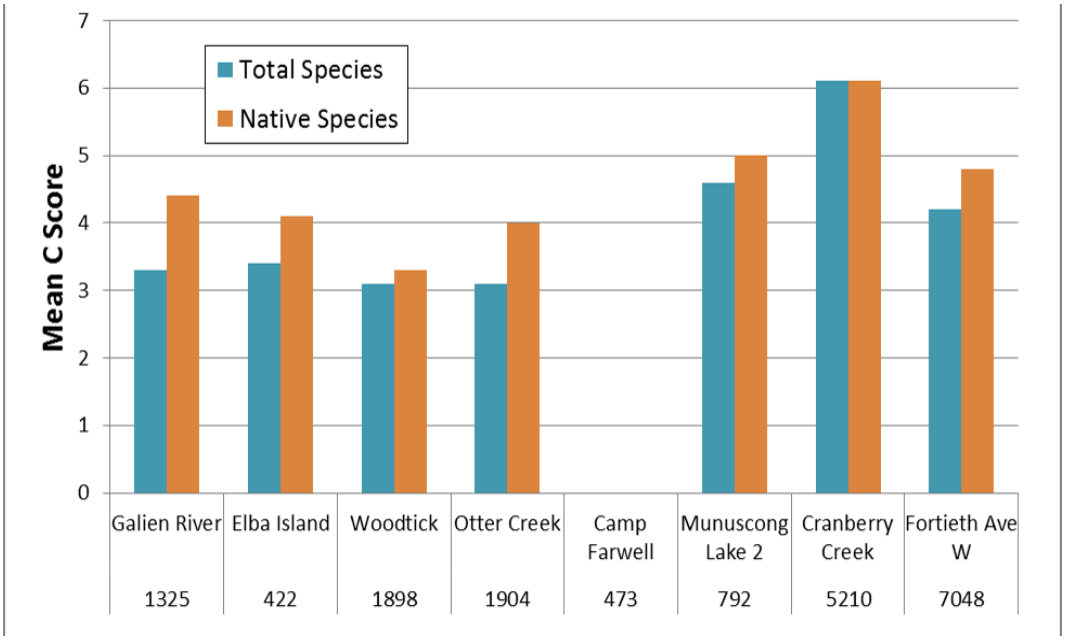

Figure 17. A comparison of mean Conservatism scores for all vegetation species versus only native species for selected coastal wetlands on lakes Michigan, Erie, St. Clair, and Superior.

For all lakes, the comparison of native species versus total species Mean C scores is effective at demonstrating both the local reduction in wetland quality, and the regional degradation seen in the southern lakes (Ontario, Erie, St. Clair, and the southern portion of Lakes Michigan and Huron).

TEAM REPORTS

Western Regional Team: Jerry Niemi (Birds and Amphibians), Valerie Brady and Lucinda Johnson (Fish and Macroinvertebrates), Nicholas Danz (Vegetation), and Rich Axler (Water Quality)

2011 Data Entry, QA, and Results

Bird and Amphibians

Each of the 37 sites sampled in 2011 were visited a total of four times between 27 April and 10 July. Amphibians were sampled three times during this period. Table 8 provides a list of amphibians recorded during the 2011 surveys. Birds were surveyed twice during this period, once in the morning and once in the evening. There were a total of 96 species and 7,110 individual birds recorded by NRRI crews, including four of the 10 focal species (American bittern, American coot, pied-billed grebe, and sora rail). All data entry and QA/QC for bird and amphibian records was completed (100%) during the fall of 2011.

Table 8. List of amphibians recorded during 2011 surveys. The number of individuals counted and the number of full choruses observed (# of individuals cannot be estimated) are provided for each species.

Species	# Individuals	# Obs. - Full Chorus
American toad (*Bufo americanus*)	43	1
Bullfrog (*Rana catesbeiana*)	6	0
Chorus frog (Western/ Boreal -*Pseudacris*)	31	0
Green frog (*Lithobates clamitans*)	321	4
Gray treefrog (*Hyla versicolor*)	139	4
Mink frog (*Rana sylvatica*)	3	0
Northern leopard frog (*Lithobates pipiens*)	39	0
Spring peeper (*Pseudoacris crucifer*)	651	136
Wood frog (*Lithobates sylvaticus*)	74	3
Total	**1307**	**148**

In the western Great Lakes region there have been many observations of birds of special concern in the vicinity of the wetlands or using the wetland complexes in 2011. A total of 14 bald eagles were identified, including 6 observations in riverine wetlands in Lake Superior. In the Duluth-Superior area alone there are at least 4 nesting pairs of bald eagles; 3 nests within the St. Louis River Estuary and one within 0.5 mi of the shoreline within the city limits of Duluth. Additional species of interest include: 1) 7 observations of American bittern – 5 in lacustrine coastal wetlands in northeastern Lake Huron, 1 in a riverine wetland in northwestern Lake

Huron, and 1 in a riverine wetland in western Lake Huron; 2) 3 pied-billed grebe – all in lacustrine coastal wetlands of northeastern Lake Huron; 3) 34 sandhill crane – all well-distributed in many wetland types (lacustrine, riverine, and barrier-protected) in northeastern and western Lake Huron and the southern and western areas of Lake Superior; 4) 4 caspian tern in lacustrine coastal wetlands of northeastern Lake Huron; 5) 1 Forster's tern in a riverine wetland of western Lake Huron; and 6) 2 mute swan (an invasive, non-native species) at Fish Creek Wetland near Ashland, Wisconsin.

