GLIC: Implementing Great Lakes Coastal Wetland Monitoring

Semiannual Progress Report

April 1, 2011 – September 30, 2011

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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 for our first year have 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. All primary project personnel met in mid-January of 2011 to work through methods and details of all aspects of the project and training session for all groups occurred from March through June of 2011. Sampling went well for all taxa groups and teams, with all teams passing their training requirements and then passing their mid-sampling QA checks.

PROJECT ORGANIZATION

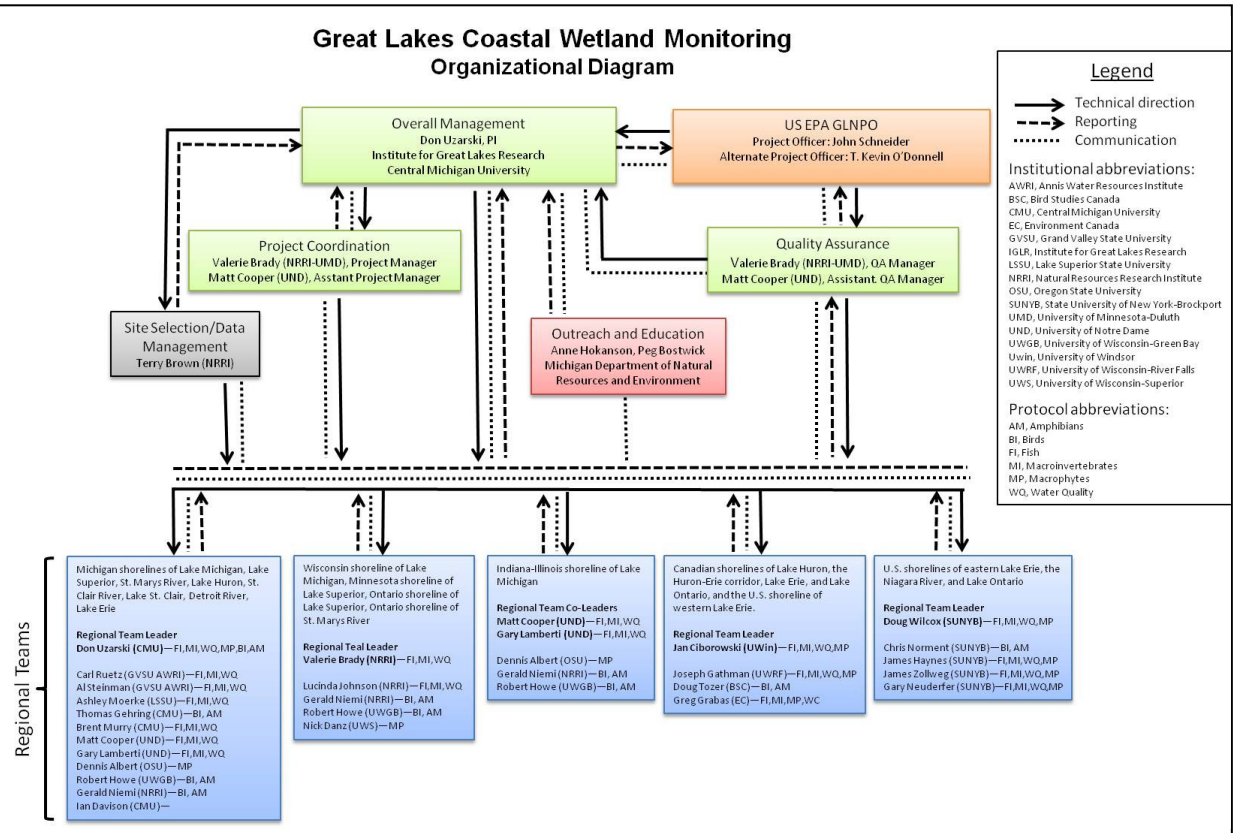

Figure 1. Organizational chart for the project showing lines of technical direction, reporting, and communication separately.

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 Ryan Archer of Bird Studies Canada has been replaced by Doug Tozer. At the Michigan Department of Environmental Quality, Peg Bostwick has retired and been replaced by Anne Hokanson.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 other major personnel changes have taken place during this reporting period.

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.

	'10	2011				2012				2013				2014				2015			
Tasks	**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

TRAINING

All personnel responsible for sampling invertebrates, fish, macrophytes, birds, amphibians, and water quality received training and were certified prior to sampling. A multi-level training and certification program was implemented to ensure accuracy of all collected data. A series of 2-day training workshops led by experts on each respective protocol were held in the spring through early summer at several locations across the basin. Workshop agendas included training on how to meet the data quality objectives for each element of the project, QAPP review, site verification procedures, hands-on training for each sampling protocol, record-

keeping and archiving requirements, data auditing procedures, and certification exams for each sampling protocol. All project co-PIs, field crew leaders, and many summer staff participated in these workshops and were certified on sampling protocols.

Training for bird and amphibian field crews began in March and was completed in May. Training took place at 3 locations (east, central, and west) across the basin to minimize crew travel costs and ensure that as many crew members as possible could attend. Crews were trained in conducting the survey, travel procedures and field safety. All individuals who were involved in doing the counts were tested and passed the amphibian call test, the bird vocalization test, and the bird visual test that was established on the web site. The test was based on an on-line system established at the University of Wisconsin, Green Bay – see http://www.birdercertification.org/GreatLakesCoastal. In addition, individuals were trained for proficiency in completing field sheets and audio testing was completed to insure their hearing was within the normal ranges. Field training was also completed to insure the following of the guidelines in the QAPP: rules for site verification, safety issues including caution regarding insects (e.g., Lyme's disease), GPS and compass use, and record keeping.

Training workshops for fish, macroinvertebrates, and water quality included a half-day in a classroom to review field and laboratory protocols and address questions by co-PIs and crew leaders. All personal were expected to study the project QAPP and relevant SOPs prior to the training. Based on the questions raised, it was clear that most individuals were prepared for the training. The afternoon of the first day included in-field demonstrations of setting fyke nets, sampling invertebrates and water quality, and collecting covariate data. Crews then returned to the classroom or laboratory to practice preparing water samples, titrating for alkalinity, and filtering for chlorophyll. On the second day, crews returned to the field to pull fyke nets and identify captured fish. Crews were then required to demonstrate their ability to appropriately conduct each field protocol, including locating areas to sample, delineating vegetation zones, setting fyke nets, and sampling invertebrates, water quality, and the other covariates. By demonstrating proficiency in these tasks, in addition to properly identifying live fish (or photographs in cases where an insufficient number of species were collected), crew members were certified in each respective protocol.

Training workshops for plants included a half-day in-office review of field sampling and plant curation protocols by co-PIs. Workshops were attended by co-PIs, crew leaders, and some crew staff. All personnel were provided the project QAPP and plant SOP prior to the meeting. Revised plant sampling forms were provided at the workshop. In the afternoon, a field session was held to discuss and demonstrate GPS data collection, transect location and orientation, and plant and physical data collection. Plant identification and sampling proficiency was not part of the original training, but was conducted by team leaders with their individual sampling teams at a later date.

In addition to the formalized workshops provided to project team members, each crew leader/co-PI provided additional on-the-job training to new crew members. This represents the 'multi-level' aspect of the project training and certification program. It is essential that individuals in leadership/supervisory positions have the ability to provide additional training and certification to their crew members when necessary and this structure worked well during the first sampling season. No crew members were allowed to sample unsupervised until they had successfully passed the appropriate tests and were certified. The project lead PI (Uzarski) and QA officers (Brady and Cooper) were briefed throughout the field season via conference calls and emails and all indications suggest that the training system was adequate in preparing field staff for the season.

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

Certification

To be certified in a given protocol, individuals were required to pass a practical exam. Certification exams were conducted in the field in most cases, either during training workshops or during site visits early in the season. When necessary, exams were supplemented with photographs (for fish, vegetation) or audio recordings (e.g., bird and amphibian calls). Passing a given exam certified the individual to perform the respective sampling protocol(s). Since not every individual was responsible for conducting every sampling protocol, participants were tested on the protocols for which they were responsible. Personnel who were not certified (e.g., part-time technicians, new students, volunteers) were not allowed to work independently nor to do any 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 was considered adequate for certification. Training and certification records for all participants were 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 would require 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 archived copies of the testing and certification records of all field crew members. Summaries of these records were also archived with the lead PI (Uzarski), and the QA managers (Brady and Cooper).

SITE SELECTION

Site selection was completed in May and most of the site selection information reported below was included in the previous semi-annual report. We include the summary below as review for completeness.

Site Selection Tool Development

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 1039 for randomized sampling over a five-year rotating panel design.

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 were used for site selection:

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 (< 3 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).

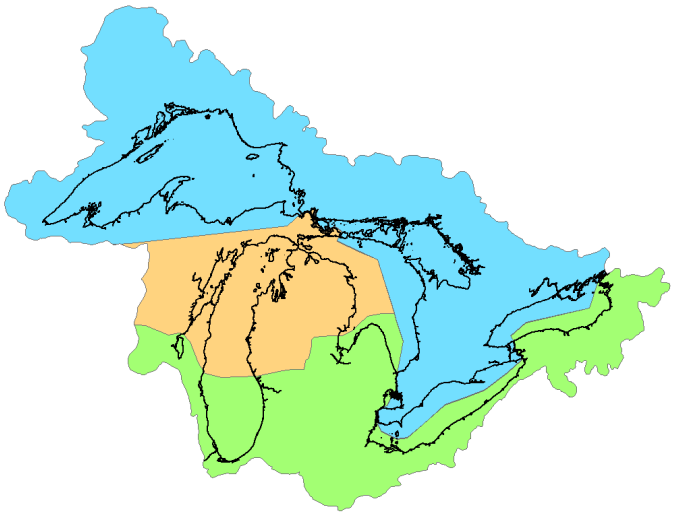

Figure 2. Divisions of lakes into regions. Note that stratification is by region *and* lake, so northern Lake Erie is not the same region as Lake Superior, etc.

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 (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.

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 2. 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 2. 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.

Name	Description	Data_level
too many	Too far down randomly-ordered list, beyond sampling capacity for fish / invertebrates / vegetation (in theory, bird and amphibian crews have the capacity to sample all assigned sites each year).	-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).

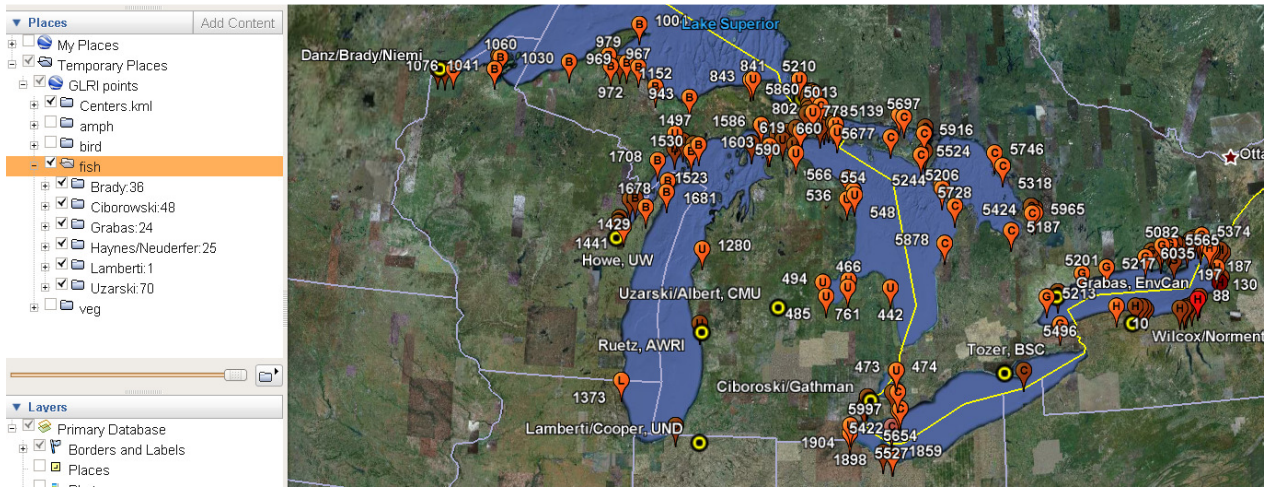

Figure 3. Wetland distribution (orange teardrops) versus regional team bases (yellow circles, one obscured at Ste. St. Marie, Michigan. The Google Earth view is shown.

Field maps

Three-page PDF maps were generated for each site. The first page depicted 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 showed the location of the waypoint provided for the site. The second page indicated the site location on a road map at local and regional scales. The third page listed information from the database for the site, including tags, team assignments, and the history of comments made on the site.

Browse map

The browse map feature allowed 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 were also shown when available. The browse map provided tools for measuring linear distance and area. When a site was clicked the tool displayed 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.

