Great Lakes Shoreline Restoration:
Evaluation and Benchmarks

by

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Abstract

Ecosystem restoration has become one of the most common forms of natural resource management, even outpacing habitat conservation as more and more ecosystems are degraded by human activities. But restoration efforts often lack a monitoring component to assess their impacts on ecosystems and to quantify their level of success, which is important for understanding which practices are most effectual to restoring the structure and function of ecosystems. This report examines the outcomes of Great Lakes shoreline restoration projects that have been funded by the National Oceanic and Atmospheric Administration's Restoration Center. Initially, I had planned to collate monitoring data from these projects to perform a quantitative analysis and evaluation of project success. However, after finding that little to no data were available, I constructed a survey of practitioners who ran the restoration projects to evaluate four primary questions: (1) What were the general restoration project characteristics in terms of its goals, cost, size, ecological systems, and target organisms? (2) Were there clearly stated goals, quantifiable objectives, and was a well-developed management plan in place? (3) Was ecological monitoring conducted and, if so, was a statistical analysis of the data compared to a baseline at a spatial or temporal reference site? (4) Was there a demonstrated success through ecosystem improvements post-restoration? While I was able to assess questions (1) through (3) from my survey, answers to question (4) proved ambiguous given that ecosystem improvements were largely evaluated by expert opinion and self-reporting by the project managers/leads for most of the projects. Despite most survey respondents claiming to have conducted monitoring, actual data from projects could rarely be obtained or was presented in an unusable format in reports, leaving success to be largely defined by the subjective interpretation of the project leads. My findings parallel those of other reviews of restoration projects, which have emphasized that projects with clear, quantifiable goals and reliable monitoring programs represent the minority of restoration efforts. If we are to evaluate restoration efforts and establish quantifiable benchmarks for success, funding agencies should require quantifiable goals in project designs, insist on statistically valid monitoring programs, require practitioners make monitoring data available for review, consider including projects in their funding portfolio that focus on quantifying the success of other restoration projects in the portfolio, and include technical expertise on restoration efforts.

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Introduction

The need for ecological restoration is rapidly increasing as we are witnessing widespread environmental degradation and accelerated environmental change. Humans have altered more than 77% of land (excluding Antarctica) and 87% of the ocean through pollution, fragmentation, exotic species invasions, urbanization and agricultural activities.[1,2] In just 46 years, between 1970 and 2016, these anthropogenic modifications have led to an average 68% decrease in wildlife populations.[3] To combat further loss of ecological resources and biodiversity, more attention has been given, in recent years, to the restoration of rivers, streams, shorelines, and nearshore aquatic habitats; and the number of restoration projects for these ecosystems has been increasing exponentially.[4,5]

Over the last decade, the Laurentian Great Lakes have been the focus of one of the largest restoration efforts of any world region in history. Between 2010 and 2021, nearly US$3 billion was spent on approximately 6,000 restoration projects in the Great Lakes.[6] Enhancement of shoreline and nearshore aquatic habitats is a common restoration focus in the Laurentian Great Lakes, as the habitats are vital ecosystems that benefit a variety of freshwater species, including native fish, birds, invertebrates, and plants.[7] Of the nearly 200 species of fish found in the Great Lakes, approximately 80% depend on nearshore ecosystems during some part of their life cycles.[8] In addition to the ecological benefits they provide, the restoration and clean-up efforts of the Great Lakes shoreline regions are projected to contribute at least $50 billion to local economies by making the region more attractive to businesses and workers, reducing municipalities costs, raising coastal property values, boosting fisheries, and increasing tourism and recreational activities.[9] Limited results suggest that restoration efforts in the Great Lakes may also benefit human health, happiness, and well-being.[10]

Despite more than 3,000 shoreline restoration efforts being funded by the Great Lakes Restoration Initiative (GLRI),[6] there has been a general lack of systematic evaluation for project outcomes to determine success rates or long-term impacts. Some have noted that many projects have been initiated without a clear statement of the project's objectives or the success criteria that will be used for evaluation, and relatively few projects have made any effort to quantitatively evaluate their end results.[11,12] The lack of clear goals and standards for evaluation have made it difficult to assess the success and efficacy of shoreline restoration projects.

There is growing consensus among the community of both funders and practitioners that project evaluation is the key to improving the future success of ecological restoration projects.[12,13] However, there are many challenges to evaluation: lack of information and pre-determined criteria, lack of evaluation design (e.g. collection of pre-restoration and control site data), and paucity of consistent standards used to measure success.[12,14,15] However, most professional societies and an increasing number of funding agencies agree that a properly planned restoration project should have (a) clearly defined and quantifiable goals for the restoration site, (b) an evaluation process that is based on analyses of measurements made before and after project implementation, and (c) a target the project is aiming for, which often comes by comparing the project site to a reference site or a historical benchmark.[13,16,17] Without clearly defined goals and quantifiable measures, there is no way to evaluate a project. Without measuring variables pre- and post-restoration, there is no way to know if the restoration effort has had an impact. Without having a target, there is no way to know if the restored site is headed in the right direct post restoration. Although the aforementioned requirements project, are considered essential for a properly planned restoration,[13,16,17] practitioners often do not follow these guidelines as they view them as cumbersome or unrealistic given funding, time, and personnel constraints.

In September of 2020, the National Oceanic and Atmospheric Administration's Restoration Center (hereafter, NOAA-RC) provided funding through NOAA's Cooperative Institute for Great Lakes Research to support this study whose objective was to *"collect and analyze existing data for previously funded [NOAA-]RC shoreline restoration projects, and determine from that analysis whether we can draw conclusions about the outputs, outcomes or effects of these project types for target species."* I was tasked with gathering, organizing, and analyzing monitoring data from in-house files/databases and by direct contacts with past partners for 21 previously funded NOAA-RC projects. In turn, I was to deliver a quantitative (if possible) or qualitative analysis and report summarizing gaps, inconsistencies, and alignment in the monitoring approaches and data collected.

During the first several months of the project (see timeline in **Appendix A**), I read and extracted information from the original grant proposals of these 21 projects, as well as from project reports and final narratives that had been submitted to NOAA-RC. During this review period, it became apparent that monitoring data were rarely reported in project documents and, in the few instances where they were, the data were not presented in a form that could be analyzed for ecological outcomes. Furthermore, I found that data for these funded restoration projects were rarely, if ever, publicly available for me to use in independent analyses. Given that data were not available for projects as had originally been anticipated by NOAA-RC, I decided to design a survey instrument that would gauge practitioner viewpoints on their restoration projects, and that could be used to assess the types of data that may have been collected for each project (even if not reported or publicly available).

My survey of shoreline restoration practitioners addressed four questions: (1) What were the general project characteristics in terms of its goals, cost, size, ecological systems, and target organisms? (2) Were there clearly stated goals, quantifiable objectives, and was a well-developed management plan in place? (3) Was ecological monitoring conducted and, if so, was a baseline established at a spatial or temporal reference site, and was a statistical analysis of the data performed? (4) Was there demonstrated success through ecosystem improvements post-restoration? As I will show, initial questioning of practitioners led them to state that their projects all had clear goals and quantifiable objectives, that routine monitoring had been performed, and that their projects had high rates of success. Yet, more detailed questioning from the survey revealed a different story – namely that the rigor in design, monitoring, and evaluation varied greatly among projects, that only in rare instances were restoration projects able to quantitatively assess the success of efforts, thus most conclusions about Great Lakes shoreline restoration were based solely on expert opinions.

Methods

At the request of NOAA-RC, I surveyed the project contacts for 21 previously funded NOAA shoreline restoration projects that focused on shoreline or nearshore stabilization/ enhancement/creation (description of each project in **Appendix B**).[18] The survey questionnaire (provided in full in **Appendix G**) was administered to each project's primary person of contact. In the following sections, I describe the survey design, my approach to administering the survey, and the means of summarizing information obtained.

Design of Survey

After finding that a quantitative assessment of monitoring data was infeasible, I worked in collaboration with representatives at NOAA-RC to design a survey instrument. I started by adapting the National River Restoration Science Synthesis (NRRSS) questionnaire from Bernhardt et al. (2007)[19] to be more relevant to Great Lakes shoreline restoration projects within the scope of my study. The NRRSS questionnaire shared some common objectives with my study, including understanding how and to what extent restoration projects are evaluated for success. I first removed types of questions that did not provide information relating to the primary objectives, including 17 questions relating to the role of the project contact, in-kind project contributions, designer of the project, impact of citizen groups, construction impact, future assessment plans, placement of the results of this study, and lessons learned from the project. To gather more information relating to the four primary objectives, I added one question relating to habitats addressed by the project, one question relating to organisms targeted for restoration, one question relating to economic analyses, one question relating to public engagement, one question relating to pre-restoration monitoring, and one question relating to post-restoration monitoring. I also changed answer categories to better fit the projects evaluated within my study. The choice of these categories was informed by compiling information from project proposals, interim reports, final narratives, and monitoring results and then analyzing that information for common project traits to determine the category choices. For example, if multiple projects were generally known to address bank stabilization in their restoration efforts, then "bank stabilization" would become an answer category for a question asking, "what were the goals of the project?" Questions were allowed an open-ended qualitative response from the interviewee that was later classified into the answer categories by the interviewer. This open-ended answer option allowed the flexibility for interviewees to add an answer category that may have been overlooked during the survey creation.