Fish and Macroinvertebrates

All fish that could not be identified in the field and were returned to the laboratory for positive identification (about 4 dozen fish) have been identified, including about a dozen small fish that were sent to fish expert, Dr. Carl Ruetz, for identification assistance. All of the fish data have been entered into the database and the data have been completely QC'd.

All macroinvertebrate samples for which the NRRI lab was responsible for identification have been identified and the data entered in the database. Data QC has just been completed. In exchange for assisting Central Michigan University with field sampling last summer, CMU has agreed to process some of those invertebrate samples. Thus, NRRI shipped the invertebrate samples from approximately 14 sites to CMU for identification. NRRI has also sent off two macroinvertebrate samples to CMU as part of the cross-lab invertebrate identification QC exchange. In return NRRI received two samples from Lake Superior State University. Those samples have been identified and the identifications provided to the QA managers.

Water Quality

Water quality provides supplemental correlative information to accompany taxonomic indicators of wetland condition and assist in their interpretation. Water quality sampling is done by fish and macroinvertebrate crews and is guided by a detailed Standard Operating Procedures (SOP).

Critical (i.e. "mandatory"), Recommended, and Supplementary sets of field and laboratory water quality parameters and their analysis protocols were established based on the previous GLCWC project (Uzarski et al. 2008), contemporaneous Great Lakes-scale surveys (i.e. GLEI [Morrice *et al.* 2008; Danz *et al.* 2007; Reavie *et al.* 2005]), and EPA's new National wetland condition assessment (NWCA: www.water.epa.gov/type/wetlands/assessment/survey/index.cfm). Protocols were based on those recently developed for the National Park Service's (NPS) Vital Signs Monitoring Program developed by NRRI for the Great Lakes Network of the NPS (Elias et al. 2008). The QAPP includes the following categories with detailed information for each:

Critical:

- Field: temperature, dissolved oxygen, pH, specific conductivity
- Lab: alkalinity, turbidity, soluble reactive phosphorus (SRP), [nitrate+nitrite] -nitrogen,

ammonium-nitrogen, chlorophyll-a

Recommended:
- Field: transparency tube clarity
- Lab: total nitrogen (TN), total phosphorus (TP), chloride, color

Supplementary:
- Field: oxidation-reduction potential (redox), *in situ* chlorophyll fluorescence
- Lab: Sediment percent organic matter

The NRRI-UMD Central Analytical Laboratory completed analysis of samples collected by NRRI-UMD (63 samples) and New York-Brockport (39 samples) crews for nutrients, chlorophyll, color, turbidity, and chloride. All analyses were completed, the data entered and QC'd, and distributed to the appropriate labs.

Wetland Vegetation
In October 2011, vegetation data were subject to QA/QC procedures by visually checking all data entered in the data management system against the field sheets. Errors were corrected in the database and noted on field sheets. Error rates were very low, <1% of all data entries. Approximately 50 unknown specimens from northern Lake Michigan and western Lake Superior wetlands were identified through herbarium work with the help of regional experts and updated in the database. Several Species of Special Concern were noted, particularly from the Door County, WI peninsula. In February 2012, vegetation personnel attended the all-investigators meeting in Detroit, MI. Investigators thoroughly reviewed all field survey protocols, making no significant changes.

Fieldwork Preparations

Site Selection

Birds and Amphibians
In 2011, a total of 52 sites were initially selected to be surveyed for birds and amphibians. Of these sites, 15 were rejected for one of the following reasons: 1) inaccessible or unsafe, including island situations, 2) no trespassing signs and owners could not be contacted, or 3) wetland areas were unsuitable for sampling (e.g. wetland size did not meet site selection requirements, wetland lacked connectivity to the lake). The 37 sites that were sampled by bird and amphibian field crews in 2011 stretched from the Duluth-Superior harbor area eastward along the south shore of Lake Superior to the eastern end of the Upper Peninsula of Michigan and to the northern region of Lake Huron. Of the sites sampled, five were benchmark sites selected because they were of particular interest for restoration potential. Three of these sites, located in the St. Louis River Estuary, are in some stage of planning for restoration work.

In 2012, a total of 35 sites have been selected to be surveyed for birds and amphibians. Of these, only three island sites have been rejected due to lack of connectivity to Lake Superior. Reconnaissance of the remaining 32 wetland sites is scheduled for April 2012 and will be completed prior to sampling. The sites selected for 2012 occur within the same general locations as those sampled in 2011 and also include sites located along the north shore of Lake Superior and multiple island wetlands in Lake Superior including sites on Isle Royale, Madeline Island, and Grand Island.

Fish, Macroinvertebrates, and Wetland Vegetation
For 2012, the Brady-Danz fish, invertebrates, and vegetation crews have been assigned 29 sites to sample on Lake Superior and Michigan. Of those 29 sites, 4 are benchmark sites and 3 are re-visit sites. All of the benchmark sites this year were on the regular sampling list, but were either too far down the list to be sampled by our crews, or needed to be sampled sooner than they were scheduled because of planned restoration work. Included in the sites to be sampled this year are sites on Isle Royale, Lake Superior.

PI Brady also worked with personnel at the National Park Service-Great Lakes and the Wisconsin Nature Conservancy to identify coastal wetlands of importance to these groups, determine which of these wetlands are already selected for sampling, and add a few of the sites to the "benchmark" list for inclusion in future years' sampling efforts. Both groups are pleased that they will be provided with background data on wetlands that they cannot easily sample themselves (see attached letter of support).