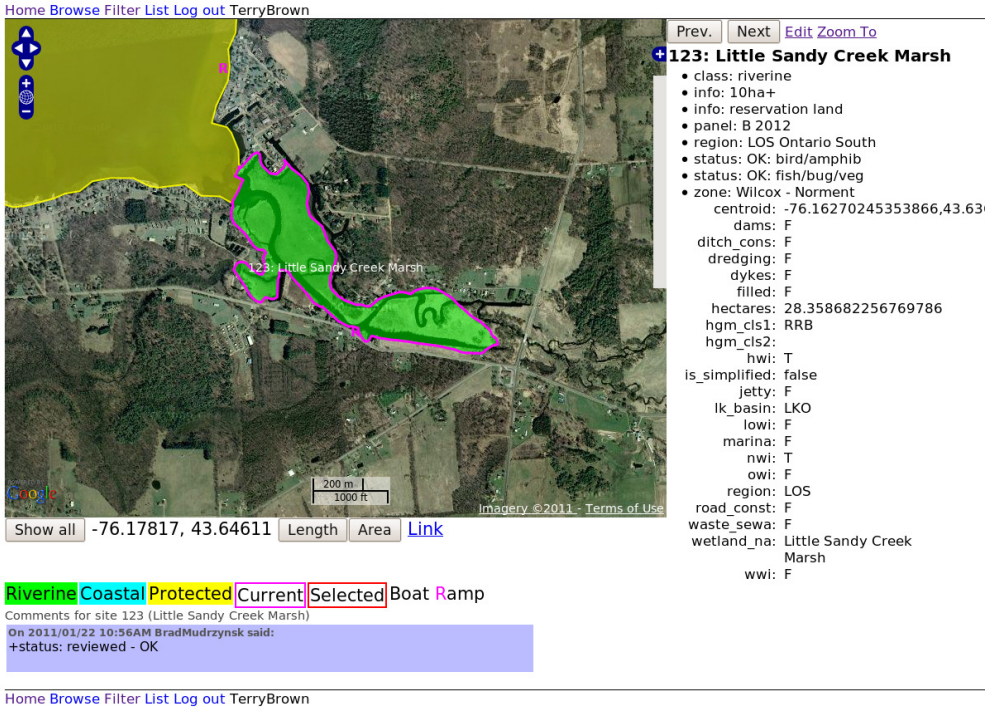

Figure 4. Screen capture of the site selection tool in use for site 123. This level shows the site, adjacent sites, and a panel of information about the site.

Site Selection in Practice

Regional team leaders and their staff each worked through all of the sites in their zone using the site selection tool. It was necessary for all sites to be evaluated for selection/rejection prior to sites being randomized into panels to preserve the validity of the statistical design. Thus all 2768 sites (Figure 5) were scrutinized multiple times by multiple people to ensure adherence to the site rejection rules.

Individuals primarily responsible for site selection/rejection by regional field team:

Western Great Lakes	Valerie Brady/Gerald Niemi
Central Great Lakes (US side)	Don Uzarski/Carl Ruetz/Robert Howe/Tom Gehring/Matt Cooper
Central Great Lakes (CA side)	Jan Ciborowski/Joseph Gathman/Ryan Archer/Gerald Niemi
Eastern Great Lakes (US side)	Doug Wilcox/ Brad Mudrzynski/Chris Norment
Eastern Great Lakes (CA side)	Jan Ciborowski/Joseph Gathman/Greg Grabas/Ryan Archer

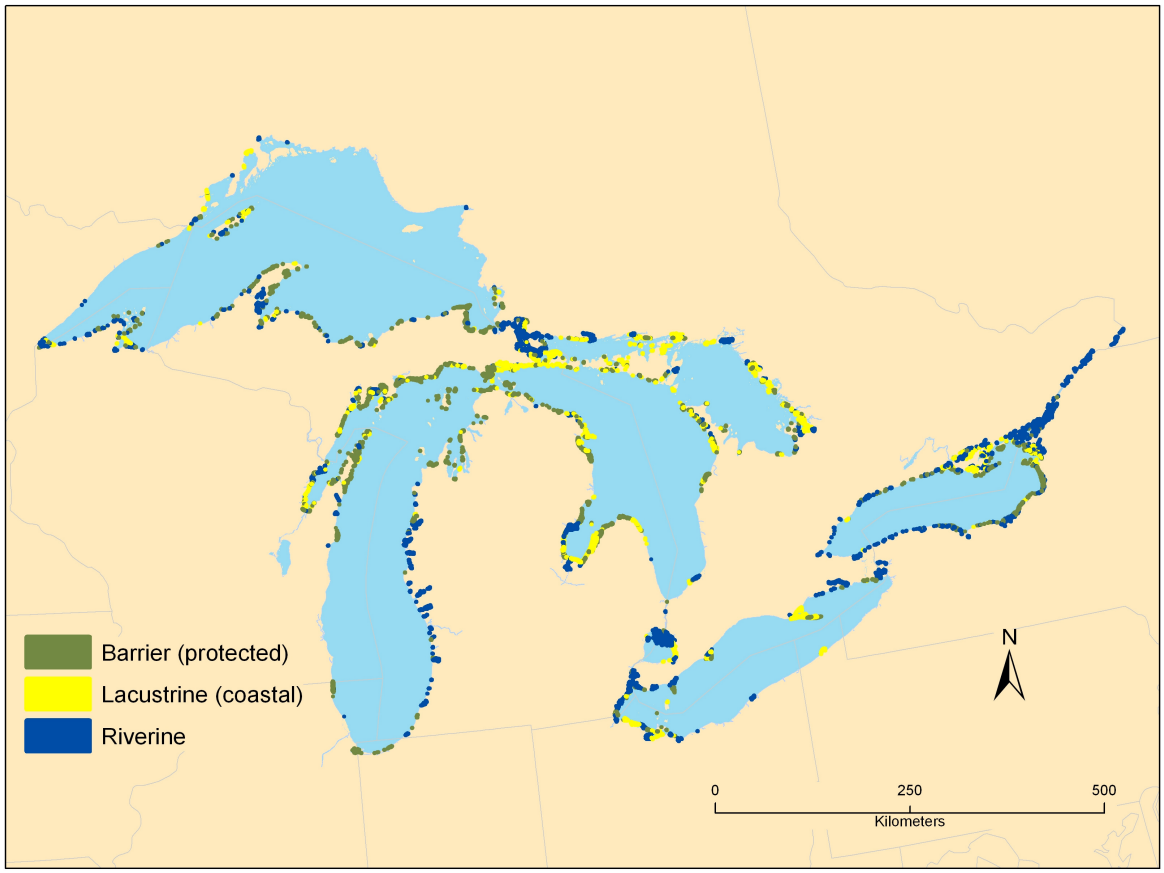

Figure 5. All 2768 wetland polygons in the original GLCWC wetland polygon layer, color-coded by wetland type.

Many sites were rejected because they were below the 4 ha cutoff, with lesser numbers rejected because of lack of lake connection or influence, and even fewer sites rejected because of access issues (Table 3). The result was 1039 sites selected for sampling over the next 5 years (Figure 6). All rejected sites were subjected to extra scrutiny by the QA managers (Brady and Cooper) to ensure that site rejection rules were being applied consistently across the basin. When inconsistencies were noted, regional team leaders were asked to re-examine the sites in question and either accept the sites back into the sampling pool or provide additional justification for site rejection. Only a few dozen instances of inconsistent site rejections were found, and most were easily rectified.

Table 3. Site exclusion reasons and counts. Many sites had multiple reasons for exclusion.

Exclusion	Count
< 4 ha	939
Barrier ridge swale	151
Forested	108
No access	132
No lake influence	4
Not connected	411
No wetland	14
St. Lawrence Seaway	243

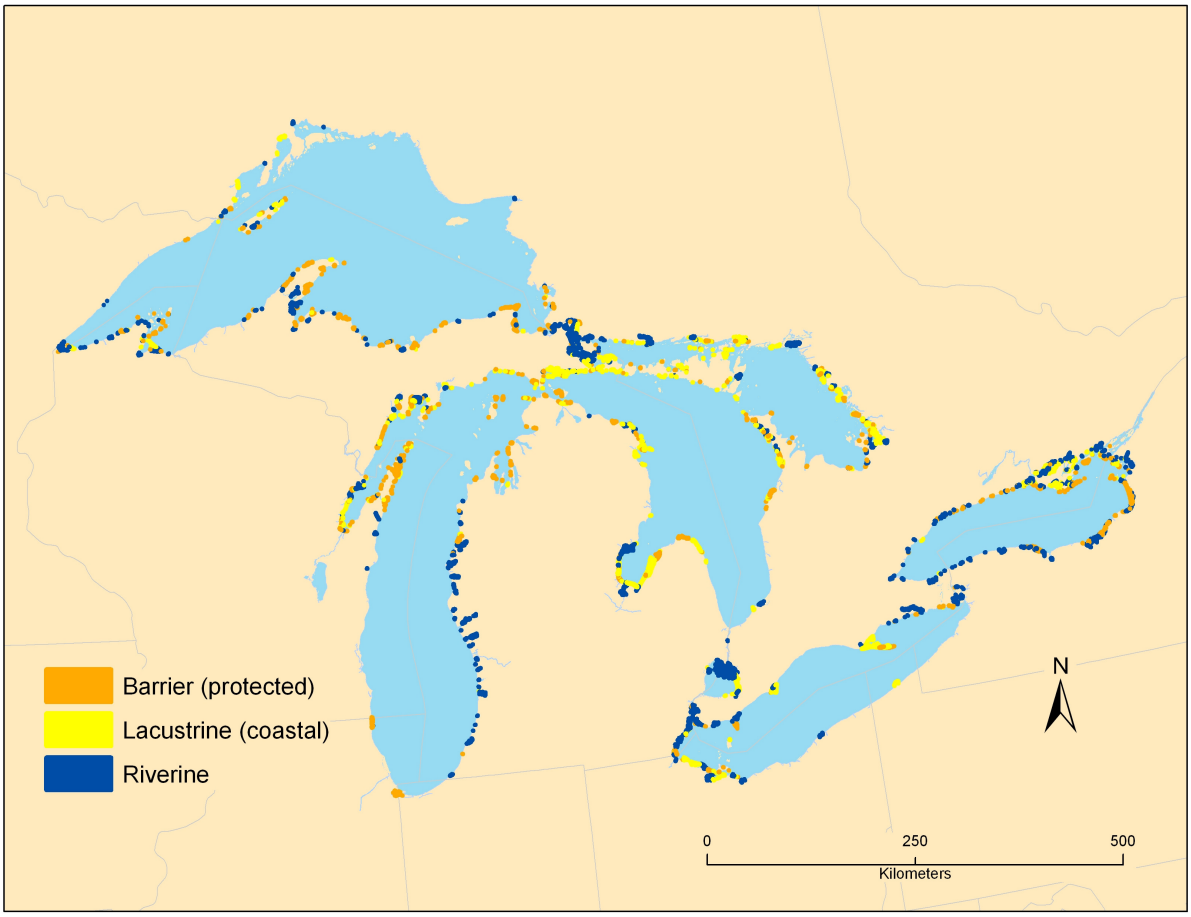

Figure 6. 1039 wetland polygons selected for sampling over the 5 year project, color-coded by wetland type. Note the profound interaction of lake and wetland type.

Once site selection was completed by the regional team leaders, Dr. Terry Brown randomized the sites into panels (sampling years, see previous section), resulting in approximately 208 sites to be sampled per year (Figure 7). Some regional team leaders did not feel that they could get their crews to island sites in the first sampling year because of the logistical difficulties on top of the rigors and logistics of dealing with the first field season. Thus, these teams swapped out island sites into future years for sites of the same type (barrier-protected, lacustrine, or riverine) from the same region of the lake. This will allow island sites to be dealt with in the future without simple "skipping" them, giving teams the time they need to work out sampling logistics in the first year, and finalize safe travel to islands in future years.