My resulting survey contained 37 questions with related answer categories that were designed to gather information about each restoration project (**Appendix G**). The questionnaire was divided into four sections with a final question for additional project contact input: Project General Characteristics (Q1-9); Project Design, Implementation & Coordination (Q10-19); Monitoring (Q20-28); Evaluation (Q29-36); and Additional Input and Advice (Q37). The section for Project General Characteristics contained nine questions**;** one each related to: overall project description, habitats targeted for restoration, project goals, actions implemented to achieve said goals, organisms targeted for restoration, land use, collaborative partners, and funding (two questions). The section for Project Design, Implementation, and Coordination contained 10 questions; one each related to: management plans, economic analysis, site prioritization, factors influencing project design, information used in project design, an advisory committee, public engagement, and project maintenance (3 questions). The section for Monitoring contained nine questions; one each related to: who performed the monitoring, factors that enabled monitoring to be conducted, monitoring constraints, regional monitoring efforts, protocols, dissemination of monitoring results, and whether monitoring was conducted (including the use of control sites, variables monitored, and data availability) (3 questions). The section related to Evaluation contained eight questions; one each related to: project site disturbances, measurable project objectives, use of monitoring data for project evaluation, benefits of the project, changes that could be made to the project, dissemination of project information, and subjective project success (2 questions). The last question related to Additional Input and Advice which asked for any additional input, advice, and information that the project contact felt should be included in the dataset. These sections were designed to provide a summary of each restoration project to better understand their ecological and physical impacts and, where possible, assess their level of success. The order of these sections and related questions were determined for ease of interview delivery. They approximately correlate to the primary survey objectives (1-4), though some sections contain questions that relate to multiple objectives.

My research interview met ethical principles and complied with federal regulations, state laws, and university policies, and protected the rights and welfare of the human participants involved in the survey. The survey was reviewed by the University of Michigan's Institutional Review Board, which is an independent committee made up of at least five members from the academic disciplines relating to the research and at least one member who is not affiliated with the institution.[20]

The survey was pilot tested on one willing project contact, with the agreement that their data would not be included in the study results. The pilot test allowed me to eliminate redundant questions, rephrase or provide prompts for confusing questions, and revise answer choices to better express standard responses. The questionnaire was then finalized, and the survey was administered to the 21 previously funded NOAA shoreline restoration projects.

Administration of Survey

Confidential interviews were carried out with contacts of restoration projects from across the Great Lakes region to gather data about general characteristics of a project, project goals and objectives, ecological monitoring pre- and post-restoration, and demonstration of success through ecosystem improvements. At the first contact for the interview, a project contact was presented a script (**Appendix C**) describing the goals of this study. If the contact agreed to participate in the study, they were sent a summary of the interview themes (**Appendix D**) and a confidentiality agreement (**Appendix E**) explaining that any identifying information would not be included in the published results. Additionally, contacts were sent a project verification document (**Appendix F**) that included previously written records gathered from grant proposals, interim reports, final narratives, and monitoring results including the project location, size, costs, timeline, target species, habitats, partners, goals, activities, and outcomes. The contact would verify the accuracy of these records and make any necessary corrections. This verification document was used to prepopulate the survey prior to the interview to help reduce response fatigue. A time was then scheduled at the contact's convenience for the interview.

The questionnaire was relayed to the point of contact through written form via email or during a video conference using Zoom's video conferencing platform[21] that lasted 45 minutes or less. Each interview was recorded with the permission of the interviewee to promote quality assurance and expedite data entry. Each respondent was asked the same questions in the same order, and care was taken to follow the prepared script. Most questions asked in the interview allowed an open-ended response that was later classified into an answer category by the interviewer. Example responses or categories were provided to the respondent when necessary. The content obtained from the interview was input to a database of summarized project information to be used for qualitative, and when possible quantitative, analysis.

I completed interviews with project contacts for each of the 21 individual coastal restoration projects from around the Great Lakes basin, representing a 100% response rate for the chosen projects. The survey respondents (e.g., project contacts) played many roles within the restoration projects. Most notably, six of the interviewees (29% of all respondents) were the director of a non-profit organization, five (24%) acted as the program manager/coordinator, three (14%) held a scientist or engineering role in the project, and one (5%) was the owner of a local business. Some of the respondents were contacts for multiple restoration projects, where five contacts conducted two or more interviews (two contacts conducted two interviews each and three contacts conducted three interviews each). In total, 13 individuals were interviewed for the 21 projects.

Analyses of results

I asked respondents a set of survey questions, each of which had sub-questions that allowed me to tally specific characteristics of the restoration projects (**Box 1**). The first set of questions asked respondents about general characteristics of projects, including the primary restoration goal, amount of funding received, project size, and targeted ecological system(s) and organism(s). Multiple ecological systems and organisms could be targeted. Responses for this set of questions were used to describe common traits and to cluster projects into similar groups. Categorical variable groupings included the primary goals, and targeted ecological systems and organisms, which were binned into pre-defined categories. For example, the target organism categories included vegetation, fish, bird, herptile (reptile and/or amphibian), mammal, arthropod, and mollusk. Frequency of the categorical selections for each variable was expressed as a percentage of the total number of projects. Discrete variable groupings included project cost/funding received and project size, and were expressed as total sums and averages across the dataset.

The second set of survey questions asked respondents if there were clearly defined goals for the project with quantifiable objectives, and whether the project included a well-defined management plan. These responses were scored as binary variables (presence/absence, yes/no). The stated project goals were analyzed for the presence of quantifiable objectives by searching for measurable parameters with associated projected values in the project proposals, interim reports, final narratives, and monitoring results (e.g., measured level of a pollutant both pre- and post-restoration), and

Box 1. Metrics for which projects were evaluated for effective ecological restoration. Project objectives (1-4) were answered using the data gathered from the survey (subpoints a, b, c…).

1) What were the general project characteristics in terms of its…
   a. Primary goals?
   b. Cost (amount of funding received)?
   c. Size?
   d. Ecological systems?
   e. Target organisms?
2) Were (was) there…
   a. Clearly stated goals?
   b. Quantifiable measures/objectives?
   c. A management plan in place?
3) Was ecological monitoring conducted? If yes…
   a. What variables were monitored?
   b. Was a baseline established at a spatial or temporal reference site?
   c. Was a statistical analysis performed on the monitoring data collected?
4) Was there demonstrated success through ecosystem improvements post-restoration by…
   a. Meeting goals and objectives?
   b. Showing biological, chemical, and physical trends towards positive restoration?

projects were scored for the presence or absence of such quantifiable goals. Frequency of presence or absence of each variable was expressed as a percentage of the total number of projects.

The third set of questions asked respondents about any ecological monitoring that was conducted, what variables were monitored, whether a baseline historical or spatial reference was included in the monitoring, and whether a statistical analysis of the monitoring data was performed. Responses were scored using a combination of categorical and binary variables. Categorical variables included any ecological parameters that were monitored (biological, chemical, and/or physical). Binary variables, scored on presence/absence (yes/no), included whether a baseline historical or spatial reference was established in the monitoring and whether a statistical analysis of the monitoring data was completed. Frequency of the categorical and binary selections for each variable were expressed as a percentage of the total number of projects.

The fourth set of questions asked respondents whether project success and post-restoration improvements were actually demonstrated. Responses to this set of questions provided insight into how the project leads evaluated their project for success. Responses were scored as a combination of binary (yes/no) and categorical variables, with binary variables including the completion of project goals (yes/no) according to the respondent. Categorical variables included the level of success (completely/partially/not at all/too soon to tell) the respondent thought their project achieved, why they thought the project was successful, and the factors they used to come to that conclusion. Frequency of the binary and categorical selections for each variable were expressed as a percentage of the total number of projects.

Results

General Characteristics of Projects

All projects considered in this study were focused, at least in part, on rehabilitation of fish habitat. All but one of the projects reviewed (95%) had more than one goal listed in the project's proposal and/or described by the project contact. The primary project goals reported were improvement of in-stream habitat (24%), removal of debris (19%), restoration of hydrologic connection (19%), construction of fish habitat (19%), provision of fish passageway (10%), management of riparian habitat (5%), and modification of dam/berm environment (5%).

Average project cost was $5,418,379, with a range from $190,000 to $34,339,432 (**Table 2**). In total, $108.3M was spent across all 21 projects. NOAA was the primary funder in 19 of 21 projects (90.5%), contributing $57.2M towards the total amount. The most funding ($75,034,874) was allocated to the State of Michigan, with 12 projects implemented in the state, followed by Minnesota (2 projects, $20,003,662), Ohio (4 projects, $10,219,998), and New York (3 projects, $3,109,053) (**Table 1**). The average project cost differed between states, with Minnesota having the highest average cost at $10,001,831, followed by Michigan at $6,252,906, Ohio at $2,555,000, and New York at $1,036,351.

Average project size was 119 acres with a range from 0.2 to 750 acres. In total, the extent of the land area targeted by all 21 projects was 2,499 acres. The size of projects in Michigan covered a total of 1,147 acres, followed by Ohio covering 1,102 acres, Minnesota covering 240 acres, and New York covering 9.4 acres (**Table 1**). The average size per project by state led with Ohio at 275.6 acres, followed by Minnesota at 120 acres, Michigan at 95.6 acres, and New York at 3.1 acres. The cost of projects per acre follows a somewhat reverse ranking by state, with New York at $110,250, Minnesota at $41,674, Michigan at $5,451, and Ohio at $2,318. Project size was not correlated with project cost (Spearman rank correlation, ρ= -0.07, p = 0.78).

Table 1. Projects costs and size per state.