Field Training

Birds and Amphibians
The training for amphibian surveys was held on 11 April, 2012, and bird crew training will take place 24 – 26 May, 2012. Training involves instructing crews on how to conduct standardized field surveys, on basic travel procedures, and on appropriate field safety measures. Individuals are trained to proficiently complete field sheets and audio testing is also completed to insure that their hearing is within the normal range. Rules for site verification, safety issues including caution regarding insects (e.g., Lyme's disease), GPS and compass use, and record keeping are also included in field training to insure that the guidelines in the QAPP are being followed. All individuals involved in conducting the surveys will have taken and passed each of the following tests on 1) amphibian calls, 2) bird vocalization, and 3) bird visual identification that are based on an on-line system established at the University of Wisconsin, Green Bay – see http://www.birdercertification.org/GreatLakesCoastal - prior to conducting surveys.

Fish and Macroinvertebrates
Fish, macroinvertebrate, and water quality field crew hiring has begun for this summer, although we have many returning personnel from year 1. Returning personnel will help train new field crew members, and the training will also serve as a refresher for returning personnel.

Fish, macroinvertebrate and water quality sampling training is planned for early June in Duluth, Minnesota. Training will include GPS use, determination of whether sites meet project criteria (open water connection to lake, presence of a wetland, safe access for crew), identification of vegetation zones to be sampled, collection of water quality samples (including lab processing) and meter readings (including meter calibration), proper setting and pulling of fyke nets, proper dip net macroinvertebrate collection, and macroinvertebrate sample picking on-site. Crews will also be trained in field data sheet use. Crew members will be tested for mastery of all of these parameters and for their ability to identify fish. Crew members will all also be given University field and lab safety training. Finally, crews will practice mock-sampling of a site to ensure that they have gained the skills necessary to successfully and correctly sample wetlands.

Wetland Vegetation
Wetland vegetation PIs have had email exchanges on plant surveys and on topics including Isle Royale surveys, whether phonological dates are likely to be significantly advanced in summer 2012 due to the warm winter and spring, and whether floristic quality indices should be calculated with or without zero values for invasive species.

Field training will be conducted in the Duluth/Superior area in June after vegetation growth is advanced enough for field practice. Crews will be trained in field sheet completion, transect and point location and sampling, GPS use, and plant curation for later identification.

Fieldwork Scheduling

Bird and Amphibians
Sites scheduled to be sampled in 2012 will be visited by amphibian crews beginning 17 April and bird crews will begin surveys on 27 May.

Fish and Macroinvertebrates
For fish sampling, the University of Minnesota Institutional Animal Care and Use Committee renewal was approved. Scientific collection permits are being requested from the Ministry of Natural Resources Canada, and the states of Minnesota, Wisconsin, and Michigan. Current plans are for fish and macroinvertebrate sampling to start the last week in June and run through mid-September. The PI (Brady) will sample with the crews during their first week of sampling to ensure that any questions and unresolved issues from crew training get resolved.

Logistics for sampling Isle Royale sites, especially for fish, have proven challenging. Field crew leaders have been working on these logistics since February, and have come up with several options, at least one of which should allow NRRI crews to sample 4-6 Isle Royale wetlands this summer. There is a slim possibility that NRRI crews may be able to team up with US EPA Mid-Continent Ecology Division field crews, who will also be sampling wetlands and bays at Isle Royale this summer.

Wetland Vegetation
In March 2012, a Field Botanist position was advertised by sending it to regional botanical experts at federal and state agencies and universities. Over 10 applicants have responded, with application reviews to occur mid-April 2012. Reviews of maps for and site selection for 2012 began in earnest in early 2012 and will continue through May. Vegetation survey training will be held in June.

Central Basin Regional Team: Don Uzarski, Dennis Albert (Vegetation), Thomas Gehring and Robert Howe (Birds and Amphibians), Carl Ruetz (Fish), and Matt Cooper (Macroinvertebrates)

Sample Processing and Data Entry

Central Michigan University
All aquatic macroinvertebrate identification has been completed and all data have been entered into the online database and checked by a second person. Macroinvertebrate samples have been exchanged between collaborating institutions to ensure accurate identification as part of the QA/QC protocols. Central Michigan University obtained samples from GVSU, UND, and NRRI-UMD to conduct QA/QC while samples from CMU were sent to UND. Water quality analysis was completed in October 2011 and all data have been entered into the data management system and checked per QA/QC protocols.

Lake Superior State University
Data entry for all parameters, except macroinvertebrates, was completed and checked by October 2011following the QA/QC procedures. A technician was hired in the fall (September-November 2011) to identify macroinvertebrate samples. He spent two days at CMU working with CMU technicians to verify his identifications and troubleshoot where necessary. He completed all identifications in November. In March, two macroinvertebrate samples from high diversity wetlands were sent to NRRI for QA/QC checks. Aquatic macroinvertebrate data will be entered into the online database before the beginning of the 2012 field season.

Grand Valley State University
Laboratory analysis of water samples for each plant zone was completed by December 2011, and all water-quality data have been entered. Aquatic invertebrate identification began in February 2012 (nearly 50% complete) and is ongoing. We recently sent aquatic invertebrate samples to Central Michigan University for QC checks.

University of Notre Dame
All laboratory analyses of water samples were completed by December 2011. Sediment processing for percent organic matter was completed in January. Our lead macroinvertebrate identifier spent one week at the CMU laboratory for assistance with invertebrate identification.