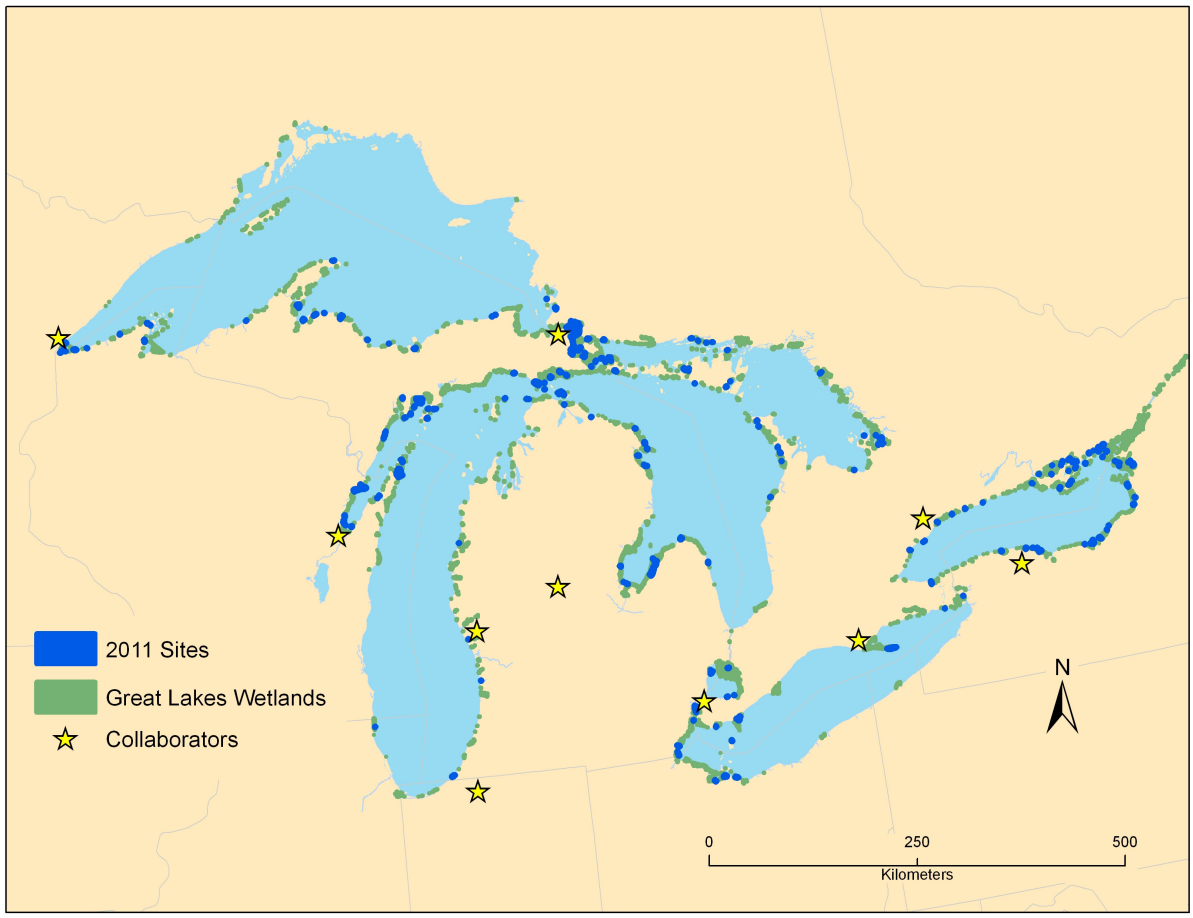

Figure 7. Wetland polygons selected for sampling in 2011, along with location of field crew bases of operation.

Wetlands have a “clustered” distribution around the Great Lakes due to geological differences. Several teams ended up with fewer sites than they had the capacity to handle, while other team’s assigned number of sites exceeded their sampling capacity. Within reason, teams with excess sampling capacity were asked to expand their sampling boundaries to assist neighboring over-capacity teams to maximize the number of wetlands that would be sampled. The site selection and site status tools were used to make these swaps. The final distribution of 2011 sites by teams is shown in Figure 8.

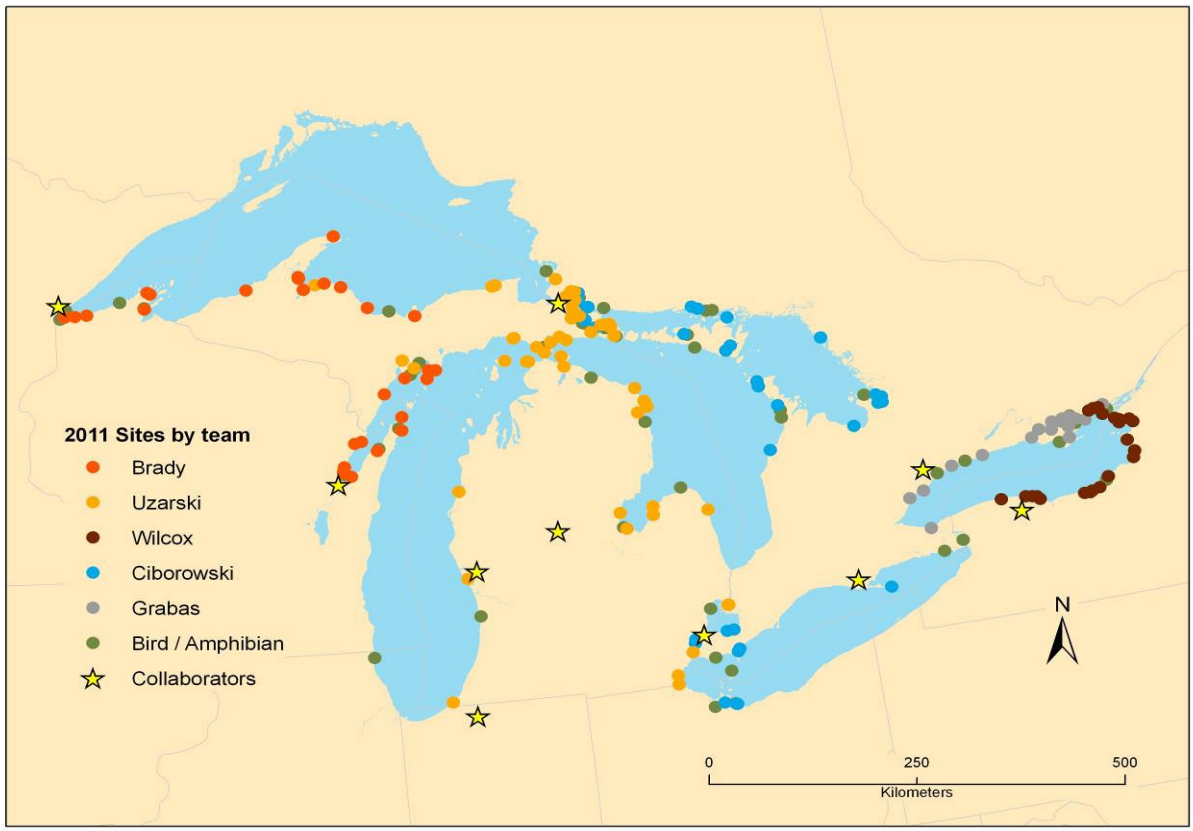

Figure 8. Wetland polygons assigned to be sampled in 2011, color-coded by regional team leader. Sites assigned only to bird and amphibian crews (due to their greater sampling capacity) are shown in green. Field crew bases of operation are also shown.

2011 SAMPLING

In 2011, crews visited and sampled 176 sites from Duluth, Minnesota, on western Lake Superior, to the mouth of the St. Lawrence Seaway at the eastern end of Lake Ontario (Table 4, Figure 9). Because riverine wetlands are the most abundant wetland type in our sample set, they were the most sampled, followed closely by lacustrine wetlands. Barrier wetlands often are small and/or lack an unregulated surface water connection to a Great Lake or connecting channel, which means that these wetlands were less likely to be sampled.

Table 4. Wetlands sampled in 2011 by wetland type.

Wetland Type	Sites Sampled
Barrier (protected)	32
Lacustrine (coastal)	67
Riverine	77
Grand Total	**176**

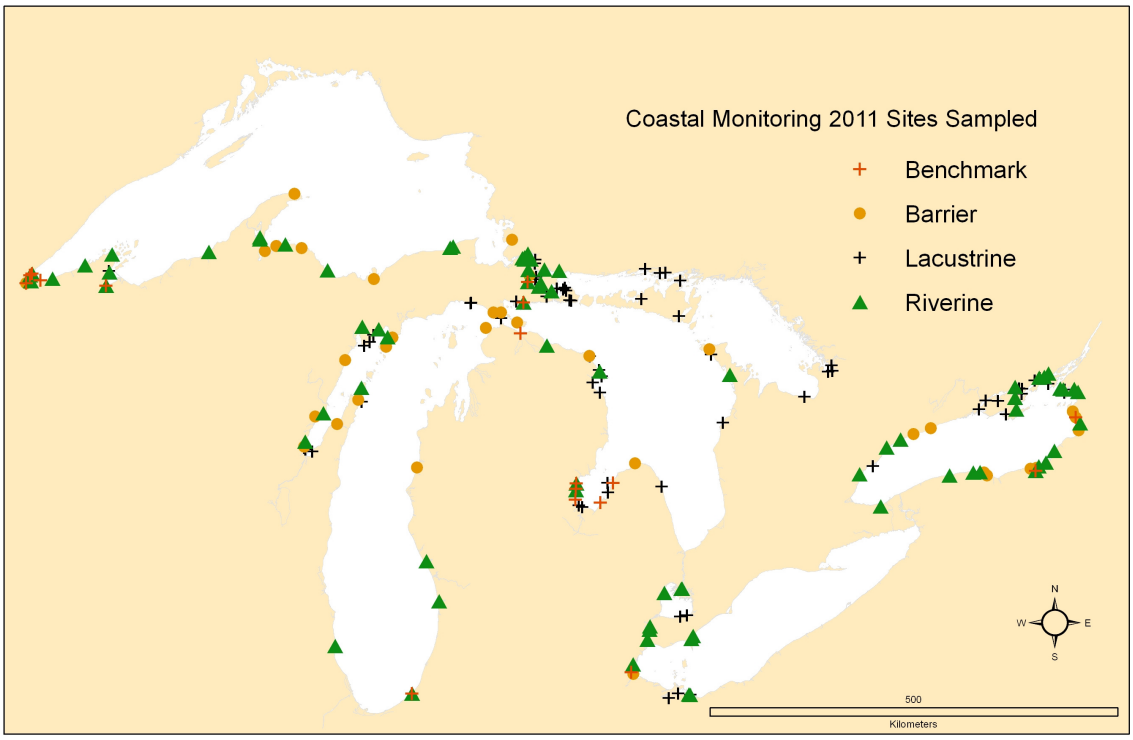

Figure 9. Wetland polygons actually sampled in 2011, color-coded by wetland type. Benchmark sites are marked with red + symbols rather than by their site type.

Teams also identified a number of important sites to sample that should either be sampled more than once in 5 years, or that would not be sampled at all because of size or that a wetland no longer exists at the site. These "benchmark" sites (Figure 9) typically are either sites that are being restored, sites that are very regionally important or in line to be protected, or sites that are especially data-rich. Seventeen benchmark sites were sampled in 2011, and many of the agencies and groups working on these wetlands are very happy to have pre-restoration data provided to them at no cost, and are hopeful that we can get back to some of these sites after restoration is complete (see attached letters). As anticipated, the bird and amphibian crews were able to move the fastest even though they visited each site five times, so these wetland components were sampled at the most sites (Table 5). Invertebrates and water quality were the next most sampled components at sites.

Table 5. Number of wetlands sampled for each component in 2011.

Taxa Group	Sampled
Amphibians	150
Birds	153
Fish	108
Invertebrates	118
Vegetation	104
Water Quality	118

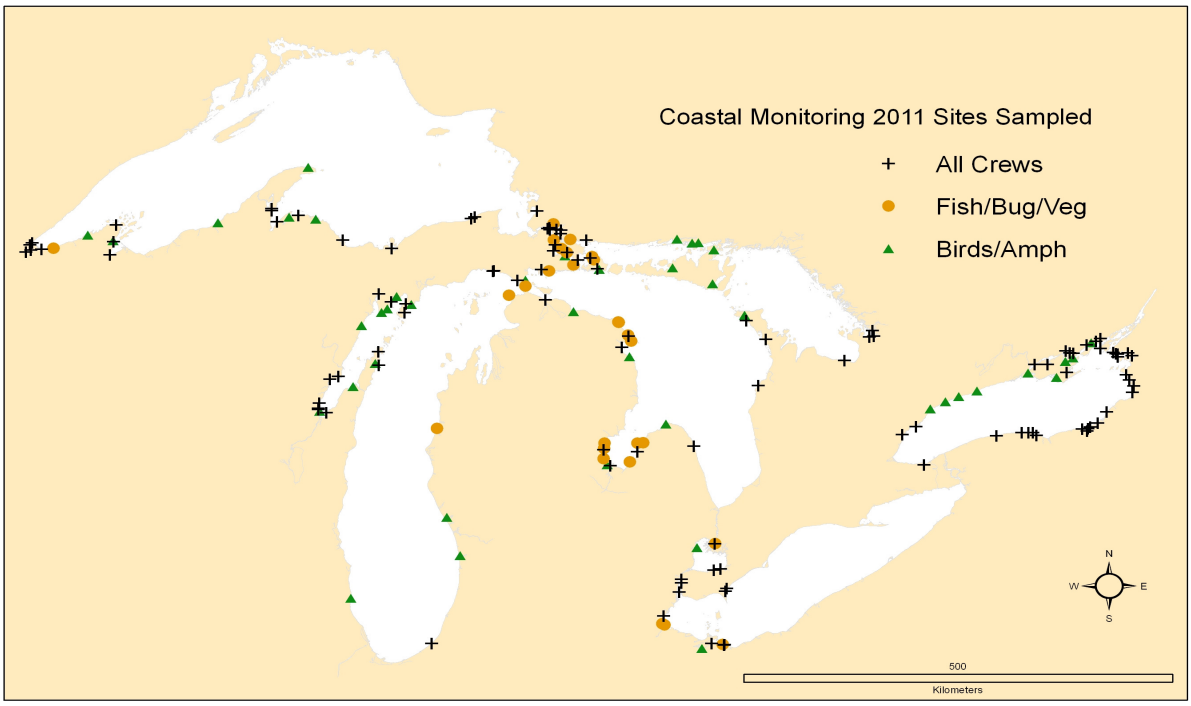

Figure 10. Wetland polygons actually sampled in 2011, color-coded by sampling crew. Sites sampled for most major wetland components are marked by + symbols.