State	Number of Projects	Sum Total Cost	Sum Total Size (acre)	Average Cost per Project	Average Size per Project (acre)	Cost per Total Size	Cost per Acre per Project
MI	12	$75,034,874	1147	$6,252,906	95.6	$65,418	$5,451.5
OH	4	$10,219,998	1102.2	$2,555,000	275.6	$9,272	$2,318.1
NY	3	$3,109,053	9.4	$1,036,351	3.1	$330,750	$110,250.1
MN	2	$20,003,662	240	$10,001,831	120	$83,349	$41,674.3

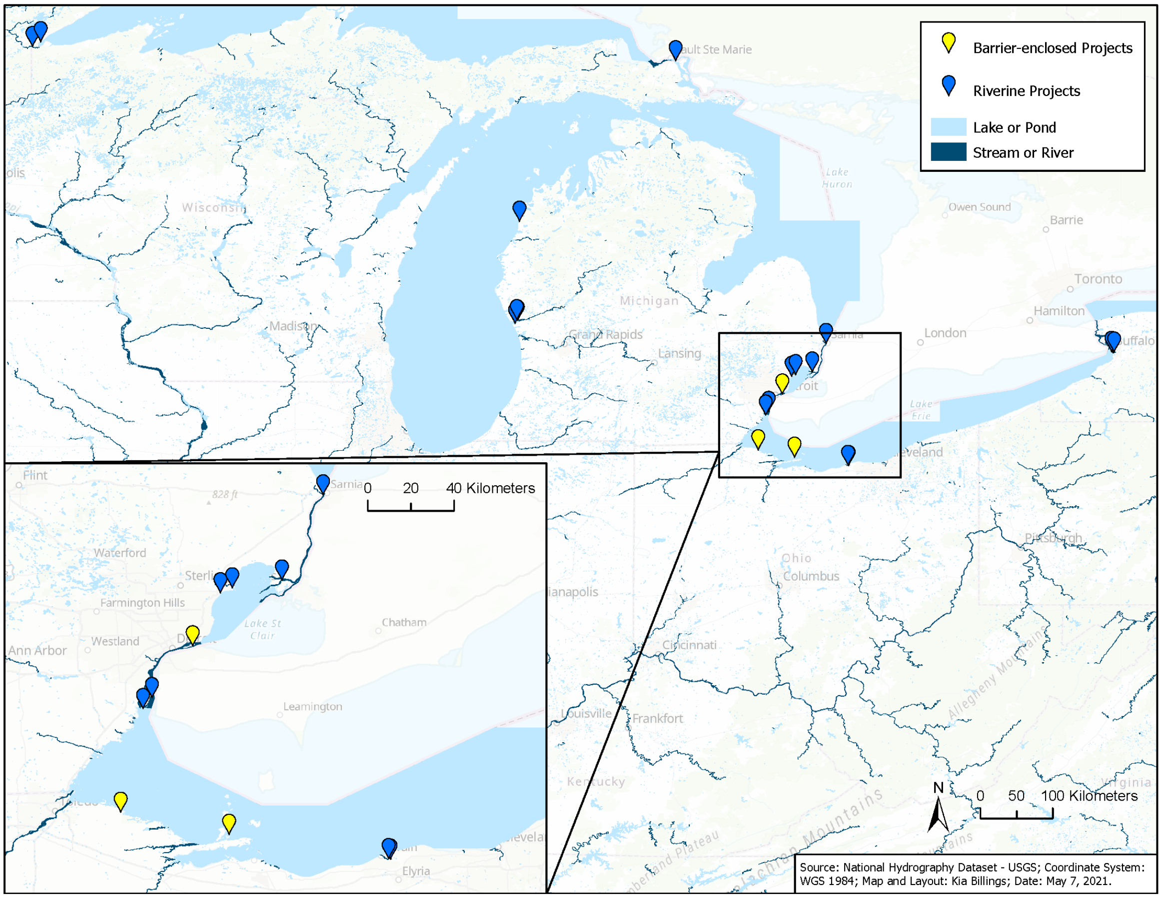

Figure 1. Map of the project locations in Minnesota, Michigan, Ohio, and New York. According to Albert et al., the Great Lakes can be classified into three coastal sections: lacustrine (exposed and directly controlled by Great Lakes waters), riverine (rivers and creeks that flow into or between the Great Lakes), and barrier-enclosed (separated from the Great Lakes by a barrier that protects from wave action but the waters originate from coastal or fluvial processes).[22] Using this classification, 18 projects are coastal riverine locations while three projects (Project ID 2823, 4260, 4387, see **Appendix B**) are barrier-enclosed due to manually controlled separation from coastal waters.

The restoration projects were implemented in a variety of environments and habitats. Riverine environments were the focus of 18 projects (86%) while three (14%) focused on barrier-enclosed environments (defined in **Figure 1**). The most commonly identified target habitats for restoration included riparian (62% of projects), in-stream (52%), wetlands (48%), shoreline (43%), and uplands (38%). The dominant land use within the project watersheds was urban (47% of projects), industrial (24%), and agricultural (24%) with only one project watershed being characterized as forested (5%) by the interviewed contact. Many projects were located on public land (71%), whereas 19% were implemented on private land and 10% were implemented on both public and private land.

The top seven targeted organisms of restoration projects were all fishes; while reptiles, amphibians, vegetation, and invertebrates were each targeted in three or fewer projects. The most popular fish target species were walleye (12 projects), northern pike (11), yellow perch (10), smallmouth bass (7), lake sturgeon (6), muskellunge (6), and largemouth bass (6). The primary limiting factors to these organisms' population within the targeted habitats were stated as lack of spawning and nursery habitat (71% of projects), lack of open space for movement (43%), lack of habitat complexity (24%), poor water quality (19%), and lack of access to resources (10%) such as food, water, air, light, and shelter.

Goals and Objectives

All survey respondents indicated that their projects were guided by clearly stated goals; however, details of the goals varied greatly between projects. For example, one project had a stated goal to "improve water quality variables" and included clear, quantifiable targets for success (shift temperature from 16°C to 15.4°C, pH from 8.59 to 8.22, and turbidity from 75.62 NTU to 22.88 NTU). Another project had a stated goal to "restore optimum bathymetry," but did not define what optimal was or indicate any measurable variable(s) that might quantify success. Survey respondents reported that 95% of their projects had quantifiable objectives. However, when I searched the original project proposals, interim reports, final narratives, and monitoring results for measurable variables with actual units, I found that 17 of the 21 projects (81%) had quantifiable objectives (**Figure 2**).

Of the 17 projects with quantifiable objectives, 16 of those projects (76% of total projects) were performed in areas of concern (AOCs) and had accompanying management plans. Within these management plans, three or more beneficial use impairments (BUIs) were addressed by more than half of the projects. The most common BUIs targeted were loss of fish and wildlife habitat (90% of total projects), loss of fish and wildlife population (86%), and degradation of benthos (62%). Overall project designs were most influenced by ecological concerns (all of projects), but some respondents also identified location-specific limitations (48% of total projects) and project costs (38%) as determining factors. Location-specific limitations refer to environmental conditions that inhibit the type or expanse of restoration, such as a river with small and numerous privately owned sections and disconnected segments.

Ecological Monitoring

Of the 17 projects that were determined to have quantifiable objectives, all 17 of those projects conducted some form of monitoring (**Figure 2**). Even though all projects conducted some form of monitoring, only one quarter to one third of projects had a monitoring design that allowed for any form of statistical inferences to be made regarding the effectiveness of the restoration effort *per se*. A monitoring design that is capable of statistical inference is one that has (a) clearly defined and quantifiable goals for the restoration site, (b) an evaluation process that is based on analyses of measurements made before and after project implementation, and (c) a target the project is aiming for, which often comes by comparing the project site to a reference site or a historical benchmark.[13,16,17] Only six projects monitored a control site that served as a spatial reference and baseline to the project, and four of those six projects (19% of total projects) conducted monitoring for both pre- and post-restoration at the project and control sites (**Figure 2**); thus, allowing statistical inference to be made about changing conditions due to project work.

The projects that had monitoring designs that allowed for statistical inference received, on average, higher amounts of funding compared to projects that did not implement such a monitoring design ($6,510,342 versus $4,950,395, **Table 2**). Additionally, these projects had roughly two more collaboration partners (6.4 versus 4.3),