She also participated in a 2-day Microsoft Access course at Notre Dame in order to work with the database more efficiently. Invertebrate identification and compilation of a reference collection was completed in March. Invertebrate samples have been exchanged with CMU for QA/QC. Water chemistry data have been entered and QC-checked by a second crew member. Invertebrate data will be entered and checked after sample exchange QA/QC verifies accurate identification.

Oregon State University
Vegetation data were entered and QC'd in the online database. Floristic quality indices have been calculated for all sites sampled by our vegetation crews. Data from six benchmark sites sampled in 2011 have been shared with organizations involved in restoration projects. Dennis Albert (OSU PI) has also communicated with the Michigan Department of Natural Resources staff concerning effects of shoreline landowner management (that is, vegetation removal, such as by mowing) on coastal vegetation; these communications are intended to assist in revision of upcoming modifications to shoreline management regulations currently being crafted by the Michigan legislature.

University of Wisconsin Green Bay
Robert Howe (UWGB PI), and graduate students Erin Gnass, and Nick Walton attended the PI meeting in Detroit on February 9th, 2012. During the meeting we contributed to minor revisions of the QAPP document and participated in discussions about logistics and site assignments for 2012. We also have worked with Niemi and colleagues on further development of methods for quantifying ecological indicators based on birds and amphibians.

2012 Field Season Preparations

Don Uzarski, Matt Cooper, Denis Albert, Ashley Moerke and lead technicians attended an organizational meeting in Detroit, Michigan, on February 9th. Carl Ruetz participated in the meeting via webinar. During this meeting all who attended gave insight and feedback on proposed changes to the QAPP and SOP's for their respective taxonomic groups. Uzarski and Cooper worked with Valerie Brady to update the QAPP and SOPs, which were approved by EPA in March.

Site Selection

A total of 53 sites were selected for the central basin regional team. Of the 53 selected sites, 11 are designated as benchmark sites and three are Year-1 sites that will be revisited. CMU will sample 23 sites with one alternative site, Notre Dame and LSSU will each sample 8 sites with one alternate and GVSU will sample 8 sites with no alternate sites.

Central Michigan University
CMU submitted the annual scientific collector's permit report for 2011 to the Michigan DNR in December and received the 2012 scientific collector's permit in January 2012. CMU has also renewed its university animal care and use (IACUC) approval status. CMU is currently preparing for the 2012 field season by ensuring all gear has received maintenance and any needed repairs are made, supplies are being re-ordered and stocked, and field technicians are being evaluated for hiring.

Lake Superior State University
In February, summer technician hiring was initiated. Announcements were posted and interviews were scheduled for the end of March. Equipment and supplies are being evaluated and replaced as needed.

Grand Valley State University
GVSU is in the process of completing their annual IACUC report for fish sampling, and Ruetz applied for the scientific collectors permit to sample fish for the 2012 field season. Jessica Comben will serve as the crew leader for GVSU for the 2012 field season.

University of Notre Dame
Renewal of the Michigan DNR scientific collector's permit was approved on March 6th. An IACUC renewal form was submitted on March 14th to the UND Animal Care and Use Committee. Jessica Kosiara will serve as the crew leader for UND. Two additional technicians have also been hired and are being trained. Kosiara and Cooper will make a reconnaissance trip to all southern Lake Michigan sites in mid-April to determine connection to Lake Michigan and accessibility. All field equipment will be evaluated and repaired or replaced in May.

Oregon State University
OSU is in charge of vegetation sampling at all sites for the US Central Basin Team. PI Dennis Albert has begun photo interpretation of the 2012 sampling sites to facilitate rapid deployment of field teams during summer. Locations of approximate sampling transects drawn on aerial photos will be followed by in-field location of random transect starting points. Hiring of summer crews has begun, along with acquisition of equipment and reservation of field vehicles.

University of Wisconsin Green Bay
Preparations are complete for the 2012 field season and sampling will begin during the weekend of April 21. Our assigned sites this year for birds and amphibians (45) are located from northern Illinois to the Canadian shores of northern Lake Huron. Graduate students have assembled maps and ownership details in advance of the first frog surveys. We also have slightly revised the field certification web site and tested it for use by field teams from all of the Great Lakes study area. The site (http://www.birdercertification.org/GreatLakesCoastal/) is currently being used for certification of 2012 field teams. We have compiled a listing with

scores of all observers who took the online tests during 2011. This list is available for quality control assessment of the 2011 field data.

Eastern U.S. Regional Team: Douglas Wilcox (Vegetation), Chris Norment (Birds and Amphibians), James Haynes (Fish), and Gary Neuderfer (Macroinvertebrates)

Data Quality Assurance

Data entry personnel successfully finished data quality assurance on the remaining 25% of vegetation, bird, and amphibian data, 50% of fish data, and 75% of water quality and aquatic macroinvertebrate collection data since 1-October 2011. Aquatic macroinvertebrate identification QA has not started, as identification is ongoing.

Winter Identification

Aquatic macroinvertebrate identification began in January, with Gary Neuderfer training and overseeing the efforts of invertebrate lab personnel. Site samples were split into separate taxonomic subsamples (e.g., Chironomidae, Ephemeroptera, and Amphipoda), to allow identification personnel to specialize in taxa. Approximately 60% of aquatic macroinvertebrate samples have been identified. Completion is slated to be finished by mid-May.