The careful stratification built into the site selection process allowed us to spread our sampling out over and lakes and wetland types quite well, corresponding to the proportions of total wetlands and wetland types found on each lake (Figure 10,Tables 6 and 7).

Table 6. Wetlands sampled on each lake for each component. Wetlands in connecting channels are assigned to the downstream lake.

Taxa Group	Erie	Huron	Michigan	Ontario	Superior
Amphibian	14	42	26	42	23
Bird	14	43	27	43	23
Fish/Bug	13	39	15	34	17
Vegetation	14	38	17	34	18

Table 7. Wetland types sampled for each component.

Taxa Group	Barrier	Lacustrine	Riverine
Amphibian	28	52	67
Bird	28	53	69
Fish/Bug	15	41	62
Vegetation	21	44	56

WEB-BASED DATA ENTRY SYSTEM

A web based data entry system was developed 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 11. Each data entry web form is password-protected, with passwords assigned and tracked on an individual basis.

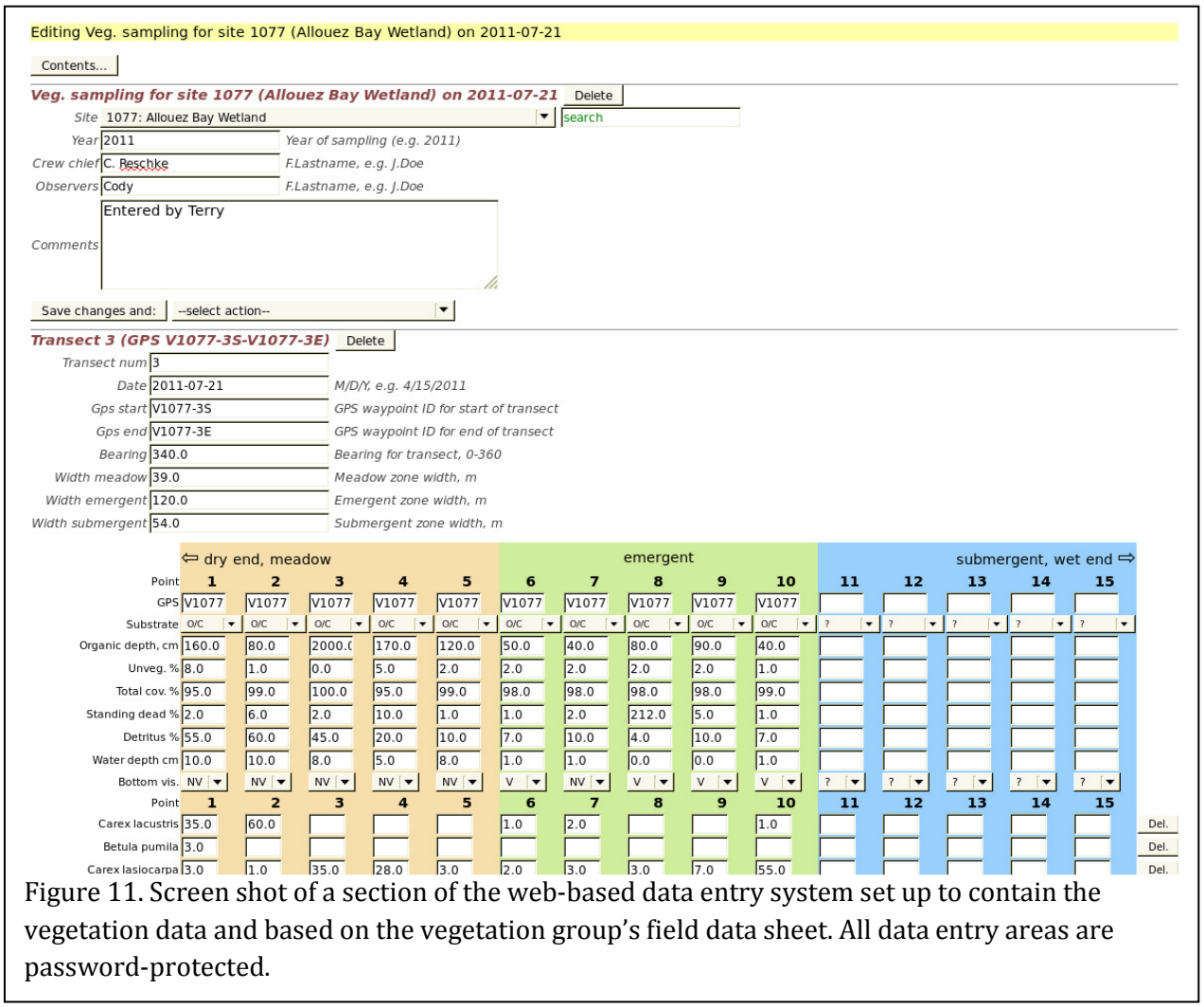

Figure 11. Screen shot of a section of the web-based data entry system set up to contain the vegetation data and based on the vegetation group's field data sheet. All data entry areas are password-protected.

Features of note include:

- fine-grained access control with individual user logins
- 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

A web-based data retrieval system is under development, using the same technologies, and is already being used to deliver data to PIs within the project (Figure 12).

Figure 12. 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 QA/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 is being given access to the retrieval system and data, located at http://beaver.nrri.umn.edu/glrimon/dv/folder/. User-specific logins will be sent to the project officers via email. Because the system is still under development and QA has not yet been completed on first-year data, we ask that the data not be shared as yet. Also note that macroinvertebrate data have not yet been added to the system because identifications are still underway. 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 13). Other features are only visible to those with a password.

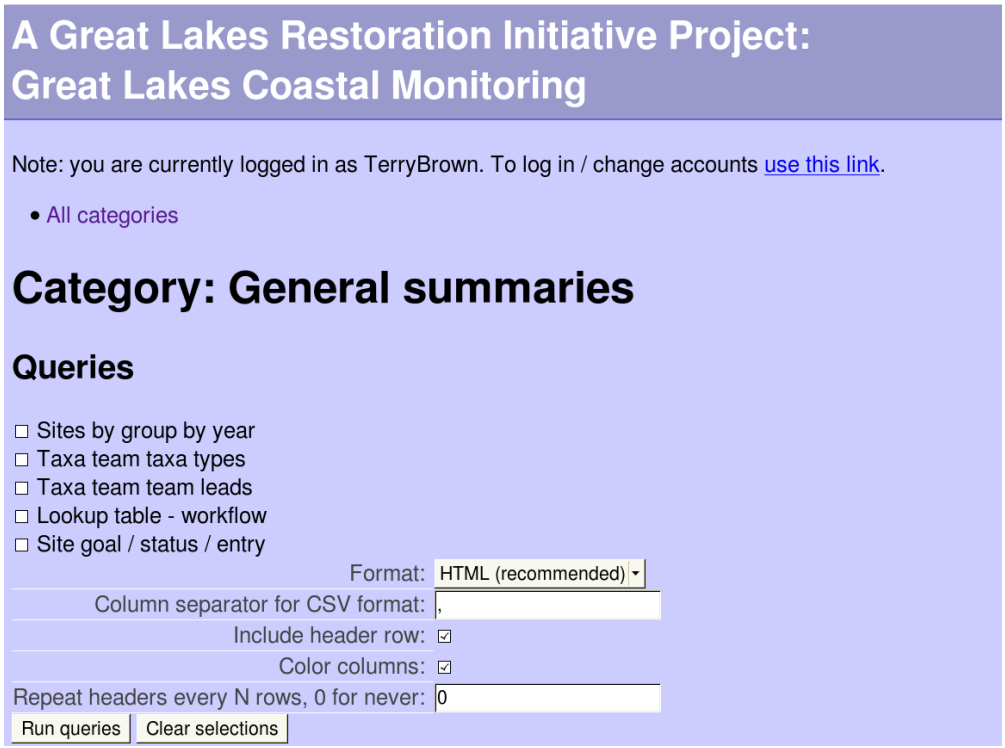

Figure 13. The General Summaries queries are available to all on the data retrieval section of the website. Retrievals of actual data are password-protected until data QA/QC is complete.

Additional features are either under active development or planned for the data retrieval system. The need for some of these features was identified at a stakeholder meeting at the Michigan Wetlands Association Annual Conference, Aug. 30-Sep. 2, 2011. These 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).

WATER QUALITY

Water quality efforts began by focusing on: WQ sample point determination within wetlands; sampling protocols; field parameters and instrumentation needs; parameters to be measured in the field; parameters to be sent to laboratories; development of detailed Standard Operating Procedures (SOPs) for training of field crews; and the creation and approval of a comprehensive Quality Assurance Project Plan (QAPP).

WQ sampling points

Criteria were established for selecting water sampling points within each wetland site, which group would perform the WQ measurements, and whether samples would be discrete or composites from several locations within a specific location. Decisions were based upon a compromise between wanting to capture accurate measurements with the need to keep sample numbers and processing times affordable by crews. Discrete samples, based on up to three pooled samples, were collected from vegetation zones and located adjacent to fish and macroinvertebrate sites. Fish/invertebrate field crew members performed the sampling and field measurements after receiving proper training. Samples for laboratory processing were given proper preservation treatments by the field crew in the evening and returned to the water quality laboratories for processing.

Parameters

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

Water Quality portion of the Quality Assurance Project Plan

The QAPP for the project included measurement protocols, recommendations for field instruments and water sampling supplies, and logistical recommendations to achieve QA/QC requirements that conformed to EPA-EMAP, EPA- National Wetland Assessment (new), USGS-NWQA, National Park Service- Great Lakes Network Vital Signs Monitoring Program, and the previous Great Lakes Coastal Wetlands Consortium (GLCWC) and Great Lakes Environmental Indicators (GLEI) projects. The minimum detection limits and Data Quality Objectives (DQO) also conform to the EPA-Clean Water Act (NPDES) requirements for field and lab measurements and, therefore, to the Great Lakes State Lab certification requirements.

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)

Field Training

The training for amphibians was held on April 29, 2011. Crews were trained in conducting the survey, travel procedures and field safety. Bird crew training took place May 23 – 26. All individuals who were involved in doing the counts were tested and passed the amphibian call test, the bird vocalization test, and the bird visual test that was established on the web site. The test was based on an on-line system established at the University of Wisconsin, Green Bay – see http://www.birdercertification.org/GreatLakesCoastal. In addition, individuals were trained for proficiency in completing field sheets and audio testing was completed to insure their hearing was within the normal ranges. Field training was also completed to insure the following of the guidelines in the QAPP: 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 sampling training occurred on June 13-15 in Duluth, Minnesota. Training included GPS use, determination of whether sites met 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 were also trained in field data sheet use. Crews were tested for mastery of all of these parameters and for their ability to identify fish. Crew members were also given University field and lab safety training. Finally, crews did a mock sampling of a site to ensure that they had gained the skills necessary to successfully and correctly sample wetlands.

Vegetation survey training was also held June 13-14 in Superior, Wisconsin. Training included an introductory PowerPoint presentation containing the significant training issues as well as images of the types of field situations that would be encountered. A lengthy question-answer period was held to clear up misconceptions. Field training occurred at wetland sites in Allouez Bay, where the crew practiced plant identification, species cover estimation, GPS use, transect lay-out procedures, and field sheet completion. Two weeks later, field crews were given individual tests for wetland plant species identification, where all crew members sufficiently passed QA/QC standards. Mid-season, crews were evaluated for their successful completion of surveys.