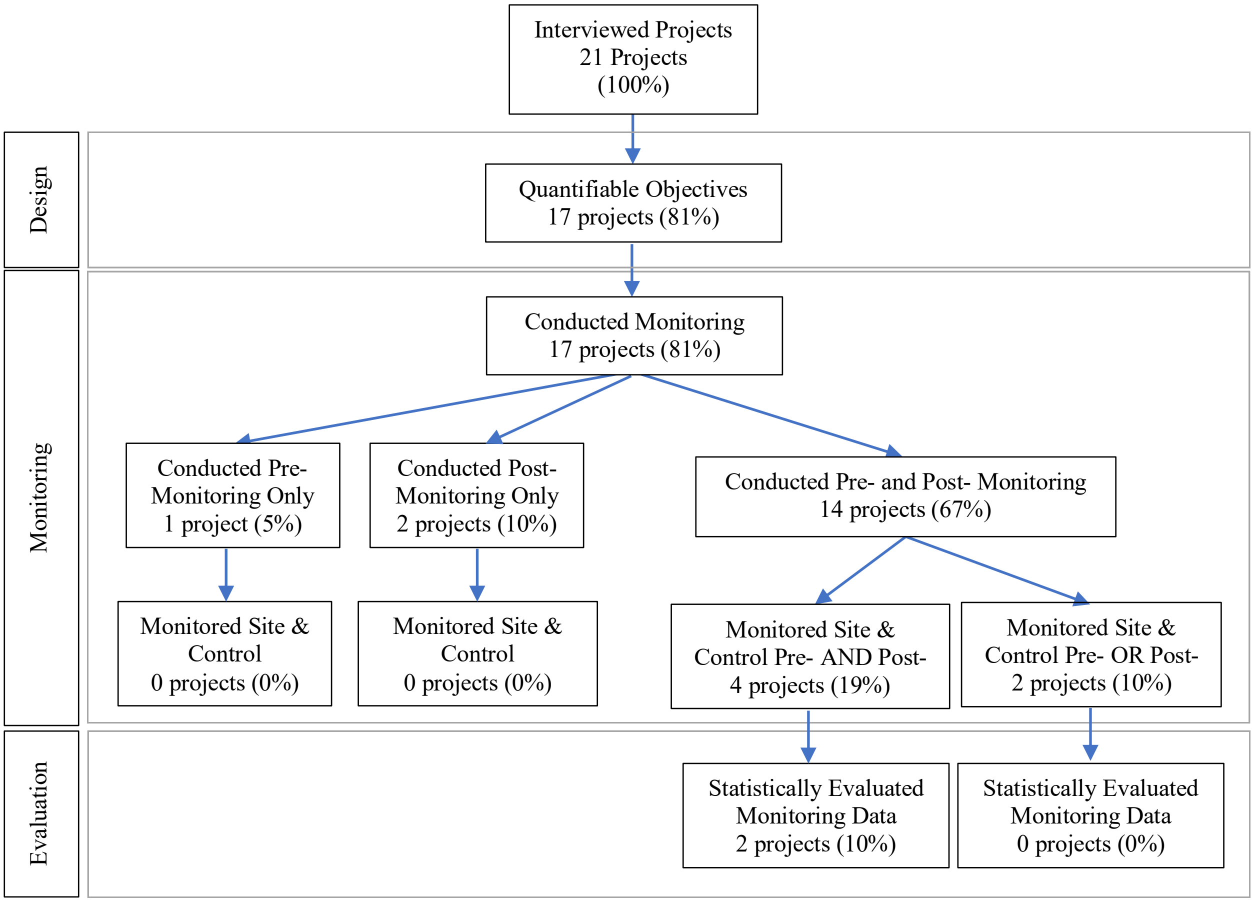

Figure 2. A summary of key findings showing the proportion of total projects that met increasing levels of rigor in their design (addressed in Goals and Objectives section), monitoring (addressed in Ecological Monitoring section), and evaluation efforts (addressed in Ecosystem Improvement section).

less public engagement (83.3% versus 100%), and the same presence of an external advisory committee (66.7%) who convened to discuss the project on a regular basis compared to projects lacking a monitoring design capable of statistical inference.

When considering all 21 projects, most monitoring programs covered only biological variables (**Table 3**) including populations of fishes, invertebrates, birds, herptiles, and vegetation. The second most common monitoring programs covered a combination of biological, chemical, and physical variables. Chemical variables included water chemistry parameters such as water temperature, dissolved oxygen, conductivity, total dissolved solids, turbidity, pH, nitrogen and phosphorus concentrations, and chlorophyll-a, while physical variables included habitat, sediment, connectivity, and morphology evaluations (**Table 4**).

Table 2. General characteristics including costs, funding, number of partners, project size, advisory committee, and public engagement presence for the project data set. A monitoring design that is capable of statistical inference is one that has (a) clearly defined and quantifiable goals for the restoration site, (b) an evaluation process that is based on analyses of measurements made before and after project implementation, and (c) a target the project is aiming for, which often comes by comparing the project site to a reference site or a historical benchmark.[13,16,17]

	All Projects	Monitoring Design capable of Statistical Inference	Monitoring Design not capable of Statistical Inference
Number of Projects	21	6	15
Range in total costs	$190,000-$34,339,432	$347,568-$34,339,432	$190,000-$18,800,000
Range in NOAA costs	$0-$13,804,394	$347,568-$13,804,394	$0-$10,751,615
Average total funding	$5,418,379	$6,510,342	$4,950,395
Average NOAA funding	$2,864,347	$2,905,539	$2,846,694
Mean number of partners	4.8	6.4	4.3
Average size (acres)	119.0	75.9	136.2
% with advisory committee	66.7	66.7	66.7
% with public engagement	95.2	83.3	100.0

Table 3. Monitoring types targeted for pre- and post-restoration monitoring of all 21 projects.

Monitoring Type	Pre (# of projects)	Post (# of projects)
Biological, chemical, physical	6	7
Biological, chemical	3	2
Biological, physical	1	1
Biological only	7	10
Total	17	20

Table 4. Monitoring variables measured during pre- and post-restoration monitoring of all 21 projects.

Monitoring Type	Monitoring Variable	Pre (# of projects)	Post (# of projects)
Biological	Fish	13	12
	Invertebrates	10	9
	Birds	6	6
	Herptile	6	6
	Vegetation	5	11
Chemical	Water chemistry[1]	8	7
Physical	Habitat	3	6
	Sediment/Substrate	4	5
	Hydraulic Connectivity	1	1
	Morphology	1	1

[1] Water chemistry includes parameters such as water temperature, dissolved oxygen, conductivity, total dissolved solids, turbidity, pH, nitrogen and phosphorus concentrations, and chlorophyll-a.

Ecosystem Improvement

Overall, 71% of survey respondents stated that their project was a complete success based on achievement of their goals, whereas 19% indicated only partial success, and 10% said it was too soon to tell. Respondents stated that multiple factors were used for evaluating project success including their own personal experiences and expertise (41%), ecological measurements from monitoring programs (62%), and/or observations unrelated to monitoring (71%).

Although the vast majority of survey respondents stated that project goals had been met, I found that independent evaluation of such claims was not possible. In part, this was due to the fact that I could rarely obtain monitoring data. Despite my attempts, points of contact responsible for data were generally unresponsive or unwilling to share the data, or the individuals who supposedly had the data were stated as unknown. In many instances, project contacts simply referred to data presented in their project reports, which were indeed available for most projects. However, when analyzing the project reports, I found that many offered no data related to the originally stated project goals or objectives. Others that did present data figures or tables did so in a form that proved to be unusable for analyses (e.g., no presentation of standard errors, no presentation of pre- and post-monitoring). As such, I found that inferences about ecosystem change due to restoration efforts were routinely based on expert opinions and self-reporting by the project leads, and generally could not be confirmed by any form of quantitative analysis.

Even if original monitoring data had been available in reports, the survey suggested that statistical inferences could only be made for four projects that performed pre- and post-restoration monitoring, and that had some type of baseline or statistical control (**Figure 2)**. Of these four, only two (10% of total) actually carried out a statistical analysis. For example, Project 2607 (see **Appendix B**) documented an increase in their Index of Biotic Integrity (IBI)[23] for fish beyond their proposed goal for fish habitat and populations (IBI project baseline: 42-49, target/criteria met: 36). However, there was no clear evidence that the fish assemblage had responded positively to the restoration effort as fish composition across sampling sites was generally consistent with pre- restoration sampling efforts.

Discussion

Key Findings

The objective of my survey was to examine the characteristics of 21 Great Lakes shoreline restoration projects previously funded by the NOAA Restoration Center to gauge practitioner viewpoints on the design, monitoring, and evaluation of those projects. I used a survey instrument to ask project leads: (1) What were the general project characteristics in terms of its goals, cost, size, ecological systems, and target organisms? (2) Were there clearly stated goals, quantifiable objectives, and was a well-developed management plan in place? (3) Was ecological monitoring conducted and, if so, was a baseline established at a spatial or temporal reference site, and was a statistical analysis of the data performed? (4) Was there demonstrated success through ecosystem improvements post-restoration? While we were able to assess questions (1) through (3) from our survey, answers to question (4) proved ambiguous given that ecosystem improvements were largely evaluated by expert opinion and self-reporting by the project managers/leads for most of the projects. Independent quantitative evaluation of project outcomes was not possible given that most of the projects did not have a monitoring design that allowed for statistical inference and rarely were data available to be shared with us. Therefore, there is at present no way to evaluate the success of restoration efforts beyond the subjectively reported opinion of survey respondents.

While all survey respondents indicated that their project goals were clearly stated, and most (95%) claimed the inclusion of quantifiable objectives for their project, the clarity and quantifiability of the goals and objectives varied widely among projects. These self-reported estimates may have been inflated given that my own analysis of project goals and objectives from review of original proposals and submitted reports resulted in a lower percentage of projects (81%) having measurable objectives (i.e. measurable using variables that have real units as opposed to concepts). Stated project goals and objectives differed in comprehensiveness, ranging from detailed and quantifiable (e.g., improve fish community health from an IBI score of 37 to 80), to broad and generally quantifiable (e.g., restore 9.6 acres of wetlands), to ambiguous and entirely subjective (e.g., 'positively impact human health'). The inclusion of quantifiable objectives in a project design is important for measuring progress and gauging the effectiveness of restoration, and the lack of quantifiable objectives makes it impossible to evaluate restoration success in any non-subjective manner. Such measurable objectives can also inform the restoration strategies and help focus efforts where most needed.