Important 2011 Findings

Basic summaries of 2011 data show the general condition of southern Lake Ontario wetlands with reference to invasive, nuisance, threatened, and endangered species. Numerous invasive plant species were found in 2011 southern Lake Ontario sites, with eight species present in at least half of the sites (Table 9). Only four plant species of conservation concern were detected in 2011 (Table 10). No invasive bird or amphibian species were found in 2011 sampling. Bird and amphibian surveys detected no threatened or endangered amphibians; however, two bird species of conservation concern were detected (Table 11). Fish sampling detected five invasive fish species (Table 12) and only one species of conservation need (Table 13) in southern Lake Ontario.

Table 9. Invasive plant species identified and the number of wetlands in which they were found in southern Lake Ontario.

Common Name	Scientific Name	Sites Present (out of 24)
European Frogbit	*Hydrocharis morsus-ranae*	22
Narrow leaf Cattail	*Typha angustifolia*	22
Hybrid Cattail	*Typha x glauca*	22
Eurasian Milfoil	*Myriophyllum spicatum*	21
Sago Pondweed	*Stuckenia pectinatus*	21
Curly Pondweed	*Potamogeton crispus*	17
Reed Canary Grass	*Phalaris arundinacea*	15
Purple Loosestrife	*Lythrum salicaria*	14
Water Chestnut	*Trapa natans*	3
Flowering Rush	*Butumus umbellatus*	2
Common Reed	*Phragmites australis*	2

Table 10. Number of sites at which they were present and New York State conservation status for plant species of conservation need found in 2011 southern Lake Ontario wetland sites. E=Endangered, EV= Exploitatively Vulnerable.

Common Name	Scientific Name	Sites Present (out of 24)	Status
Wheat Sedge	*Carex atherodes*	1	E
Spoonleaf Sundew	*Drosera intermedia*	1	EV
Roundleaf Sundew	*Drosera rotundifolia*	1	EV
Purple Pitcher Plant	*Sarracenia purpurea*	1	EV

Table 11. Number of sites at which they were present and New York State conservation status for bird species of conservation need found in 2011 southern Lake Ontario wetland sites. T= Threatened, SC= Special Concern.

Common Name	Scientific Name	Sites Present (out of 24)	Status
Least Bittern	*Ixobrychus exilis*	5	T
American Bittern	*Botaurus lentiginosus*	3	SC

Table 12. Invasive fish species identified and the number of sites where they were present in southern Lake Ontario.

Common Name	Scientific Name	Sites Present (out of 24)
Eurasian Carp	*Cyprinus carpio*	20
Round Goby	*Neogobius melanostomus*	10
Alewife	*Alosa pseudoharengus*	5
Goldfish	*Carassius auratus*	2
Rudd	*Scardinius erythropthalmus*	2

Table 13. Number of sites at which they were present and New York State conservation status for fish species of conservation need found in 2011 southern Lake Ontario wetland sites. SC=Special Concern.

Common Name	Scientific Name	Sites Present (out of 24)	Status
Redfin Shiner	*Lythrurus umbratilis*	1	SC

2012 Site List and Benchmarks

Dr. Douglas Wilcox and Brad Mudrzynski from The College at Brockport worked with members of the project management team and other regional PIs during the month of March to finalize Lake Ontario site assignments, including exchange of some site responsibilities. The College at Brockport team picked up six Lake Ontario sites in Canada to perform fish, aquatic macroinvertebrate, water quality, and vegetation sampling, while Bird Studies Canada picked up seven bird and amphibian sites initially assigned to The College at Brockport. These swaps were performed both to maximize the logistical efficiency of sampling and to ensure proportionally representative sampling across strata.

The College at Brockport's 2012 site list for fish, aquatic macroinvertebrate, water quality, and vegetation sampling contains 14 riverine, 6 barrier-protected, and 4 lacustrine wetlands for total of 24 sites. The bird and amphibian site list contains 16 riverine, 6 barrier-protected, and 3 lacustrine wetlands for a total of 25 sites. Both lists contain three benchmark sites that were chosen to assist other restoration and management activities that impact Great Lakes coastal wetlands. Yanty Creek (site 15) is located within Hamlin Beach State Park and will be

undergoing a restoration project to remove invasive *Phragmites* and create more nesting habitat for Black Tern (*Chlidonias niger*), a New York State-listed endangered species. Restoration is also being considered for Southern Sodus (site 7029) to lower nutrient levels within the wetland and eliminate cyanobacteria growth. Finally, Lakeview Pond (site 7020) was designated as a benchmark site to assist a follow-up study to the Lake Ontario/St. Lawrence River adaptive management study being conducted by the International Joint Commission. Data collected by designating these three sites as benchmarks will assist these current and future projects in conserving and restoring Lake Ontario wetlands. Finally, The College at Brockport will resample one 2011 site, Perch River (site 163), as assigned.

Summer Preparation and Crew Assignments

Preparation for 2012 fieldwork began during the month of March, with most of the preparation being targeted for bird and amphibian sampling. Bird and amphibian crew members were trained and recertified by Dr. Christopher Norment on 5-April. Numerous permits ranging from state-level collection permits to site-specific access permits have been secured or are in delivery. Finally, equipment checks and inventory are being performed and supply needs are being assessed to prepare for the summer fish, aquatic macroinvertebrate, water quality, and vegetation sampling.

Canadian and US Western Lake Erie Regional Team: Jan Ciborowski, Joseph Gathman, (Water Quality, Fish and Macroinvertebrates), Janice Gilbert (Vegetation), Doug Tozer (Birds and Amphibians), and Greg Grabas (north shore of Lake Ontario – Water Quality, Fish, Macroinvertebrates, Vegetation)

Site selection, field sampling, and results

All field data collected during the 2011 field season has been uploaded and QA'd. New sites for 2012 have been assessed by remote examination, and field work is just getting underway for birds and amphibians. Preliminary assessments of site accessibility and suitability for sampling by the other teams are partially complete. The appointment of a second field team should provide additional sampling capacity and ensure that the planned sampling quota for 2012 will be achieved. Sites will be visited on lakes Ontario, Erie and Huron (including North Channel and Manitoulin Island).