Site Sampling

Site selection results: The bird and amphibian group ended up with 53 sites to sample, stretching from the Duluth-Superior harbor area eastward along the south shore of Lake Superior to the eastern end of the Upper Peninsula of Michigan. This includes 5 benchmark sites. The fish and macroinvertebrate and vegetation crews ended up with 33 sites to sample, including 9 barrier-protected wetlands, 8 lacustrine wetlands, and 16 riverine wetlands. This includes 3 benchmark sites. Their sampling range extended from the Duluth-Superior harbor eastward to the eastern side of Green Bay, Wisconsin, and the east side of the Keewenaw Peninsula of Michigan.

Benchmark sites were selected because they are of interest for restoration potential. Three of the sites, located in the St. Louis River Estuary, are in some stage of planning for restoration work. Restoration activities for the sites are being coordinated by the Minnesota Pollution Control Agency and the US Fish and Wildlife Service, with many collaborators from multiple agencies and university research groups (see attached letters of support).

Bird and amphibian sampling: Reconnaissance of the 57 potential bird/amphibian sites was completed prior to sampling. The bird and amphibian field crews group sampled a total of 37 sites in Lake Superior and the northern region of Lake Huron. Each site was visited a total of five times, including 3 counts for amphibians and 2 counts for birds. Some sites were rejected for the following reasons: 1) inaccessible or unsafe areas for entry, including island situations; 2) no trespassing signs and owners could not be contacted; or 3) wetland areas were unsuitable for

sampling for amphibians or birds. Amphibian crews started sampling on May 1 and bird surveys began May 27, and sampling was completed by mid-July, 2011.

Fish and macroinvertebrate sampling: For fish sampling, the University of Minnesota Institutional Animal Care and Use Committee application was approved. Scientific collection permits were approved by the Ministry of Natural Resources Canada, and the states of Minnesota, Wisconsin, Michigan, and Ohio.

Fish and macroinvertebrate sampling started on June 26 and was completed in by mid-September. Of the 33 wetlands initially targeted for sampling, 23 were successfully sampled. Reasons for sites not being sampled included no safe access for crews (5), no wetland being present (1), the wetland not having an open water connection to the lake (2), and water depth being too shallow in appropriate zones (in which case, the wetland was still sampled by the vegetation crew; n=3).

Crews quickly adapted to field-picking macroinvertebrates and processing water quality samples at night, things new to our crews. No crew members were injured during field sampling, but crews found working in the 12-ft-tall *Phragmites* beds around Green Bay to be hazardous (and damaging to waders). Crew members were required to wear eye protection while working in *Phragmites*, and some wore long-sleeve shirts for better arm protection. Crews found that one of the most time-consuming activities was locating functional boat launches because most of the map sources for boat ramps have not been updated since water levels dropped 10 years ago. The result is that many launches shown on the most up-to-date maps of the lake shoreline for Lake Michigan and Green Bay are not functional or no longer exist.

The PI (Brady) sampled with the crews during their first week of sampling to ensure that any questions and unresolved issues from crew training got resolved. She then again sampled with the crews in mid-season for QA to ensure that all crew members were still sampling correctly. All crew members were found to be sampling as trained, and were very thoughtful and thorough in the way they approached and surveyed new sites.

Vegetation sampling: Vegetation sampling started on July 5 and was completed by the last week of August. Of the 33 wetlands initially targeted for sampling, 24 were successfully sampled. Reasons for sites not being sampled mirror those used by the fish/macroinvertebrate group. Two crews were used to survey wetlands, one crew traveling throughout Wisconsin the Michigan U.P., with the other crew surveying exclusively in the St. Louis River estuary.

The primary issue of difficulty for vegetation surveys was getting to and from sites. Surveyors used canoes as the primary means of travel. In the St. Louis River, canoes proved too time-consuming, so an airboat was used from the Fon du Lac Band of Chippewa. Some of the deeper

water emergent zones in the St. Louis River estuary and elsewhere proved dangerous to walk across and impossible to boat across, so transect lengths were sometimes truncated for safety. Of course, travel through *Phragmites*-dominated wetlands especially in the Green Bay area was arduous and slowed sampling considerably.

Several hundred plant specimens were collected, labeled, and returned to the nightly accommodations for identification during the field season. Many specimens remained unidentified during field work and were brought back to the herbarium at the University of Wisconsin-Superior for proper identification after the field season.

Coordination of Field Activities

Our group is coordinating with a separate monitoring program (Wisconsin DNR and Lake Superior Research Institute, funded by GLRI) that is also surveying coastal wetland vegetation, macroinvertebrates, birds, amphibians, and water quality. They are using GLCWC protocols, resulting in very similar datasets. Although their schedule did not allow them to attend our field training workshops this year, nor were we able to coordinate sampling schedules, we have made plans to compare data at sites sampled in common. This will help us answer questions of variability among crews and slight variability (~ 1 month) in sampling date.

Water Quality Samples

Prior to the field season, the water quality team (led by Dr. Rich Axler) established final instrumentation needs for the NRRI, New York, and U. of Windsor sampling crews in order to minimize sample transport via overnight express while still completing analyses within QAPP specified holding times. This involved consultation with EPA-EMAP and USGS-Denver Lab senior scientists regarding the basis for several of EPA's and APHA's analyte holding times.
The team also determined a final field sampling protocol to allow the fish and invertebrate crews to collect water quality data as efficiently as possible, and determined the appropriate field laboratory instrumentation and supplies to allow field crews to process water samples after sampling. This includes filtering, aliquoting into various bottles, performing ANC/alkalinity titrations, and performing turbidity measurements. Sample bottle sets for the various analytes were prepared and distributed to the field crews. All of this information will be included in a QAPP update to take place this winter.

The NRRI-UMD Central Analytical Laboratory is analyzing samples collected by NRRI-UMD (63 samples) and New York-Brockport (39 samples) crews for nutrients, chlorophyll, color, turbidity, and chloride. To date 96% of samples have been analyzed for all parameters, with the remainder to be completed and quality assured by the end of October 2011.

Sample Processing

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, with the exception of about a dozen small fish that are being sent to fish expert, Dr. Carl Ruetz, for identification.

All vegetation samples that could not be identified in the field have now been identified. Most of these were identified back at the hotel rooms while the crew was still out in the field.

The NRRI microscopy laboratory has a stockpile of 153 macroinvertebrate samples collected from Coastal Monitoring wetlands this summer. Identification is expected to begin in November. QA will include trading samples with other laboratories to detect differences and problems in macroinvertebrate identification.

Data Entry and QA

All bird and amphibian data have been double-entered and QA'd, as have all vegetation data. All fish and water quality data have been entered into the database and QA is 75% complete. Macroinvertebrate data will be entered and QA'd late in the winter after identification is complete.

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

2011 Sites

Site selection was completed in the previous reporting period (Oct 2010—April 2011) by assessing all wetlands in the region using the web-based site selection tool. After wetland polygons were scrutinized, the randomization and selection procedure produced a list of 53 sites for potential monitoring in the Central Basin in 2011. Sites consisted of 21 riverine, 25 lacustrine, and 7 barrier-protected wetlands. While this was more than our team's sampling capacity of 40 sites for fish, macroinvertebrates, and plants, we assumed that some sites would be rejected in the field because they lacked a surface connection to a Great Lake or were inaccessible. The Central Basin team sampled sites in southeastern Lake Superior, northwestern Lake Michigan (the Big Bay de Noc area), drowned river mouth wetlands along the eastern shore of Lake Michigan, southern Lake Michigan (along the Indiana and Illinois shoreline), northern Lake Huron into the St. Mary's river, the entire eastern shorelines of Lake Huron, Lake St. Clare, and Lake Erie.

The CMU crew sampled 16 sites in the Upper Peninsula of Michigan, and northern Lake Huron. The GVSU crew sampled eight wetlands in Michigan's Lower Peninsula. The LSSU crew sampled wetlands in the eastern end of Lake Superior and throughout the St. Marys River. The UND crew was assigned one site in Illinois, and seven in Michigan's Upper Peninsula. The number of Indiana-Illinois sites was substantially reduced during the site evaluation process because the overwhelming majority of coastal wetlands in this region were found to no longer connect to Lake Michigan. Therefore, the UND crew assisted the rest of the Central Basin team by sampling along the Michigan shoreline of Lakes Michigan, Huron, and Superior.

The LSSU and UND crews each sampled one benchmark site and the CMU crew sampled six benchmarks. Selection of benchmark sites was done in consultation with the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, and the Nature Conservancy. Each agency provided a list of sites with current and ongoing coastal wetland restoration projects in the region and identified the highest priority sites for data collection.

QAPPs and SOPs

Many members of the Central Basin Team, both co-PIs and their staff, contributed to finalization of the Quality Assurance Project Plan, which was signed in late March. Members also contributed to finalization of Standard Operating Procedures which were finalized prior to initiation of fieldwork. Members of the Central Basin Team used the approved QAPP and relevant SOPs during fieldwork preparation/training and throughout the sampling season to ensure consistent methodology.

Training and Certification

Central Basin Team members responsible for fish, macroinvertebrate, and water quality monitoring attended the training session held on May 24th and 25th 2011 at Vanderbilt Park in Quanicassee, MI. Training was led by Uzarski, Cooper, and Ruetz. The training consisted of a classroom portion in which the SOP's were discussed and many questions from field crews were addressed. An in-field training session was also conducted to familiarize technicians with all sampling protocols. Crew members received training on vegetation zone identification, water quality sampling, proper fyke net deployment, macroinvertebrate sampling, and sediment/vegetation/surrounding land use covariate assessment. Field crews were also instructed on proper techniques for alkalinity titration and water filtering/sample storage. On day two crews were trained on proper techniques for pulling fyke nets and handling fish. Crew leaders were also tested and certified on each element of field sampling as required by the QAPP. Members of the LSSU crew were unable to attend the May 24th - 25th training and instead traveled with the GVSU and UND crews to two sites on Saginaw Bay in June where they

received training and certification. All certification records have been archived with Uzarski, Brady, and Cooper.

Central Basin bird and amphibian crews were tested for identification of frog and bird calls and were trained in proper field procedures prior to initiation of field work. Amphibian training was completed before April 8, 2011 and bird training was completed by May 15, 2011. Online testing was used for identification of amphibians and birds by sight and sound and all crew members reached proficiency before sampling. Central Basin plant crews were trained and certified by Dennis Albert in Pellston, MI June 22-25.

Other Fieldwork Preparation

The CMU crew obtained IACUC approval and received a sampling permit from the Michigan DNR in April, 2011. Two full time technicians (Jessica Sherman and Thomas Clement) were hired as field leaders and lab managers for the project. Purchasing of supplies was completed in early summer. Summer field crews were hired and trained in CPR and first aid.

The GVSU crew applied for IACUC approval for fish sampling in February 2011 and received final approval from GVSU's IACUC in late April. Ruetz received a scientific collector's permit from the Michigan Department of Natural Resources on February 28, 2011. Jessica Comben was hired as the crew leader for the GVSU field sampling crew and two additional technicians were hired for GVSU's portion of 2011 fieldwork. Equipment and supplies were purchased in late spring.
The LSSU crew received IACUC approval (#F11S01) for fish collection and handling for the duration of the project. A scientific collector's permit for Michigan was obtained from the Department of Natural Resources in May and a permit for Ontario water's was obtained in early June. Amanda Chambers was hired as LSSU's crew leader and Jake Riley and Ellis Raatz were hired as field assistants. Equipment and supplies were purchased in May and June.

The UND crew received IACUC approval from UND's Animal Care and Use Committee on April 19, 2011 and a scientific collector's permit was obtained from the Michigan DNR in May. Jessica Koshiara was hired as the UND crew leader and two additional undergraduate technicians were hired for the 2011 field season. Equipment and supplies were purchased in May. All technicians received boater safety training (online) and lab safety training prior to the start of fieldwork.

Prior to the field season the UW-GB bird and amphibian crew developed a web-based testing tool to improve and verify the skills of field workers. Field workers also obtained digital audio recordings at many study sites. These recordings of bird and anuran choruses, in addition to new photographs of frogs and toads, will be used to improve the testing web site during 2012.

Field Work

Central Michigan University:

A total of 22 sites were visited by the CMU crew for fish, invertebrate, and water quality sampling. Of these 22 sites, seven were deemed un-sampleable because they were either lacked a connection to the Great Lakes or were not inundated. Of the remaining 15 sites, 26 vegetation zones were sampled. Water quality and macroinvertebrates were sampled at all of these zones. Water and macroinvertebrates were preserved for laboratory analysis. Fish were sampled at 20 zones where the water depth was greater than 0.20 m. All fish sampled were identified to species, enumerated and a maximum of 25 fish per species captured were measured. Fish were released alive except those that required lab identification or those used to create a reference collection required by the QAPP.