One noteworthy result of my survey was the high proportion of project managers/leads who stated they were confident in the success of their projects. When asked if they personally considered their project a success, 71% of respondents indicated that their project was completely successful in achieving their goals. Even so, my results simultaneously showed that fewer than half of all projects had the ability to perform any statistical data analysis that would provide inferences about the impact of restoration. Projects not only need to have quantifiable goals, they need to evaluate pre- and post restoration to know if the effort has had any impact, and they need a target (e.g., reference site, historical benchmark) to know if the restored site is headed in the direction of the stated goal.[13,16,17] The disparity between practitioner certainty in success and the actual monitoring designs that provide means for quantifying trends attributable to restoration leaves the definition of success for most projects to the opinions or subjective interpretation of practitioners. Without an appropriate monitoring design that allows for statistical inference, restoration effectiveness cannot be measured, benefits/costs cannot be quantified, and future restoration initiatives may be hampered because detailed ecological comparisons cannot be made using past projects.[24]

The inability for independent quantitative evaluation of project outcomes is perhaps not a surprise given the structure of the original Great Lakes Restoration Initiative (GLRI) program. Projects funded near the program's establishment in 2009 were considered "shovel ready" projects,[25,26] which likely discouraged and even biased against monitoring (particularly pre- restoration monitoring).[27–29] In addition to shovel ready bias, common constraints expressed by survey respondents that prevented adequate monitoring were lack of funding (55%) and lack of time (45%). Respondents suggested that the typical time allocated by grants for restoration initiatives to design, implement, and monitor their project is just a few years, making it difficult to monitor an ecological response in such a short time span.[30]

While there is certainly some truth to the short-time span of grant cycles, it is noteworthy that a few projects did develop monitoring programs with pre- and post-monitoring data compared to targets that would indeed allow for quantitative inference about the success of restoration. However, only two of these projects actually followed through to perform the statistical analyses needed to quantify success. It is sobering to realize that more than $108M was spent on the 21 projects reviewed for this study; yet, only two of those projects actually performed statistical analyses to assess the success of their restoration efforts. More projects should have capacity to allocate at least small portions of their budgets to design effective monitoring programs, and funding agencies should require this in the future. Alternatively, agencies could include a project or two in their funded portfolios that are charged with monitoring the success of a select subset of other restoration projects. Either option would increase the rigor of self-proclaimed successes reported by practitioners and offer independent verification of whether funding has been well spent.

In addition to the lack of adequate monitoring, another key bottleneck in measuring success lies in the lack of setting clear targets for restoration. Targets for restoration often come in the form of historical benchmarks or spatial reference sites, though targets based on other criteria are also reasonable to use (e.g., physiological requirements of the focal species). However, many practitioners view the use of targets as imposing unrealistic expectations on their restoration efforts. For example, practitioners often claim “there is no pristine site that can serve as a spatial reference”, or “there is no period in history where sites have been untouched by humans.” Such claims are little more than a strawman argument, as targets in contemporary restoration are rarely used as measures of human impact. Rather, targets simply represent a human-value judgement of what is to be achieved quantitatively by a restoration effort. Practitioners often avoid setting targets because they themselves, or their stakeholders, cannot decide on or agree on what they are trying to achieve in a restoration effort. Strawman arguments like those mentioned above simply provide a convenient excuse for avoiding the hard decisions and building consensus among stakeholders. Funding agencies should not allow such excuses to continue, lest we continue to spend $108M on 21 projects and not be able to say whether they achieved any clear target for restoration.

It was also striking to me that, when asked, many of the practitioners responsible for projects were unable or unwilling to share their data so that I could perform my own analyses. Indeed, many practitioners referred to data presented in their project reports which contained summarized data that were not usable for independent evaluation. Many practitioners recommended that I consult a different project member for the data. Oftentimes the search for this data was futile as either the point of contact who was responsible for the data was unknown, or the data could not be located due to the project’s age or change of data management. On the very rare occasion that data were collected and the point of contact responsible for the data was known, the point of contact was unwilling to share the data outside of their organization.

Comparison with other Restoration Syntheses

Many of my findings are consistent with those from other restoration syntheses, in relation to ecological monitoring and evaluation. The most comparable synthesis to my study is that of Bernhardt et al. (2007), who found that only 11% of 317 river restoration projects across the U.S. had conducted pre- and post-restoration monitoring at the project site and a control site.[19] Bernhardt et al. (2007) also found that more than two-thirds of the projects that followed a monitoring design that allowed for statistical inference had significant community involvement and had an external advisory committee who convened to discuss the project on a regular basis.[19] My study found that projects that had monitoring designs that allowed for statistical inference had external advisory committees for the majority of projects as well, but less community involved in the form of public engagement. Additionally, these projects received, on average, higher amounts of funding compared to projects that did not implement such a monitoring design ($6,510,342 versus $4,950,395, **Table 2**). This suggests that analyses of restoration success require sufficient funding to pay for monitoring designs that allow for proper statistical inference.

Several other studies beyond Bernhardt et al. (2007) have emphasized the lack of quality monitoring programs as being a major impediment to evaluating restoration projects. Miller et al. (2010) conducted a meta-analysis on macroinvertebrate responses for 24 river restoration studies and found that the low quality and quantity of pre- and post-restoration monitoring data ultimately limited the reliability and validity of their analyses.[31] Similar to my study, Miller et al. (2020) concluded that in order to advance restoration science, rigorous monitoring designs are needed that include pre- and post-restoration monitoring at both the project and a control site, and there should be increased reporting of monitoring results in peer-reviewed journals and databases.[31] Hartig et al. (2011) surveyed 38 soft shoreline engineering projects in the Detroit River-western Lake Erie watershed in 2008-2009.[32] Only six of the 38 projects (16%) had some form of quantitative assessment of ecological effectiveness while the rest assessed "effectiveness" through qualitative visual inspections or did not conduct any kind of monitoring whatsoever.[32] Some of the key lessons learned from Hartig's survey include the need for establishing goals with quantitative objectives to measure project success and involving citizen scientists, volunteers, and universities in monitoring.[32] Several other reviewers of restoration projects have come to identical conclusions,[33-34] leading Hassett et al. (2007) to conclude "Even if monitoring is reported, most databases do not provide enough information to adequately evaluate ecological success."[35]

Limitations

While the high level of confidence stated from expert opinions could certainly be touted as success of restoration projects *writ large*, I would caution against this conclusion since surveys and expert opinion can lead to biased interpretations of projects. Common sources of bias in questionnaires include ambiguous or complex questions, framing and leading questions, response fatigue, respondent's inaccurate recall, or "faking good" where the respondent alters their response in the direction they perceive to be desired by the interviewer.[36] Consider, for example, the comments of one project manager/lead I surveyed, who was quoted as saying his/her project was "partially successful." Yet, when questioned further about challenges experienced during implementation of the project, that same individual stated the project was actually a failure when examined post-construction because the project site had reverted back to its original pre-restoration condition. This type of survey bias has potential to generate overly optimistic assessments of restoration success as project leads are sometimes disinclined to discuss and elaborate on negative aspects of project performance.

I also caution against drawing broad conclusions about Great Lakes Restoration efforts from my study alone, as I assessed a relatively small sample of 21 projects that were of specific interest to one unit of a funding agency (the Restoration Center of NOAA). These 21 projects represent a small fraction of the shoreline restoration efforts being conducted across the Great Lakes basin. Additionally, these projects were not selected at random or as a representative sample of the broader set of restoration programs. As such, my findings should remain limited to this small sample, and my conclusions should not be extrapolated to Great Lakes restoration efforts as a whole. Future studies that incorporate larger and more representative samples are needed to draw conclusions about the Great Lakes restoration efforts *writ large*.

Recommendations

Restoration initiatives are an important management action to address the degradation of ecosystems. Based on this assessment of a small subset of restoration projects in the Great Lakes, I find several aspects of coastal restoration that can be improved. I suggest that funding agencies should:

1. Require quantifiable goals and objectives in restoration project design and management plans, and establish review criteria for ensuring these quantifiable goals and objectives exist.
2. Insist on, and provide funding to support, the execution of statistically meaningful monitoring designs that are needed to detect changes in project goals and objectives (pre- and post-restoration monitoring), and to be able to link those changes to a restoration effort by comparing to an established baseline (e.g., control site).
3. Require that project monitoring data be made publicly available in its raw (unsummarized) form, either in a permanent data repository and/or accompanying a final project report.
4. Consider including one or two projects in their funding portfolio that focus on quantifying the success of other restoration projects in the portfolio, thus allowing for independent verification of success for a subset of key projects.
5. Include technical expertise and knowledgeable staff on restoration initiatives who understand scientific models and how to craft testable hypotheses in order to increase certainty over project evaluations.

Importantly, none of these recommendations are new or unique. Indeed, they reiterate what has been stated by numerous prior syntheses of restoration efforts, and they restate what has been repeatedly called for by professional societies like the Society for Ecological Restoration. But perhaps if the recommendations are repeated enough times, they will eventually be adopted by those who fund, and those who perform restoration efforts.

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Appendices

A. Timeline of Major Project Events

Table 1S. Timeline of the major events of the project. This timeline shows the general evolution of the project, starting with the attempt to analyze existing project data to determine whether conclusions could be drawn about the ecological outcomes of these projects for targeted organisms, and the deeper development of a survey instrument once it was realized a quantitative analysis could not be executed with the existing data.