All fish, macroinvertebrate, macrophyte and water quality data were compiled and entered into the database and quality checked over the winter. A reciprocal exchange of macroinveretabrate specimens among labs is in progress to ensure consistency of identification.

Sampling for fishes in Canada requires approval by the University of Windsor's Animal Use Care Committee as well as permits for Scientific Collection of Aquatic Species (Ontario Ministry of Natural Resources), compliance with the Province of Ontario's Environmental Protection Act

(Ontario Ministry of Natural Resources), and Species At Risk (Fisheries & Oceans Canada), and Wild Animal Collection (Ohio Department of Natural Resources). Permit renewal applications are in progress to ensure approval by the start of the sampling season. Reports to the permit granting agencies were submitted and approved in late fall. Records of fishes caught were sent to local conservation and refuge managerial groups in Ontario and Ohio where appropriate. Fish data from vegetation-dominated wetland were analysed by Curtis Makish, Honours undergraduate thesis student, to assess the effect of *Phragmites* monocultures on fish species richness and community composition. Preliminary analyses indicate that the fish assemblages caught in fyke nets adjacent to *Phragmites* beds are very similar to catches made beside *Typha* (cattail) beds, and were distinct from the fauna of *Schoenoplectis* (bulrush) beds. These trends will be validated by examination of data from other Great Lakes sites sampled in 2011 and 2012.

Field Training

A training session for the Tozer team (birds and amphibians) was held on 26 March 2012 at Bird Studies Canada in Port Rowan, ON. Five people who will be collecting data for the project in 2012 attended. The training session consisted of an overview of the project's objectives and methodology; descriptions of the site selection and station placement methodology, including working through examples as a group with numerous discussion; detailed overview of the bird and amphibian survey field protocols, both the "classroom" and the field; overview of reporting, safety, and online data entry; and review of GPS use. The session ended with a test to assess each individual's comprehension of the topics covered. All individuals have successfully completed the online amphibian identification tests. The online bird identification tests are to follow shortly. For 2012 the Tozer bird and amphibian survey team consists of 3 crew members and 2 contractors. Three of the 5 individuals surveyed birds and amphibians for the project in 2011, so the majority of the crew is already familiar with the methodology and procedures. Amphibian surveys began on 2 April. Record-early temperatures this year may result in surveys being after peak calling for early-breeding amphibians at some locations.

Field crew members who worked with fishes, macroinvertebrates, and water quality sampling are being oriented for the coming field season during the last week of April 2012. Field training sessions will be held locally (Turkey Creek, ON). Four of the 6-person Windsor field crew from 2011 will be involved in field work in 2012, joined by 4 new workers, two or three of whom will become graduate students in fall 2012. The Canadian Wildlife Service will again have 7 personnel to conduct work on Lake Ontario in 2012. Training will include GPS use, determination of whether sites meet project criteria (open water connection to lake, presence of a wetland, safe access for crew), identification of vegetation zones to be sampled, collection of water quality samples (including preprocessing for shipment to water quality labs) and learning to calibrate and read field instruments and meters. Other instruction and testing will train new field crew in setting, removing, cleaning and transporting fyke nets, and protocols for collecting and preserving macroinvertebrates using D-frame dip nets and field-picking. Crews

will be instructed in field data sheet entry. All field personnel will be given refreshers in basic fish identification training. One new member (Jeffry Buckley) will take the Royal Ontario Museum course in fish identification, which is required of at least one team member in possession of an Ontario Scientific license to collect fishes. Crew leaders Jane Gilbert and Joseph Gathman had previously had extensive coursework in fish identification through the Royal Ontario Museum and Michigan State University, respectively. All field team members will receive field and lab safety training. Vegetation survey training will be led in early June by team leader Janice Gilbert near Windsor, ON. They will be introduced to the specific vegetation sampling methodology and data recording methods outlined in the QAPP.

ASSESSMENT AND OVERSIGHT

The project QAPP was approved and signed on March 21, 2011. It was reviewed this winter and updated. The update to the project QAPP ('Revision 3') was approved and signed on March 28, 2012. No major changes to the QAPP were made, and the majority of updates were clarifications of methodology based on our crews' collective experiences during Year 1. Other changes included reformulating some certification criteria and mid-season QA metrics. All Standard Operating Procedures (SOPs) were also updated and appended to QAPP Revision 3. Similar to the QAPP, changes to SOPs were mostly minor, including clarifications and additional detail based on our experience in Year 1.

Major QA/QC elements that were carried out over the previous 6 months include:

- Training of all new laboratory staff responsible for macroinvertebrate sample processing: This training was conducted by experienced technicians at each regional lab and was overseen by the respective co-PI or resident macroinvertebrate expert. Those labs without such an expert sent their new staff to the closest collaborating lab for training.

- Collection and archiving of all training/certification documents and mid-season QA/QC forms from regional lab: These documents have all been scanned to PDF and will be retained as a permanent record for the project.

- QC checks for all data entered into the data management system (DMS): Every data point that is entered into the DMS is being checked to verify consistency between the primary record (e.g., field data sheet) and the database. This has been completed for all data that has been entered into the database over the past six months, including macroinvertebrates and remaining water quality data.