Amphibians and birds were surveyed at 18 wetland sites by the CMU crew (the bird/amphibian team led by Howe was responsible for sampling the remaining Central Basin wetland sites). The CMU bird and amphibian crews focused on wetlands of the Lower Peninsula of Michigan which included Lakes Huron, Michigan, and Erie. Six of the non-sampled sites were either islands (4 sites) that could not be accessed safely for night sampling or were not accessible due to private landowners refusing to grant access (2 sites). For all sites with landowner permission issues, crew members attempted to gain permission by talking to landowners in person and following up with phone conversations. One site had access through a private subdivision, but landowners would not grant access from land. Two sites were not sampled because a surface water connection to the Great Lake was not found. Amphibians were sampled from April 8 to July 9, 2011 and birds were sampled from June 2 to July 16, 2011. Wetlands were sampled three separate times for amphibians and two separate times for birds. Two teams, each with two members, were used throughout the sampling season, except at the beginning of the season when a third crew of 2 members was used.

Grand Valley State University:

The GVSU crew sampled 8 wetlands in Michigan for fish, invertebrates, and water quality during June-August 2011. In total, 20 plant zones were sampled. Overall, the GVSU season was successful. The sampling period (June-August) coincided with maturation of plants, which made for easier plant identification. On average, the GVSU crew (3-4 people) spent approximately 20-24 hours to sample an entire site (collecting fish and invertebrates and processing water quality). Some of the challenges encountered were: daily water fluctuations, adverse weather conditions, and some minor equipment failures (i.e. broken stir plate and prop damage on boat). These challenges were addressed as soon as possible by repairs and revisiting a site when necessary.

Lake Superior State University:

From June to August 2011, the LSSU crew visited 12 sites to determine if they met the sampling criteria and if there were access issues. Two sites (5078 and 5341) were not sampled because of private property issues and 1 site (906) was not sampled because it did not contain vegetation zones that met the size/area criteria for this project. Crews returned to 9 sites (802, 917, 816, 792, 806, 815, 5210, 812, and 915) and collected water quality, macroinvertebrate, and fish data and samples (along with other associated measurements) for all vegetation zones identified. Water samples were sent to Central Michigan University for dissolved nutrient analyses and filters were sent to the University of Notre Dame for chlorophyll *a* analyses. Macroinvertebrate samples are currently being processed at LSSU and identification of approximately 10% of the samples has been completed.

University of Notre Dame:

The UND crew assisted the GVSU crew at two Lake Erie wetlands in late June and four Saginaw Bay wetlands in early July. After assisting the other Central Basin crews, the UND crew visited 10 wetlands on Lakes Michigan, Huron, and Superior. Three of these wetlands (843, 1603, and 1373) were deemed unsampleable for water quality, invertebrates, and fish because they lacked inundated herbaceous vegetation. Sites 1604, 1267, and 605 were not visited because they were on islands that could not be reached safely. The seven sites that were sampled entirely by the UND crew contained a total of 17 plant zones. One of these wetlands (630) was a benchmark site. Challenges encountered during the field season included safely accessing remote sites on Lake Michigan (e.g., 1584 and 1586) and obtaining permission to sample wetlands in protected areas. For example, access to site 1373 (Illinois Beach Nature Preserve) was denied initially and a formal request for access was submitted to the Illinois Nature Preserve Commission. Permission had not been granted by the end of August so an initial site visit was made to determine if the site would be sampleabe in September (based on inundation and the condition of plants). The site was found to be unsampleable at that time so a follow-up request to the Commission was not made. If permission had been obtained earlier in the year, the site would likely have been sampleable. The UND crew has also completed chlorophyll *a* analyses for all Central Basin crews as well as the Eastern Basin Canadian Team and has completed color analyses for the Central Basin Team. Macroinvertebrate sample processing has begun at UND, including training of crew members by experienced taxonomists at CMU.

Oregon State University:

Field sampling for vegetation was completed at 41 sites, including several benchmark sites. All sites that were visited were sampled, with the exception of one transect in the St. Clair River delta, where a hostile landowner threatened field workers, and two Canadian First Nation sites, where we are still awaiting approval to visit and sample on First Nation lands. All plants were

checked, and the project director, Dennis Albert reviewed all unknown plants collected by the sampling crews. Challenges encountered during the field season included accessing island sites and coordinating with fish and invertebrate crews to determine whether sites should be sampled based on project-level criteria (connectivity and inundation). OSU is continuing to review data files entered into the database.

University of Wisconsin-Green Bay:

The UW-Green Bay field team consisting of Dr. Robert Howe, Dr. Amy Wolf, two graduate research assistants, and 9 other graduate or undergraduate field investigators sampled 60 points for amphibians and 80 points for birds at 33 coastal wetland sites in 2011. Each point was visited 5 times, twice for birds and 3 times for amphibians. Locations of the points ranged from Illinois Beach State Park along western Lake Michigan near Zion, Illinois, to Drummond Island in northern Lake Huron. In addition to 8 species of anurans, most of the wetland or shoreline species found regularly in this region were recorded, including Pied-billed Grebe, American Bittern, Least Bittern, Common Tern, Forster's Tern, Black Tern, Caspian Tern, Red-breasted Merganser, Common Merganser, Virginia Rail, Sora, Wilson's Snipe, Osprey, Bald Eagle, and regionally uncommon species like Henslow's Sparrow and Yellow-headed Blackbird. The number of sites actually sampled was less than the targeted number because 1) open marsh habitat was not present at some sites; 2) appropriate marsh habitat was not accessible without lengthy boat ride (e.g., to roadless islands of northern Lake Huron) or trespass across private property of non-cooperative landowners. We experienced only one case of belligerent landowners, but others were not safely accessible at night (for frog/toad surveys) or during the time available for sampling.

Quality Assurance / Quality Control

All Central Basin field crews (CMU, GVSU, UND, LSSU, and OSU) were observed for adherence to relevant SOPs during the field season. Supervising PIs/Co-PIs conducted the mid-season checks in most cases. All field crews passed these evaluations and no corrective actions were necessary. Documentation for these mid-season QA/QC checks have been filed with Brady, Cooper, and Uzarski.

Data Entry

All Central Basin crews have finished data entry for field data (in situ water quality, fish, and covariates). The CMU crew has also completed data entry for laboratory water quality data. All data that has been entered to date has also been QC checked by a second crew member. Vegetation data and associated GPS points have also been entered into the project database,

though vegetation data QC is currently ongoing. Remaining data will be entered and QC checked as it becomes available.

Future work

All Central Basin crews are currently conducting laboratory work (e.g., remaining water quality and sediment analyses and macroinvertebrate identification). Water quality and sediment analyses will be completed by early November and macroinvertebrate processing is currently on schedule for completion by early spring 2012. Macroinvertebrate quality control procedures including trading samples among laboratories will also be conducted over the coming months. All Central Basin crews will also begin photo interpretation of sampling sites for the 2012 field season and develop a strategy for efficient sampling.

The UW-GB crew will be working with Nicole Van Helden, Director of the GLRI-funded Conservation-Green Bay Watershed project of The Nature Conservancy, to assist in the development of local monitoring for their restoration project on the Duck-Pensaukee watersheds of lower Green Bay. UW-GB's EPA-funded work on ecological indicators also is being implemented directly by The Nature Conservancy's Wisconsin Field Office in Madison, Wisconsin, in an ambitious monitoring program for sustainable forestry in the Wild Rivers Legacy Forest in northeastern Wisconsin. The Wild Rivers Legacy Forest represents the largest land conservation transaction in Wisconsin history, an unprecedented partnership involving The Nature Conservancy, the State of Wisconsin, and two timber investment companies.

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

Site Selection

The Eastern Team selected wetland sites in early spring with the aid of Google Earth, Bing Maps, high resolution ortho-imagery, and previous knowledge of sites. Sites were eliminated that were not connected to lake water, did not meet size requirements, or were otherwise not useable for this study. The remaining sites were put in the five-year randomization, which resulted in 27 sites for 2011. Two of the sites, Third Creek and Floodwood pond, were benchmark sites and were chosen to help The Nature Conservancy in restoring and conserving the wetlands. One site was excluded because it exceeded the Eastern Team's summer sampling capacity.

Training

The Eastern Team's bird and amphibian crew was trained on April 5 at Bird Studies Canada in Port Rowan, Ontario, Canada. Crew members received training on sampling protocols, safety, data recording, and bird and amphibian identification. Crew members were also tested to ensure their hearing and vision were adequate to perform the detection-dependent sampling. Finally, all crew members passed the online certification exam developed by the University of Wisconsin-Green Bay (http://www.birdercertification.org/GreatLakesCoastal) prior to field sampling to ensure they could identify all birds and amphibians they may encounter in the Great Lakes.

Fish, macroinvertebrate, and water quality training took place on May 17 and 18 at The College at Brockport. Eastern crew members were trained on proper use of equipment (including fyke nets, sweep nets, water quality meters, and GPS units), how to fill out datasheets, water collection methods, proper QA methods, vegetation zone identification, and boating safety in the lab on May 17. These skills and methods were then practiced in a mock sampling of Sandy Creek to ensure that crew members both understood and could perform the sampling protocols. Dr. James Hanyes (co-PI, fish) and Gary Neuderfer (co-PI, macroinvertebrates) traveled with the crew for the first week of sampling to ensure appropriate sampling methods. All fish, macroinvertebrate, and water quality crew members were certified in the field to show they could sample, identify, and record all data to the standards required by the project. Finally, a mid-summer QA check by co-PIs was performed to ensure that crew members continued to perform to sample correctly.

Vegetation crew members received both laboratory and field training on June 16 and 17 at The College at Brockport. Laboratory training included proper transect layout, quadrat spacing, GPS use, and data recording. Lab-based training was then reinforced by a mock sampling of Brush Creek, a Lake Ontario tributary north of Brockport. Dr. Douglas Wilcox (PI, vegetation) traveled with the field crew for the first two weeks of sampling to ensure the vegetation crew understood and performed all sampling appropriately. All vegetation crew members were certified to show they could sample, identify, and record all data to the standards required by the project. Finally, a mid-summer vegetation QA check was performed to ensure that vegetation crew members continued to sample correctly.

Sampling

The Eastern Team sampled 24 of their 26 scheduled fish, water quality, aquatic invertebrate, and vegetation sites between 29 June and 11 August 2011. Site 88 (McIntyre's Bluff) was rejected due to a permanent barrier beach that removed hydrologic connectivity to the lake. High resolution ortho-imagery and input by Environment Canada researchers caused site 5195 Collin's Creek Wetland 1 to be rejected due to an elevation gradient that prevented hydrologic

influence from Lake Ontario. The 24 sites sampled included seven barrier protected, four lacustrine, and thirteen riverine wetlands. All 24 sites were in Lake Ontario, with 21 and 3 located on the US and Canadian side, respectively. The bird and amphibian crew completed their three rounds of sampling at the same set of wetlands between 19 April and 11 July except two Canadian sites, 5531 Little Cataraqui Creek Complex, 5718 Parrot Bay Wetland, which were sampled by Bird Studies Canada, led by Doug Tozer.

The Eastern Team's spring bird and amphibian crew sampled five to six bird sites per morning or evening and about 10 amphibian sites per night. The close proximity of some sites allowed the spring bird/amphibian crew to group and sample multiple sites quickly, which allowed them to use periods of good weather efficiently. Summer sampling by the fish/invertebrate/water/plant crew began at the most southwestern Lake Ontario sites and moved northeasterly as the summer progressed to limit the impact of plant phenology on sampling. Four sites were sampled each week, with each site being sampled over the course of 24 hours. The summer field crew traveled together and consisted of two fish, two vegetation, and two aquatic invertebrate specialists. Traveling together made sampling more efficient, as crews could borrow equipment and assist each other when one crew finished early. No serious problems were encountered by either the spring or summer crews, and the most common issues dealt with determining hydrologic connection to the lake and gaining access to sites. Both problems were overcome by talking to adjacent landowners who were generally helpful.

The most common invasives plant species encountered by the Eastern Team were hybrid cattail (*Typha X glauca*) and narrowleaf cattail (*Typha angustifolia*). Other common invasive plant species found included reed canary grass (*Phalaris arundinacea*), European frogbit (*Hydrocharis morsus-ranae*), curly-leaf pondweed (*Potamogeton crispus*), and Eurasian watermilfoil (*Myriophyllum spicatum*). Purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) were present at a few sites but were not as common as the previously mentioned invasives. The common carp (*Cyprinus carpio*) was the most widespread introduced fish species found on the south shore of Lake Ontario. Round goby (*Neogobius melanostomus*) was found in a few sites but was not common. The most notable rare plant species were found at 7051 South Pond 2 and included spoonleaf sundew (*Drosera intermedia*), roundleaf sundew (*Drosera rotundifolia*), and purple pitcherplant (*Sarracenia purpurea*). Fyke nets yielded musk turtles (*Sternotherus odoratus*) at site 163, Perch River Wetland, which is located in an area of New York State that has not had a reported musk turtle sighting in ~20 years. The red-finned shiner, a species of special concern in New York State, was found in Johnson's Creek Wetland. Twelve glass shrimp (*Palaemonetes* sp.), an uncommon species for Lake Ontario, were found in fyke nets at site 7054 Isthmus Marsh South.