Date	Event
October 2019	Julie Sims from NOAA-RC approaches PI Brad Cardinale to discuss NOAA's interest in evaluating shoreline restoration projects
March 2020	A project workplan is submitted to NOAA through the University of Michigan's Cooperative Institute for Great Lakes Research (UM-CIGLR)
May 2020	M.S. student Kia Billings is hired to lead the project, and is paid for the first several months on PI Cardinale's discretionary funds so the project can begin
June 2020	First meeting with NOAA-RC to discuss project list, reports, and survey instrument gather list of projects, proposals & reports from NOAA
July 2020	Initial sharing of project documents (proposals, progress reports, monitoring reports) from NOAA.
September 2020	UM-CIGLR receives funding for the project Lack of usable data in project documents is realized. Continued work on survey development with added monitoring details.
October 2020	Final input from NOAA on survey. Approval received from UM IRB.
December 2020	Project list of 22 projects is finalized. Review of project proposals and reports completed. Additional project dropped in March 2021, bringing total project count to 21.
December 2020 – March 2021	Interviews conducted using survey. Attempts made to gather monitoring data and reports not supplied by NOAA.
May 2021	Survey completed.

B. Project Descriptions

Table 2S. Project name and description for each of the 21 projects in the data set**.**

Project Name	Project ID	Description
Muskegon Lake Great Lakes Area of Concern Habitat Restoration Project (ARRA)	2607	In partnership with the Great Lakes Commission and local partner West Michigan Shoreline Regional Development Commission over 33 acres of wetland and 2.5 miles of shoreline at 10 separate locations were restored within the Muskegon Lake Area of Concern (AOC). This work significantly contributed to the removal of fish and wildlife related beneficial use impairments and completing management actions within the AOC ultimately resulting in the delisting of the AOC.
Arcadia Marsh / Bowens Creek Restoration and Fish Passage	2811	This project will restore access to a significant amount of stream channel and coastal emergent marsh adjacent to Arcadia Lake, Manistee County, Michigan. The restoration will be accomplished by diverting water from a channelized stream back into its original channel where instream habitat will be provided; seven perched, undersized or misaligned culverts will be replaced within the Bowens Creek watershed; excess sediment will be removed, and native vegetation will be planted within Arcadia Marsh to restore historic wetland conditions; and marsh will be treated for invasive plant species.
Restoring native fish spawning habitat in the St Clair River Delta (Middle Channel) in the St Clair River Area of Concern	2821	The spawning reef supports native fish species. Project involves the construction of 40,000 square ft. of native fish spawning habitat in the St. Clair River AOC and connects spawning habitat to almost 14 square miles of rich, underutilized nursery area in the St. Clair delta.
Restoring Lake Erie Hydrology and Coastal Marsh at Middle Harbor	2823	A principal feature of this project was its contribution to restore the physical, chemical, and biological processes and ecosystem functions to 350 acres of coastal wetland habitat. The project provided a full range of ecosystem services including hydrologic retention, nutrient and sediment trapping, spawning, nesting, and nursery habitats, and other habitat needs of fish and wildlife, and prevention or management of non-native plant and animal species.
Lower Black River Fish Habitat Restoration Project	2825	The primary objective of this project was to restore the physical conditions of the Black River's aquatic habitat to benefit fish and other aquatic species. The primary mechanism was the creation of fish shelves, which incorporated a shallow, underwater ledge with aquatic vegetation and rock piles. The fish shelves provided a "living shoreline," helping to stabilize the river banks while at the same time providing habitat for fish, macroinvertebrates, and other aquatic organisms.
Little Rapids Habitat Restoration Engineering and Design - St. Marys River AOC	2923	Through a regional partnership with the Great Lakes Commission, water flow to historic rapids habitat in the St. Marys River was restored with the construction of a bridge to replace two undersized culverts. Implementation of this project was the last remaining restoration action needed to remove the St Marys River AOC's habitat related BUIs and is an important step in delisting the AOC. This project builds off of a previously funded FY 11 GLRI award that supported the engineering and design of the restoration project.
Regional Partnership for Restoring Habitat in Great Lakes Areas of Concern with Local Implementation in Muskegon Lake; Michigan	3008	The Great Lakes Commission is the lead partner overseeing the West Michigan Shoreline Regional Development Commission and other local partners implementing a plan to restore impaired fish and wildlife habitat and populations in the Muskegon Lake Great Lakes Area of Concern. The project will soften armored shoreline, restore and improve wetlands, shoreline and lake bottom. Native plantings will lead to improvements of benthic habitat along near shore waters of the lake and in tributaries to the lake. A more natural connection between the land and the littoral zone will be created, resulting in improved fish and wildlife passage between open water and nesting/foraging area. Permanent conservation of critical habitats will be determined in consultation with landowners.

Clinton River Spillway Habitat Restoration - Phase I Implementation	3031	Working with the Macomb County Public Works Office, the Clinton River Spillway Habitat Restoration project focused on invasive vegetation management and the restoration and enhancement of four specific areas within the approximately 2-mile-long Spillway corridor. Restoration included the replacement of an existing concrete rubble shoreline with a living shoreline (graded banks, stone and sand placement, plantings, and woody materials) as well as the addition of discrete sections of off-channel pools focused on refugia for small fish, habitat for waterfowl and other wading birds, and basking areas for herpetofauna. This project built off of a previously funded GLRI award (2011) that supported the engineering and design of the restoration project.
Upper St. Clair River Habitat Restoration Project	4006	Primarily, this project enhanced reproductive success and productivity of native species and contributed substantially to the removal of the Loss of Fish and Wildlife Habitat BUI, and ultimately to the delisting of the St. Clair River AOC. The following project outcomes completed: 1- Restored 4,300 total feet of shoreline/ Removed 700 feet of sea wall and 2,600 tons of debris; 2-Constructed .75 acres of native fish spawning habitat in the St. Clair River AOC in close proximity to a .25 acre underutilized nursery area in the St. Clair River south of the proposed project; 3- Constructed 1.75 acres of soft shoreline restoration and shallow water nursery habitat; and 4- Created & implemented interpretative signage, displays and materials, and an education program training 30 – 50 local volunteers (annually) in the long-term management of invasive plants.
Detroit River - AOC Stony Island Habitat Restoration	4258	Working with the Friends of the Detroit River, engineering and design plans were developed to determine the appropriate restoration techniques to restore wetland and submerged habitat within the degraded and eroded areas adjacent to Stony and Celeron Islands in the Detroit River Area of Concern. Once implemented, we expect to create and protect at least 10,000 linear feet of coastal shoreline and more than 100 acres of marsh and submerged habitat. Implementation funding was provided for the Stony Island site only. The work completed at Stony Island includes the restoration of 3,246 LF of habitat shoal and creation of 550 LF of habitat shoal islands in the upper bay. Fifty acres of backwater habitat was enhanced, protected and created. Additionally, a variety of habitat design elements were incorporated into the project to provide multiple niche habitats in support of existing fish and wildlife species.
Howard Farms: Restoring coastal wetlands, Lake Erie hydrology, natural stream channel, fish passage, and public recreation	4260	Through a regional partnership with Ducks Unlimited, this project restored coastal wetland habitat in Ohio's western Lake Erie basin and was the largest farmland-to-coastal wetland restoration in the western Lake Erie watershed in many decades. This project was funded over multiple years, and restored over 560 acres of coastal wetland and 100 acres of naturally vegetated upland to the landscape. More than 28 fish species will benefit from restoring and reconnecting these coastal marshes to Lake Erie.
Black River Landing & Heron Rookery Habitat Restoration Project	4351	Working with the City of Lorain and local partners, this project directly benefited the Black River, Black River AOC, and Lake Erie. The primary objective was to restore the physical conditions of the Black River's riparian and aquatic habitat to benefit fish, macroinvertebrates and other species. Activities included the restoration of in-stream aquatic habitat and stabilization of streambank, and advanced the delisting of 3 habitat-related BUIs for the AOC. The project complements previous and ongoing restoration projects conducted by the City under GLRI.
St. Louis River Restoration Initiative Implementation Partnership: Chambers Grove	4366	Through a regional partnership with the Minnesota Department of Natural Resources), Fisheries Division, the project removed 800 feet of hardened shoreline (sheet pile and gabion baskets) that forms the riparian corridor within this section of a critical spawning area in the St. Louis River Estuary. The resulting action restored the natural biological function of the shoreline and established spawning habitat features that would be attractive to lake sturgeon, walleye and smallmouth bass. The hardened shoreline along the Chambers Grove City of Duluth Park protects a walkway and fishing platform along the river's edge. Floods damaged the former sheet