- Macroinvertebrate QC checks: Each regional lab that is processing macroinvertebrate samples has 'blindly' traded samples with at least on other lab. Swaps were made between labs that sampled wetlands at a similar latitude to ensure familiarity with the taxa being evaluated. Labs sent two previously-processed samples with relatively high taxa diversity to their assigned QC lab, and then sent the corresponding IDs and counts to the QA managers. Each sample was contained in a single vial that was identified with a unique code that precluded the receiving lab from determining the site or vegetation zone that the sample originated from. The receiving lab will then process the sample as usual and send the IDs and counts to the QA managers. The QA managers will compare the original IDs with the QC IDs to determine correspondence between the two labs. Inconsistencies in taxa IDs will be resolved by a 3rd or 4th lab or by additional taxonomic experts, if necessary, depending on the nature of the discrepancies. At present, all labs have made the required sample swaps and many have completed the required processing. After QA managers compare original and QC taxa IDs and counts, and resolve discrepancies, they will communicate results and necessary corrections to the various labs and write a report that will be included in the next semi-annual report and distributed to all labs.

- Mid-season QC checks: The only mid-season QC check that was required over the previous six-month period was for macroinvertebrate processing. Regional lab leaders conducted these mid-season checks and were responsible for remedying any problems that were detected. The macroinvertebrate sample swaps are an additional measure to ensure consistent taxonomy.

- Creation/maintenance of specimen reference collections: Reference collections for macroinvertebrates, fish, and plants are being created or maintained by each regional team. Macroinvertebrate reference collections, in particular, were developed or expanded over the previous six months as these samples have been processed.

- Data Quality Objectives (DQO) for laboratory analyses: Participating water quality laboratories have generated estimates of precision, bias, accuracy, representativeness, completeness, comparability, and sensitivity for all water quality analyses. These metrics were calculated over the past six months and will be linked to the primary data that is being generated (see example report below).

- Bird and amphibian crews began their field season in late March. All training and certification of crew members was conducted prior to crew members working independently. Records of this training and certification are being compiled and archived at each respective regional lab as well as with the project QA managers.

Example Water Quality QC Information

Water quality analyses for 2011 from the NRRI Central Analytical Lab have been completed. All laboratory results from 2011 have passed the criteria shown below (Table 14) and all results have been entered into the GLIC-CWC database.

Table 14. Data acceptance criteria for water quality analyses.

QA Component	Acceptance Criteria
External Standards (QCCS)	± 10%
Standard curve	$r^2 \geq 0.99$
Blanks	± 10%
Blank spikes	± 20%
Mid-point check standards	± 10%
Lab Duplicates	± 15% RPD* for samples above the LOQ
Matrix spikes	± 20%

**Relative Percent Difference (RPD):* While our standard laboratory convention is to analyze 10% of the samples in duplicate and use %RSD (100 * CV) of the duplicates as a guide for accepting or rejecting the data, another measure of the variation of duplicates is RPD or: RPD = ((|x1-x2|)/mean) *100

Variability in Water Quality Field Replicates

An analysis of sampling variability is shown in Table 15. It is important to note that for many constituents, the variability within sample sets is related to the mean concentration, and as concentrations approach the method detection limit (MDL), the variability increases dramatically. A calculation of field replicate variability with values at or near the level of detection will often result in high RPDs. For example, if the chlorophyll measurements on a set of field duplicates are 0.8 µg/L and 0.3 µg/L, the mean is 0.6, resulting in an RPD of 91%, but since the MDL is ± 0.5 µg/L, this can be misleading. The same can occur with analyte lab duplicates, and in these instances the QA officer will determine whether data are acceptable. Table 15 and Figure 18 summarize the QA/QC data for 2011 and indicate that data quality objectives were met. Higher than expected RPDs were associated with a preponderance of near detection limit sample values.

Table 15. An assessment of sample variability in relative percent difference for water quality parameters with the acceptance criteria. The maximum expected RPD values are based on the MN Pollution Control Agency quality assurance project plan provided for the Event Based Sampling Program (http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/surface-water-financial-assistance/event-based-sampling-grants.html#for-grantees).

Analyte	MDL	Mean Value	Average RPD	Maximum expected RPD
Chlorophyll-a	< 0.5 µg/L	4.4 (n = 5)	*65.2	30
Phaeophytin	< 0.5 µg/L	5.3 (n = 5)	19.4	30
Total phosphorus	< 0.002 mg/L	0.43 (n = 5)	24.8	30
Ortho-phosphorus	< 0.002 mg/L	0.012 (n = 5)	13.7	10
Total nitrogen	< 0.010 mg/L	0.998 (n = 5)	10.9	30
NH4-N	< 0.002 mg/L	0.129 (n = 5)	**66.4	10
NO2/NO3-N	< 0.002 mg/L	0.070 (n = 5)	**48.3	10
True color	< 5 units	149 (n = 5)	7.7	10
Turbidity	< 0.4 NTU	5.3 (n = 4)	10.4	10
chloride	< 0.5 mg/L	14.1 (n = 5)	12.3	20
ANC	< 0.5 mg/L	123 (n = 4)	2.9	10

*7 out of 10 of the chlorophyll field replicates were < 2 µg/L or 4 times the MDL (range 0.3 – 1.8).
**The variability between ammonium-N and nitrate/nitrite-N field replicates also exceeded the criteria however 6 out 10 values for each were < 10 X the MDL (i.e. < 0.02 mg/L). More detail can be found in Figure 18.