Laboratory Work

Approximately 25 fish specimens could not be identified in the field during summer sampling. Dr. James Haynes and Matt Piche successfully identified 24 of the unknowns by September 31 and have continued to work on the remaining unknown. No unknown plant specimens were brought back to the lab for identification as all were identified in the field or hotel rooms at night. The NRRI-UMD Central Analytical Laboratory successfully analyzed 39 zones of water quality data. However, a few individual samples are going to be reanalyzed to double-check results. No macroinvertebrates samples had been processed by the end of September; however, laboratory equipment and sample storage was set up to prepare for sample processing.

Data Entry and QA

All fish, macroinvertebrate field processing, water quality, vegetation, bird, and amphibian data were entered by September 31. At that point in time, 75% of vegetation, bird, and amphibian, and 50% of fish data was QA'd. Approximately 25% of the water quality and macroinvertebrate data were QA'd by the end of September.

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)

Field Training

Training for birds and amphibians was held on April 5, 2011 at the Bird Studies Canada Centre in Port Rowan, Ontario and coordinated by PI Doug Tozer. Field crews were instructed in the project's objectives and methodology, site selection procedures and station placement guidelines within selected wetlands. The amphibian and bird survey field protocols were demonstrated in detail in both the "classroom" and the field. Crew members were also instructed in methods of reporting, safety, and data entry, and were tested for their ability to use GPS instruments with adequate precision and accuracy as per the quality assurance project plan. Each individual's comprehension of the topics was evaluated with a test. Most crew and contractors were required to complete the online amphibian identification tests and were subsequently evaluated for their ability to recognize bird species by song and by visual characteristics.

Field crew members who worked with fishes, macroinvertebrates, and water quality sampling attended a training session on May 17-18 near Brockport, NY (Ontario crew) or May 24-26 at a

location near Saginaw, MI (other crews). Training included GPS use, determination of whether sites met 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 was conducted to train 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 were instructed in field data sheet entry. All field personnel were given basic fish identification training. 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 were also given field and lab safety training.

Vegetation survey training was held June 16-17 near Brockport, NY in conjunction with instruction for the field teams supervised by Dr. Douglas Wilcox. Vegetation team members received the same general instructions and project orientation as did the other groups. In addition they were introduced to the specific vegetation sampling methodology and data recording methods outlined in the QAPP.

Site selection, field sampling, and results

Bird and amphibian field crews evaluated 57 sites that had been selected and ordered for potential sampling in 2011 (19 on Lake Ontario, and 38 at other sites). Of these, 13 were rejected as being inaccessible, unconnected to the lake, too small, or otherwise unsuitable. Most of the rejected sites were located on Lake Huron. However, one eastern Lake Erie site and 8 sites on Lake Ontario were rejected. Forty sites were visited (each on 5 occasions) and sampled for amphibians and birds by our team. An additional 3 sites on Lake Ontario were sampled by the Wilcox team of Brockport, NY. Ten sites listed in the ordered sequence were not visited. Most of those were located on Manitoulin Island or in the North Channel of Lake Huron and were either too remote or too difficult to reach (island locations). All amphibian and bird data have been compiled, entered into the database, and QC'ed.

The fish and macroinvertebrate and vegetation crews evaluated 60 sites, including all of those assessed by the Bird and Amphibian field crews. The same 11 sites were rejected as unsuitable for any form of sampling. A total of 36 sites were actually sampled. Three Canadian Lake Ontario sites were sampled by the Wilcox team of Brockport, NY. At 33 sites, the full suite of water quality, fishes, macroinvertebrates and wetland vegetation was assessed. Three sites were suitable only for vegetation sampling. Thirteen sites falling in the site selection order (3 on Lake Erie and 10 on Lake Huron) were not visited in 2011, either because of accessibility problems (island sites) or because their geographical distribution made them too difficult to reach relative to other sites designated by the sampling order.

Of two benchmark sites identified for 2011, one (Hillman Marsh, Lake Erie) was sampled, and the other (Point Au Baril, Lake Huron) was deferred until next year (listed as rejected on the basis of access in 2011). Both sites had been identified as being of interest to Environment Canada researchers or LAMP workgroups. No requests for benchmark sites were received from the State of Ohio in 2011.

All fish data have been compiled and entered into the database and quality assured. All of the macroinvertebrate samples have been examined and specimens identified to the family level, and the identifications quality checked according to QAPP protocols. We are in the process of identifying Chironomidae to subfamily or tribe level as practicable. Data will be entered into the database when the database system has been approved to receive macroinvertebrate information. Quality assurance of the vegetation data is almost complete. Approximately 25% of the data have been entered into the database. All water quality data have been uploaded to the database, but quality assurance is still in progress.

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). All permits had been approved at that start of the sampling season. Reports to the permit granting agencies have been completed in draft form and will be sent to both regional administrators and to local offices in whose jurisdiction sampling took place. Records of fishes caught will also be sent to local conservation and refuge managerial groups in Ontario and Ohio where appropriate.

Water Quality Samples

Water quality sampling followed the protocols spelled out in the QAPP as developed by the water quality team (PI Dr. Rich Axler). Metered measurements were made and water samples were collected at the time that fyke nets were placed in the water. Water samples were stored refrigerated on ice in darkness until the evening, at which time they were processed and prepared for shipment to the analytical laboratory. With the exception of Chlorophyll *a* samples (which were shipped and analyzed by colleagues at the University of Notre Dame), all laboratory analysis was conducted by Environment Canada's National Laboratory for Environmental Testing (NLET) in Burlington, ON. The lab received samples by overnight express courier to ensure that they complied with QAPP specified holding times. All analyses have been completed. Field-based measurements have been entered into the water quality database. Analytical laboratory data have been entered into the database, and are receiving final QA review.

Outreach and Collaboration Team: Michigan Department of Environmental Quality (Anne Hokanson)

The Michigan DEQ is responsible for organizing outreach and public information regarding the Great Lakes Coastal Wetland Monitoring effort funded by the EPA through the Great Lakes Restoration Initiative. Michigan DEQ will also organize coordination meetings for the project investigators and facilitate informational sharing efforts between the researchers and resource management agencies around the Great Lakes.

During this reporting period, Michigan DEQ staff continued the planning and organizational efforts to prepare for and host a Great Lakes Coastal Wetland Monitoring Coordination Meeting that was referenced in the previous status report. The purpose of this meeting was to:

- Link the research teams for the Great Lakes Coastal Wetland Monitoring project with state wetland management programs and tribes throughout the basin.
- Facilitate communication and coordination between the research community and state regulators and managers, and tribes.
- Provide state and tribal regulators an opportunity to learn more about the Great Lakes Coastal Wetland Monitoring project (goals, sites, and data collection methods) and to provide input on the project outcomes and potential uses for this research.
- Provide an opportunity to meet and coordinate with researchers working on the project, reflect on the first year of field work, discuss first year lessons learned and reporting preparation, and to communicate with other state and federal regulators, and tribes about the project.
- Many great research projects produce a wealth of data, but the information is not accessible to regulators and land managers and never achieves the potential to influence wetlands management on a widespread scale. This project and this meeting in particular, aim to bridge the gap between state and tribal wetland managers and researchers on the ground.

The coordination meeting was held on Tuesday August 30, 2011 at the Grand Traverse Resort in Acme, MI. This date and location was selected because it directly preceded the Michigan Wetlands Association (MWA) Annual Wetlands Conference, and we were hopeful that would improve the attendance of out-of-state agency representatives who may be planning to attend the MWA conference, but struggle with out-of-state travel approvals through their respective agencies. Although travel was a significant hurdle for many of the invitees, the meeting was a great success. We had an attendance of 33 individuals at the meeting in Acme, and during the panel discussion in the afternoon we hosted another 8 attendees online using a Go-To-Meeting Webinar. There were representatives from all of the project biological research teams and most of the partner universities, as will as representatives from the states of Michigan, Wisconsin, and Minnesota, two representatives from USEPA, one representative from the International Joint Commission, and one representative from a private herpetological

consulting company. We were also expecting a representative from the state of Pennsylvania, but unfortunately weather delayed his travel and he was not able to attend.

The first half of the meeting day focused on the coastal wetland monitoring project goals and methods being used in the field. This morning session included a keynote address by John Schneider of the USEPA entitled "History and Future of the Great Lakes Coastal Wetland Monitoring Project," followed by presentations on the project background and design by Don Uzarski of CMU, Matt Cooper of Notre Dame, Brad Mudrzynski of Brockport, and Gerald Niemi and Robert Howe of UMN NRRI. There was also a presentation on data management and database demonstration by Valerie Brady and Terry Brown of UMN NRRI.

Great Lakes Coastal Wetland Monitoring Coordination Meeting Attendees:

- Tom Bernthal, Wisconsin Department of Natural Resources
- Peg Bostwick, Association of State Wetland Managers
- Valerie Brady, University of Minnesota
- Terry Brown, University of Minnesota
- Amanda Chambers, Lake Superior State University
- Thomas Clement, Central Michigan University
- Matt Cooper, University of Notre Dame
- Nancy Cuncannan, Michigan Department of Environmental Quality
- Dave Dempsey, International Joint Commission
- Roger Eberhardt, Michigan Office of the Great Lakes
- Chad Fizzell, Michigan Department of Environmental Quality
- Joe Gathman, University of Wisconsin River Falls
- Alisa Gonzales-Pennington, Michigan Office of the Great Lakes
- Melanie Haveman, US Environmental Protection Agency Region 5
- Michelle Hohn, Michigan Department of Environmental Quality
- Anne Hokanson, Michigan Department of Environmental Quality
- Robert Howe, University of Wisconsin Green Bay
- John Jereczek, Minnesota Department of Natural Resources
- Susan Jones, Michigan Department of Environmental Quality
- Dina Klemans, Michigan Department of Environmental Quality
- Todd Losee, Michigan Department of Environmental Quality
- Amy Lounds, Michigan Department of Environmental Quality
- David Mifsud, Herpetological Resource and Management
- Ashley Moerke, Lake Superior State University
- Doug Morse, Michigan Department of Environmental Quality
- Brad Mudrzynski, State University of New York Brockport
- Brent Murry, Central Michigan University
- Gerald Niemi, University of Minnesota
- Ellis Raatz, Lake Superior State University
- John Schneider, US Environmental Protection Agency
- Neil Schock, Central Michigan University
- Jessica Sherman, Central Michigan University
- Don Uzarski, Central Michigan University

The second half of the meeting day shifted focus to a discussion of the future uses and implications of this project and resulting data. Chad Fizzell of Michigan DEQ gave a presentation on the uses and implications of status and trends data from a spatial mapping perspective, and started the discussion of different potential applications of these data in the future. This was followed by a presentation from Roger Eberhardt of Michigan Office of the Great Lakes, who highlighted some of the other significant Great Lakes research and planning efforts underway throughout the basin, and the possible links that this project may have to those efforts.

We concluded the meeting with a panel discussion entitled "Moving Forward – Agency Perspectives." The panelists included Dave Dempsey of the International Joint Commission, Todd Losee of Michigan DEQ, Tom Bernthal of Wisconsin DNR, John Jereczek of Minnesota DNR, and Melanie Haveman of USEPA Region 5, and the discussion was moderated by Peg Bostwick of the Association of State Wetland Managers. The panel discussion was extremely productive, and really created a strong dialogue between the research community and the agencies. We even had significant participation from the online webinar participants. This panel discussion touched on many topics such as accessibility of the project results for agencies, implications for other state monitoring efforts and prioritization of restoration and preservation sites, and there were also many questions regarding the form of the data outputs from the project. At the end of the panel discussion and the meeting, the small group conversations about the project continued in the hallway, and there was a general sense of excitement at the communication between researchers and the agencies. We received many compliments on the meeting, and many requests for more opportunities for this type of interaction; many attendees appreciated the meeting but did express concerns that one meeting by itself is not enough, these lines of communication will need more efforts throughout the project and afterwards.

Finally, on Friday September 2, 2011, after the conclusion of the MWA Wetlands Conference, Michigan DEQ and Central Michigan University hosted an optional field trip to demonstrate some of the coastal wetland monitoring protocols being used in this project. There were approximately 27 participants in this field trip, from an array of organizations – government, consulting, research, watershed management, and general interest. We demonstrated sampling techniques for the fish, invertebrates, and water chemistry protocols at a wetland site in Acme, MI (see pictures attached in Appendix). All of the attendees enjoyed the opportunity to see how this research is being done, as well as get some hands on access to the types of equipment being used and species being found in our coastal wetlands.