		piling and walkway and the City agreed to the restoration of the shoreline to a natural condition while retaining public recreational use, including fishing.
Blue Tower Turning Basin Restoration	4381	Since its designation as an AOC, much has been accomplished in the Buffalo River AOC, especially in remediating hazardous waste sites. Significant work is currently underway to remediate contaminated sediment, which will aid in delisting seven of the AOC's nine BUIs. The primary issues affecting the Buffalo River today are impaired water quality, contaminated bottom sediments, inactive hazardous waste sites, point and nonpoint source pollution, combined sewer overflows, and fish and wildlife habitat loss and degradation. Blue Tower Turning Basin (BTTB) included the E&D and restoration of approximately 1,632 linear feet of in-water habitat, in the form of emergent vegetation (EV), and submerged aquatic vegetation (SAV). The restoration of this narrow Project Area brings the Buffalo River approximately 8.18% closer to delisting Beneficial Use Impairment (BUI) #14-1-b: 14: Loss of Fish and Wildlife Habitat, 1) Restore Habitat Connectivity; AND b) implement the Buffalo River Habitat Action Plan (2013).
Buffalo Motor & Generator Corp. Restoration	4382	Since its designation as an AOC, much has been accomplished in the Buffalo River AOC, especially in remediating hazardous waste sites. Significant work is currently underway to remediate contaminated sediment, which will aid in delisting seven of the AOC's nine BUIs. The primary issues affecting the Buffalo River today are impaired water quality, contaminated bottom sediments, inactive hazardous waste sites, point and nonpoint source pollution, combined sewer overflows, and fish and wildlife habitat loss and degradation. This project designed the restoration techniques needed to restore the site. The Buffalo Motor & Generator Corp. project included the E&D and construction of approximately 331 linear feet of in-water habitat, in the form of emergent vegetation (EV), submerged aquatic vegetation (SAV), and, potentially, submerged fish-habitat structures. This brings the Buffalo River approximately 1.66% closer to delisting Beneficial Use Impairment (BUI) #14-1-b: 14: Loss of Fish and Wildlife Habitat, 1) Restore Habitat Connectivity; AND b) implement the Buffalo River Habitat Action Plan (2013).
Detroit River - AOC Lake Okonoka Habitat Restoration Design	4387	Belle Isle is positioned at the "gateway" to the Detroit River. This project will make advancements in reconnecting Belle Isle's internal waterways and wetlands to the River and restoring the wet-mesic flatwoods forest to enhance habitat for a great diversity of animal and plant species. This will provide additional spawning habitat and nursery areas for juvenile fish immediately downstream from a successful spawning shoal at the eastern tip of Belle Isle. The project will reconnect Lake Okonoka in two places. A connection to the Blue Heron Lagoon under Lakeside Drive will be created via a constructed channel and bridge. Lake Okonoka will be connected directly to the Detroit River under The Strand via a large box culvert on the southern side of Lake Okonoka, west of the end of the South Fishing Pier. NOAA/GLRI funds have contributed to a hydrologic assessment and pre-design of Belle Isle's waterways and wet-mesic flatwoods forest; development of final engineering bid documents for the bridge and culvert connections; habitat enhancements in Lake Okonoka and along Belle Isle's south shore adjacent to the South Fishing Pier structures; and project construction.
Black Creek Marsh Coastal Wetland Restoration at Lake St. Clair Metropark	4388	The Black Creek Marsh coastal wetlands have been impacted historically by dredging, filling, hydrological modifications, and invasive species infestation. These wetlands have been physically disconnected from their source, the Clinton River and Lake St. Clair, and therefore no longer receive many of the benefits of lake coastal processes. Through this award, the grantee dredged approximately 55,000 square feet of improved open water channel habitat, and approximately 32,000 square feet of open water pools connected by these channels. Although this was a change in scope from the original intent to reconnect the historic Black Creek channel to the Clinton River (which was stymied by a lack of landowner

		participation), the work still met award objectives to increase spawning habitat for fish such as Northern Pike and Lake Perch, improved recreation opportunities, and continued the control of invasive aquatic species, such as Phragmites, through a combination of spot herbicide application, mowing, and prescribed burning on newly acquired properties and in other places in the Black Creek Marsh.
Riverbend Phase 1 Post-Construction Management	4390	Riverbend Phase I Restoration effort included further-enhancements and addressed failures and potential erosion concerns at the Riverbend Phase I shoreline, riparian, and upland habitat restoration site. At approximately 2,800 linear feet, including approximately 6.29 acres, the Riverbend Phase I restoration brings the Buffalo River approximately 14.04% closer to delisting Beneficial Use Impairment (BUI) #14-1-b: 14: Loss of Fish and Wildlife Habitat, 1) Restore Habitat Connectivity; AND b) implement the Buffalo River Habitat Action Plan (2013). NOAA funding under this grant supported the equivalent of 175 linear feet of streambank restoration as part of post construction maintenance.
Bear Creek Hydrologic Reconnection and Wetland Restoration Project	4469	The Muskegon Lake Bear Creek Hydrologic Reconnection and Wetland Restoration Project restored a 36.4 acre degraded wetland that was diked and disconnected from Muskegon Lake AOC surface waters in the 1930s to enable conversion to a celery farm. The site, which contains two separate ponds, was no longer farmed yet remained disconnected from Bear Creek and Bear Lake, resulting in the loss of significant natural resource ecological values and functions. The Bear Creek Hydrologic Reconnection and Wetland Restoration project reconnected the two sites to Bear Creek and Bear Lake to restore fish and wildlife habitat and improve the nutrient functions of this former floodplain wetland. Reconnection of the wetland system has improved habitat, water quality and fish and wildlife passage between open water, nesting and foraging areas. The implementation of this project resulted in the reconnection of 36.4 acres of floodplain habitat, restoration of 36.4 acres of emergent and open water wetlands and 2,015 ft. of softened stream bank. Integral to this project was the removal of phosphorus-laden sediments from the ponds, removing dikes and associated fill, managing invasive plants to restore wetlands, install woody structure, grade and enhance habitat along the shoreline.
Grassy Point/Kingsbury Bay Habitat Restoration Project	4547	Relatively uncontaminated sediments and dense growth of invasive species will be removed to reestablish the bathymetry of a shallow sheltered bay at Kingsbury Bay in the St. Louis River, which historically supported a large area of high-quality habitat. Approximately, 166,000 cubic yards of material will be excavated from Kingsbury Bay with a portion of this amount to be transported to the Grassy Point restoration project nearby which is not part of the settlement. Other components of the settlement include the restoration and stabilization of Kingsbury Creek upstream of Kingsbury Bay, the establishment of wild rice at particular locations within the estuary and signage and displays regarding native American culture in the region.
Detroit River - AOC Celeron Island Habitat Restoration	4651	This implementation project is a major step in completing a habitat re-construction among the islands in the lower part of the Detroit River. This area of the Detroit River serves as one of the most important spawning areas for western Lake Erie. Celeron Island is a 68-acre island in the lower Detroit River at the mouth of Lake Erie, located in the Township of Grosse Ile, MI. To prevent erosion of the southern end and northeast side of the island and to reform the previously lost wetland areas by reducing river currents and wave action, the project team will construct a series of emergent and offshore shoals to protect the island from strong south and southeast lake driven waves and will allow for the regeneration of wetlands in the quiet water formed behind the shoals. Associated with the shoals, additional fisheries and avian habitat will be constructed.

C. Initial Contact Script

The following was the script used to initiate the contact for survey participation:

Hello, my name is Kia Billings and I am a graduate student in the University of Michigan's School for Environment and Sustainability. At the request of Julie Sims with the National Oceanic and Atmospheric Administration (NOAA) Restoration Center (RC), I am conducting research to summarize the characteristics of NOAA-funded projects that have focused on the restoration, protection, and enhancement of shorelines and nearshore aquatic habitats in and around the Great Lakes. This research will help NOAA gauge the success of shoreline restoration for target species and inform future monitoring protocols for restoration.

1) I have on record that you are the project contact for the restoration project called (project name) on (water body) in (state). Do you recall this project? [Yes/No]

2) Would you be willing to spend 30 minutes on a day and time that is convenient for you to answer survey questions about your project? [Yes/No]

  2a) If yes, can we please schedule a date to conduct the survey?

  2b) If no, can you suggest someone else that I could contact about this project? (I will need their name, affiliation, phone number/email address)

Continue if Yes:
I appreciate you agreeing to participate in our survey. I want to let you know that the interview will be recorded in order to ensure the answers are coded for quality assurance. These recordings will be destroyed once all information has been registered. We will not retain any identifying information about you, or about the specific project so that answers will remain fully confidential.

3) Prior to the interview, I will be sending you an email containing an overview of the types of questions that will be asked in the survey. This overview will help you gather the appropriate information if necessary. In addition, I will be sending a short summary with details about (project name) as I understand them. If you need more time to gather information before the appointment time or if you feel someone else would be better suited to answer the questions, please do not hesitate to contact me.

* If the project contact agrees to be interviewed, the following documents will be sent to them prior to the interview date: Summary of Survey Themes, Confidentiality Agreement, Project Verification. *

D. Summary of Survey Themes

Overview of Interview Topics

Part I. Project General Characteristics

- What were the strategies and habitats addressed in the project?
- What motivated the project?
- What were the goals of the project?
- What actions were implemented for the project?
- What species were targeted?
- What entities funded, designed, and implemented the project?

Part II. Project Design, Implementation & Coordination

- Was this project coordinated with other efforts in the watershed or region?
- Was an economic analysis performed on the project?
- How was the project site(s) chosen?
- What was the source of the design criteria and project plan? (i.e., from state or federal guidebooks, from in-house expertise, etc.)
- What was the role of scientific information or the scientific method in informing project design, implementation, and evaluation?
- To what extent was the public involved in informing project design, implementation, and evaluation?

Part III. Monitoring

- Were data collected before, during, or after the project was conducted, either at the project site or at (a) reference site(s)?
- What types of data were collected? Which data collection protocols were used?
- What factors constrained this project (e.g., the planning, design, monitoring or evaluation options for restoration projects)?

Part IV. Evaluation

- Did the project achieve its stated goals and/or were there unforeseen benefits of the project?
- How was the project assessed?
- Did the project generate new knowledge and was that knowledge made available to others?

Part V. Additional Input and Advice

- What aspects of restoration could scientists address that would benefit the restoration community at large?
- Which areas of restoration ought to be improved in order to best enable progress in ecological restoration?

E. Confidentiality Agreement

The following was the confidentiality agreement that was sent to project contacts once they agreed to participate in the survey:

We appreciate your agreement to take part in the Great Lakes Shoreline Restoration Evaluation and Benchmarks Survey.

As previously mentioned when we invited you to survey, your answers to our interview questions will remain confidential. We will not retain any link between your responses and contact information or the project name and location. Results from the survey will be published only in aggregate form with no direct quotes made to the public.