Project_ID	Lake Name	QA sample	Site	Date Sampled	Chl (ppb)	%RPD	Phaeo (ppb)	%RPD
GLCW	1062		Wild Rice	8/3/2011	0.8	91	0.8	0
GLCW	1062	Fld Rep	Wild Rice	8/3/2011	0.3		0.8	
GLCW	1519		spike rush	7/15/2011	1.4	25	0.7	44
GLCW	1519	Fld Rep	spike rush	7/15/2011	1.8		1.1	
GLCW	1523		wet meadow	7/12/2011	1.4	7	0.6	0
GLCW	1523	Fld Rep	wet meadow	7/12/2011	1.3		0.6	
GLCW	7049		Open	8/25/2011	0.9	147	1.9	42
GLCW	7049	Fld Rep	Open	8/25/2011	5.9		2.9	
GLCW-SUNY	130		SAV	7/27/2011	10.9	56	23.1	11
GLCW-SUNY	130	Fld Rep	SAV	7/27/2011	19.3		20.7	
					avg	65.2		19.4

Project_ID	Lake Name	QA sample	Site	Date Sampled	TP (mg/L)	%RPD	oP (mg/L)	%RPD	TN (mg/L)	%RPD	NH4-N (mg/L)	%RPD	NO2/NO3	%RPD
GLCW	1062		Wild Rice	8/3/2011	0.031	9	0.007	13	0.357	6	0.018	77	0.000	200
GLCW	1062	Fld Rep	Wild Rice	8/3/2011	0.034		0.006		0.379		0.008		0.001	
GLCW	1519		spike rush	7/15/2011	0.008	13	0.002	0	0.398	2	0.019	5	0.060	17
GLCW	1519	Fld Rep	spike rush	7/15/2011	0.007		0.002		0.388		0.018		0.071	
GLCW	1523		wet meadow	7/12/2011	0.023	16	0.003	50	1.642	2	0.019	116	0.000	0
GLCW	1523	Fld Rep	wet meadow	7/12/2011	0.027		0.005		1.672		0.071		0.000	
GLCW	7049		Open	8/25/2011	0.075	4	0.031	0	1.686	10	0.600	24	0.263	4
GLCW	7049	Fld Rep	Open	8/25/2011	0.072		0.031		1.531		0.472		0.274	
GLCW-SUNY	130		SAV	7/27/2011	0.105	81	0.018	5	1.131	34	0.052	110	0.016	21
GLCW-SUNY	130	Fld Rep	SAV	7/27/2011	0.044		0.019		0.799		0.015		0.013	
					avg	24.8		13.7		10.9		66.4		48.3

Project_ID	Lake Name	QA sample	Site	Date Sampled	color (pt-(	%RPD	Turbidity (NTU	%RPD	Cl (mg/L)	%RPD	ANC	%RPD	turbidity	%RPD
GLCW	1062		Wild Rice	8/3/2011	90	1	11.4	7	1.3	1	87.4	0	34.7	13
GLCW	1062	Fld Rep	Wild Rice	8/3/2011	91		10.6		1.3		87.4		39.4	
GLCW	1519		spike rush	7/15/2011	34	21	1.2	18	10.5	2	117.7	1	2.1	40
GLCW	1519	Fld Rep	spike rush	7/15/2011	27		1.0		10.7		117		1.4	
GLCW	1523		wet meadow	7/12/2011	304	2	1.7	6	7.7	8	217.1	1	23.2	49
GLCW	1523	Fld Rep	wet meadow	7/12/2011	311		1.6		7.1		215.5		14	
GLCW	7049		Open	8/25/2011	227	4	7.2	10	34.6	49	77.6	11	18.7	22
GLCW	7049	Fld Rep	Open	8/25/2011	237		8.0		21.0		86.2		23.4	
GLCW-SUNY	130		SAV	7/27/2011	79	10			23.8	2	115	3	2.2	19
GLCW-SUNY	130	Fld Rep	SAV	7/27/2011	87				23.4		112		2.65	
					avg	7.7		10.4		12.3		2.9		28.6

Summary	chl	phaeo	TP	oP	TN	NH4	NO3/NO2	color	turbidity	chloride	ANC
n	5	5	5	5	5	5	5	5	4	5	4
avg RPD	65.2	19.4	24.8	13.7	10.9	66.4	48.3	7.7	10.4	12.3	2.9

Figure 18. QA/QC summary tables for Coastal Wetland Monitoring water quality field duplicates.

Communication among Personnel

Regional team leaders and co-PIs continue to maintain close communication as the project enters into the second year of data collection. All major project members met in Detroit on February 9, 2012 to discuss and resolve methodological questions that arose after the first year of sampling. QAPP and SOP edits were also discussed and largely agreed upon during the meeting. All remaining QAPP/SOP issues were resolved via e-mail and conference calls following the February meeting.

Good communication has also been maintained among technical staff responsible for processing macroinvertebrate samples. For example, many phone calls and e-mails have been exchanged between staff to resolve taxonomic questions as they arise. Additionally, numerous staff members have traveled to other regional labs to work side-by-side with other project taxonomists to ensure consistent IDs. We will continue to maintain this level of communication among staff members as it promotes consistency among labs.

From the QA managers' perspective, the first full year of the project was highly successful. The quality management system developed for this project has been fully implemented and is

functioning well. The current version of the QAPP and SOPs (Revision 3) is an improvement over the previous version in that some minor inconsistencies have been eliminated and additional clarification has been added. We anticipate that very little revision will be required in subsequent years, though we will review each protocol carefully each year to determine whether improvements can be made.

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