Future work

During the next reporting period, we will begin to plan an outreach effort to build upon the dialogue between the research community and the agencies we had at the coordination meeting. This may include another meeting in the upcoming year, a series of conference calls,

or the initiation of some sort of dialogue forum to further the conversation. We will also begin to strategize the dissemination of project results to these agencies once the first year's data is accessible. We are on track with the project goals of outreach and coordination of this monitoring effort, and are confident that we will maintain this performance in the next reporting period.

ASSESSMENT AND OVERSIGHT

The project QAPP was approved and signed on March 21, 2011. Regional team leaders, other co-PIs, field crew chiefs, and technical assistants collectively spent hundreds of hours working on the QAPP, SOPs, and field data sheets in preparation for the first field season. Sampling methods in the QAPP closely follow those from the GLCWC. In those instances where GLCWC protocols had not yet been finalized, PIs worked together to establish the procedures and ensure consistency with GLCWC intent and, where possible, other sampling protocols that have been used historically.

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

- Training and certification: See sections above.

- GPS testing: Every GPS unit used during the 2011 field season was tested for accuracy and its ability to upload data to a computer. Field staff collected a series of points at locations that could be recognized on a Google Earth image (e.g., sidewalk intersections) then uploaded the points to Google Earth and viewed the points for accuracy. Precision was calculated by using the measurement tool in Google Earth. Results of these tests have been archived and referenced to each GPS receiver by serial number.

- Review of all sites rejected after initial site visits: In cases where a site was rejected during a site visit, the reason for rejection was documented by the field crew. The project QA officers (Brady and Cooper) then reviewed these records to ensure consistency among crews. Additionally, in most cases, field crew leaders contacted either Uzarski, Brady or Cooper by cell phone when deciding whether to reject a site.

- Mid-season QA checks: For each type of sampling, a set of mid-season QA criteria were developed to ensure that crews were following appropriate methodology (see QAPP). These mid-season QA checks were completed by co-PIs and archived with Uzarski, Brady, and Cooper. No corrective actions were required based on these evaluations.

- Maintenance, calibration, and documentation for all field meters: All field meters were calibrated and maintained according to manufacturer recommendations. Calibration/maintenance records are being archived at each institution.

- Collection of duplicate field samples: Precision and accuracy of many field-collected variables is being evaluated with duplicate samples. Duplicate water quality samples were collected at approximately every 10th vegetation zone sampled.

- Creation/maintenance of specimen reference collections: Reference collections for macroinvertebrates, fish, and plants are being created or maintained by each regional team. Laboratories that already have established reference collections are using these for the project but adding new species as they are collected.

- Data Quality Objectives (DQO) for laboratory analyses: Participating laboratories are generating estimates of precision, bias, accuracy, representativeness, completeness, comparability, and sensitivity for all water quality analyses. These metrics are being archived and will be linked to the primary data as it is generated.

- QA 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 nearly all data that has been entered into the database.

Regional team leaders and co-PIs have maintained close communication throughout the entire project. All major project members met in Detroit in mid-January of 2011 to discuss all project methodological details, ensure that everyone understood the goals and objectives, and to make sure that all QA requirements and reporting requirements were known and understood by everyone.

Since the meeting, regional team leaders and co-PIs have held several conference calls regarding site selection and field work preparation as well as cross training sessions in three regions across the basin. Most PIs spent the first week of field season in the field with their crew to ensure no questions or confusion remained from training. PIs then visited their teams again during mid-season to ensure that all sampling was still being conducted in accordance with the training and the QAPP. During mid-field season, a conference call was held among PIs and field crew chiefs to ensure that sampling was going well with all teams, teams were on schedule, and to address any questions teams had about sampling protocols. PIs kept in close contact with crews via cell phone, and the leadership team was also always available via cell phone to answer specific crew questions.

In addition, email lists have been formed to allow all project participants to easily keep in contact with one another and ask questions of the project leadership or the group as a whole. Thousands of emails have been generated, helping to ensure that all project personnel remain in close contact.

From the QA managers' perspective, the first field season was highly successful. The quality management system developed for this project was fully implemented and Co-PIs and their respective staff members followed established protocols very closely, relying on the QAPP and SOPs as guiding documents. QA managers were also encouraged by each crew's willingness to contact their supervisors or, in many cases, the project management team when questions arose. This was often done via cell phone from the field. We will continue to encourage such communication as the project progresses.

Challenges faced during the first field season, in terms of quality assurance, include standardizing the way crews report pre-season certification and mid-season QA/QC checks. In the coming years standard forms will be used to ensure consistency among crews.

No major injuries were reported by any field crew members this first sampling season. PIs were impressed by the work ethics of their field crews, their willingness to work long hours day after day, to successfully sample under quite adverse conditions, and to conduct that sampling in accordance with strict QA procedures. The first year of this project was extremely successful.

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20 June, 2011

Dr. Donald G. Uzarski
Director of CMU Institute for Great Lakes Research
Central Michigan University
Mount Pleasant, MI 48859

Dear Dr. Uzarski,

The Nature Conservancy requests that Erie Marsh Preserve and the adjacent wetlands in North Maumee Bay be used as a benchmark site for the Great Lakes Coastal Wetland Monitoring project. The diked portion of Erie Marsh Preserve is currently scheduled for restoration to improve habitat quality and access for fish and other aquatic organisms.

The proposed restored marsh is approximately 258 acres and would be ideal for sampling all parameters of the monitoring project (fish, invertebrates, birds, amphibians, vegetation, and water chemistry). The diked area of the preserve will be reconnected to Lake Erie to provide habitat for aquatic organisms. The data obtained within the dike could be compared to the adjacent wetlands outside of the dike to evaluate restoration success.

The use of Erie Marsh Preserve as a benchmark site will benefit The Nature Conservancy's goal to restore coastal wetlands within North Maumee Bay and the adjacent diked preserve by comparing its current and future status with other coastal sites within the basin. Furthermore, gathering data both pre- and post-restoration is very important to determine the effectiveness of the restoration. Given the proposed five year term of your project, monitoring could be continued after restoration for several years to evaluate success. Data collected from Erie Marsh could also inform restoration of diked wetlands within the entire Great Lakes basin. In addition, the use of North Maumee Bay as a benchmark site would allow The Nature Conservancy to obtain high quality data at no additional cost to our non-profit organization.

Central Michigan University will benefit from this joint endeavor by gathering data from a unique pre- and post-altered habitat. This data would also be available for use in scientific publications.

We hope that you will consider using Erie Marsh Preserve and North Maumee Bay as a benchmark in your coastal wetland monitoring project.

Sincerely,

Denny McGrath
Assistant State Director

MINNESOTA LAND TRUST

Dr. Valerie Brady
Natural Resources Research Institute
University of Minnesota Duluth
Duluth, MN 55811

Dear Dr. Brady: October 14, 2011

This letter is in support of your work on the Great Lakes Coastal Monitoring Project. Thank you for including the St. Louis Estuary sites: 21st Ave West, 40th Ave West, and Radio Tower Bay as Benchmark sites. These sites are important large-scale habitat restoration sites for removing habitat related Beneficial Use Impairments in the Lower St. Louis River Area of Concern. Restoration of these site is a joint effort by a number of agencies and groups including Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Minnesota Pollution Control Agency, U.S. Fish & Wildlife Service, US EPA Mid-Continent Ecology Lab and the Fond du Lac Band of Lake Superior Chippewa and the Minnesota Land Trust. Our objective is to address their degraded condition and then restore them to once again be functioning Great Lakes coastal wetlands.

The data you collect on fish, invertebrates, wetland vegetation, birds, amphibians, and water quality will help us with our effort to understand the pre-restoration condition and to evaluate how the ecological functions change following restoration actions. In addition, comparing these sites to all other Great Lakes coastal wetlands, will help to put into context their condition and their contribution to the rest of the Great Lakes ecosystem. We do hope that you will be able to sample these sites again after restoration is complete enabling a change analysis that can quantify the gains in ecosystem services these restoration projects may contribute to Lake Superior the Great Lakes basin.

These restoration projects are the result of a broad collaboration of agencies and organizations, each with their own expertise and bringing important resources to the projects. UMD-NRRI's long term commitment and participation in these projects is invaluable. The data and analysis you provide at no extra cost to us is very helpful and allows us to compare our sites to many more sites than we would have otherwise been able.

We hope that you are able to add additional restoration sites to the Coastal Monitoring project as we address additional sites as we believe this will benefit both the science based decision making involved in restoration planning and the natural resources recovery for which we all aim.

Sincerely,

Daryl Peterson
Senior Project Manager

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Central & Western New York Chapter
1048 University Avenue
Rochester, NY 14607

October 18, 2011

Dr. Douglas Wilcox
SUNY College at Brockport

Dear Doug –

The Nature Conservancy is glad to provide a letter of support for the monitoring of coastal wetlands in the Lakeview Wildlife Management Area and in the southern portion of Sodus Bay.

In both of these locations, The Nature Conservancy is actively pursuing conservation of wetlands, either through restoration of hydrologic functions (Lakeview Wildlife Management Area) or actual protection of wetlands through land acquisition. The monitoring of the Great Lakes Coastal Wetlands Consortium will provide useful baseline information which will complement conservation efforts, and assist us in evaluating the impact of this work. We are particularly encouraged that the monitoring will span several years, and look forward to further collaboration.

Thank you for this opportunity to send a letter of support, and best regards,

David Klein
Senior Field Representative

Photos from the Demonstration of Coastal Wetland Monitoring Protocols Field Trip, September 2, 2011

YOU ARE INVITED TO ATTEND!

What: Great Lakes Coastal Wetland Monitoring Coordination Meeting

When: Tuesday August 30, 2011

Where: Grand Traverse Resort near Traverse City, MI

Purpose of this Meeting:

- Link the research teams for the Great Lakes Coastal Wetland Monitoring project with state wetland management programs and tribes throughout the basin.
- Facilitate communication and coordination between the research community and state regulators and managers, and tribes.
- Provide state and tribal regulators an opportunity to learn more about the Great Lakes Coastal Wetland Monitoring project (goals, sites, and data collection methods) and to provide input on the project outcomes and potential uses for this research.
- Provide an opportunity to meet and coordinate with researchers working on the project, reflect on the first year of field work, discuss first year lessons learned and reporting preparation, and to communicate with other state and federal regulators, and tribes about the project.
- Many great research projects produce a wealth of data, but the information is not accessible to regulators and land managers and never achieves the potential to influence wetlands management on a widespread scale. This project and this meeting in particular, aim to bridge the gap between state and tribal wetland managers and researchers on the ground.

The Great Lakes Coastal Wetland Monitoring project is a highly ambitious wetland monitoring project, throughout the Great Lakes basin. Because it was the recipient of the largest Great Lakes Restoration Initiative grant award yet, there is a significant level of expectations and scrutiny of the project outcomes. The hope is that this project can launch a consistent, basin-wide coastal wetland monitoring cycle, with support and motivation for the effort from the research community and the regulatory community. This project has the potential to link research on status and trends in coastal wetlands to state and tribal regulation and land management in a way that improves our overall understanding of the status of our coastal resources today, and helps us to consistently make better management decisions in the future.

Who Should Attend:

- Coastal Wetland Monitoring PI's and Crew Leaders
- Great Lakes States Regulatory Agencies, Great Lakes Tribes, Canadian Regulatory Agencies, and Regional Great Lakes Basin Agencies
- Interested Federal Agencies involved in Great Lakes coastal wetland issues

GREAT LAKES COASTAL WETLAND MONITORING COORDINATION MEETING

Tuesday August 30, 2011 Grand Traverse Resort Acme, MI

Agenda

9:00 am	Welcome *Anne Hokanson, Michigan DEQ*
9:15 am	**Keynote Address**: History and Future of the Great Lakes Coastal Wetland Monitoring Project *John Schneider, USEPA*
9:45 am	Coastal Monitoring Background and Design *Don Uzarski, CMU*
10:45 am	***BREAK***
11:00 am	A Review of Amphibian and Bird Monitoring in Great Lakes Wetlands *Gerald Niemi, Natural Resources Research Institute*
Noon	***LUNCH***
1:00 pm	Database Demonstration *Valerie Brady and Terry Brown, Natural Resources Research Institute*
1:30 pm	Status and Trends Uses and Implications *Chad Fizzell, Michigan DEQ*
2:00 pm	Links to Other Great Lakes Efforts *Roger Eberhardt, Michigan Office of the Great Lakes*
2:30 pm	***BREAK***
2:45 pm	Panel Discussion: Moving Forward – Agency Perspectives *Moderator: Peg Bostwick, Association of State Wetland Managers* Dave Dempsey, International Joint Commission Todd Losee, Michigan DEQ Tom Bernthal, Wisconsin DNR John Jereczek, Minnesota DNR Kevin Hess, Pennsylvania Coastal Zone Management Program
4:15 pm	Closing Remarks and Discussion *Peg Bostwick, ASWM*
4:30 pm	Adjourn