The phone or teleconference interview will be recorded. These recordings will be destroyed as soon as all responses are entered into our database. The purpose of the recording is to make sure that data entries can be checked after the interview, in order to ensure your time is used valuably and in the shortest fashion possible.

F. Project Verification

The following template was used to gather data from project proposals, interim reports, final narratives, and monitoring results prior to the interview with the project contact:

Project Contact Verification
(I will ask if this information is correct at the beginning of the scheduled interview)

Project name:

State:
County:
Watershed:
Water body:

Latitude:
Longitude:

Project start:
Project end:

Project status:

Funding total:
Funding from NOAA:
Primary funder:

Project size:

Landowner:

Targeted species:

Partners:

Project goals:
Project actions:
Outcomes:

G. Questionnaire

Prior to beginning the survey, please check for any errors that might exist in our project records (from verification sheet) and fill in all unknown values.

Part I. Project General Characteristics

1) Please provide a 1-2 sentence project description. [Text]

2) What type of habitat(s) was the focus of the project? [Check all that apply]

- Freshwater wetland
- Riparian zone (non-wetland)
- In-stream
- Submerged aquatic vegetation
- Soft bottom mud/sand
- Hard bottom
- Rocky shoreline
- Upland
- Beach
- Other [Text]

3) What were the goals of the project? [Check all that apply]

- Water quality management
- Riparian management
- Stormwater management
- In-stream habitat improvement
- Bank/shoreline stabilization
- Fish passage
- Flow modification
- Channel reconfiguration
- Land acquisition
- In-stream species management
- Aesthetics/recreation/education
- Remove invasive species
- Culvert modification (remove, replace, modify)
- Hydrological reconnection
- Native vegetation enhancement
- Woody structure placement
- Debris removal
- Construction of fish reef habitat
- Reconstruct shoreline
- Dam/berm modification (remove, replace, modify)
- Sediment removal
- Shoal construction
- Erosion control
- Other [Text]

3a) Which of these was the primary goal for this project? [Categories]

- Water quality management
- Riparian management
- Stormwater management
- In-stream habitat improvement
- Bank/shoreline stabilization
- Fish passage
- Flow modification
- Channel reconfiguration
- Land acquisition
- In-stream species management
- Aesthetics/recreation/education
- Remove invasive species
- Culvert modification (remove, replace, modify)
- Hydrological reconnection
- Native vegetation enhancement
- Woody structure placement
- Debris removal
- Construction of fish reef habitat
- Reconstruct shoreline
- Dam/berm modification (remove, replace, modify)
- Sediment removal
- Shoal construction
- Erosion control
- Other [Text]

3b) Why was [GOAL from Q3a] considered the main goal for this project? In other words, why was it important to achieve this goal in the project?

- Addressing greatest factor influencing aquatic degradation
- Legal requirements
- Focus for which funding was available
- Public demand and/or safety
- Problem that could be most easily addressed
- Other [Text]
- I don't know

4) What actions were implemented to achieve the project's goal(s)? [Text]

4a) Are there quantitative measures of each action taken? [Yes/No/I don't know]

4ai) If Yes, Are the quantitative data available, or can they be made available?
[Yes/No/I don't know/Source [Text]]

5) Was there a particular group of organisms targeted for the project's goals?
[Yes/No/I don't know]

5a) If Yes, Which group(s)? [Check all that apply]
- Vegetation
- Fish
- Birds
- Reptiles
- Amphibians
- Mammals
- Arthropods
- Mollusks
- Other [Text]

5b) If Yes, Were specific species targeted? [Yes/No/I don't know]

5bi) If Yes, Which species? [Text]

5bii) If Yes, Does the species have a factor that limits its existence in the focal habitat? [Yes/No/I don't know]

5biii) If Yes, What is the limiting factor? [Select one]
- Nursery/spawning habitat
- Open space for movement
- Habitat complexity
- Water quality
- Access to resources
- High wave energy
- Other [Text]

6) What is the dominant land-use within the project watershed? (Be sure the contact is describing the watershed as a whole rather than just the adjacent land-use)
- Urban
- Suburban
- Agricultural
- Undeveloped
- Protected
- Wildland
- Other [Text]
- I don't know

For the next 5 questions only ask the subject to classify the entity if it is not obvious, otherwise just clarify (e.g. if they answer that the project was funded by MI DNR just confirm that this is a state agency)

7) Who was the primary funder of the project? [Text]
Classification:
- Private landowner

- Commercial developer
- City/county agency
- Local or regional authority (e.g., Conservation District, Water Management Authority)
- State agency
- Federal agency
- Non-governmental/Not for profit organization
- Other [Text]
- I don't know

7a) How much did they contribute? (dollars)

8) Were there additional funders? [Text]

Classification: [Select which applies for each funder]

- Subject's Organization
- Private landowner
- Commercial developer
- City/county agency
- Local or regional authority (e.g., Conservation District, Water Management Authority)
- State agency
- Federal agency
- Volunteers
- Non-governmental/Not for profit organization
- Other [Text]
- I don't know

8a) How much did they contribute? (dollars)

9) Were there other partners that haven't been mentioned yet? [Text]
By partners we mean any entities that were involved in any aspect of the project that have not been mentioned in previous questions.

Classification: [Select which applies for each partner]

- Subject's organization
- Private landowner
- Commercial developer
- City/county agency
- Local or regional authority (e.g., Conservation District, Water Management Authority)
- State agency
- Federal agency
- Volunteers
- Non-governmental/Not for profit organization
- Other [Text]
- I don't know

Part II - Project Design, Implementation & Coordination

10) Was the project linked to a local or regional plan (e.g. lake wide action management (LAMPs), watershed, or remediation/restoration plans)? [Yes/No/I don't know]

11) Did the project justification include an economic analysis? [Yes/No/I don't know]

11a) If Yes, what kind of analysis? [Select one]

- Cost-benefit analysis
- Return on investment
- Property value projection
- Other [Text]

11ai) What were the results?

12) What factors led to the prioritization of this site over other possible restoration locations?
[Check all that apply]

- Funds available
- Public interest
- Scientific interest
- Ecological concerns
- Infrastructure concerns
- Legal requirements
- In-formal watershed plan
- Part of a broader vision for the area
- Recreation
- Available land opportunities
- Other [Text]

13) What factors were the most important in determining the final project design? [Check all that apply]

- Cost
- Requirements or mandates
- Location-specific limitations
- Ecological impacts
- Ecological opportunities
- Stakeholder preferences
- Previous experience
- Available expertise
- Other [Text]
- I don't know

14) What types of analyses or information were used in creating, implementing, and evaluating the design plan that was selected? [Rank from most to least influential]

- Past experience
- Workshops or short courses
- Manual/Book/Report/ Government agency guidelines
- Peer-reviewed journal

- Models or project site analysis
- Individuals (If so, what area(s) of expertise?)
- Hydrology
- Biology
- Ecology
- Geomorphology
- Engineering
- Other [Text]
- I don't know

15) Is there a formal advisory committee associated with this project – that is, a selected group of people convened to discuss the project on a regular basis that differs from those who run day-to-day project management? [Yes/No/I don't know]

    15a) If Yes, What kinds of members? [Check all that apply]
    - Members of the public
    - NGOs
    - Tribal representatives
    - Academics
    - Agency scientists
    - Consultants
    - Industry representatives
    - Other [Text]
    - I don't know

16) Did the project conduct any public engagement? [Check all that apply]
- Local advisory board with community members
- Stakeholder outreach and engagement to raise awareness of the project
- Public comment collected through local meetings or online forum
- Other [Text]
- No public engagement was necessary/required
- No
- I don't know

17) Was funding available for project maintenance? [Select one]
- Yes
- No
- I don't know
- Initially no, but funds and/or volunteers were later acquired

18) What types of follow-up maintenance occurred? (Check all that apply)
- Structural reinforcement (additional structures added to protect existing project elements)
- Planting
- Seeding
- Additional substrate

- Watering
- Invasive species removal
- Removal of debris jams
- Structural elements relocated or replaced
- Entire project redone
- Other [Text]
- I don't know
- None
- No follow-up maintenance needed

19) Do you anticipate a need for on-going maintenance for the project in the future?
[Yes/No/I don't know]

19a) At what frequency?
- Once
- Monthly
- Annually
- After major disturbance
- Other [Text]

PART III – Monitoring

20) Did your organization or some other entity collect monitoring data specific to this project?
[Yes/No/I don't know]

IF YES TO Q20 PROCEED TO Q21; IF NO, FINISH Q20a-b AND GO TO Part V.

20a) What constraints prevented you from collecting data in order to evaluate the restoration project? [Check all that apply]
- Lack of funding
- Lack of people power or staff time
- Lack of materials needed for data collection
- Lack of technology for data analysis
- Not hired to do data collection
- Not part of organizational mission
- Other [Text]

20b) If you could have monitored one thing, what would that have been?
[Select one]
- Physical
- Chemical
- Biological (does not include monitoring of vegetation)
- Vegetation
- Photo monitoring
- Other [Text]

21) Who performed the monitoring and evaluation component of this project?
[performed = what entity was responsible for conducting the monitoring]
[Check all that apply]

- Agency staff
- Volunteers
- Scientists
- University students/professors
- Non-profit/watershed group staff
- For profit/consultant
- Other [Text]

22) What factors enabled your team to monitor this project? [Check all that apply]

- Pursuit of additional funds
- Funding mandate
- Local volunteer interest
- Interested expert
- Academic researcher involvement
- Ongoing regional effort
- Legal requirement
- Personal commitment
- Other [Text]

23) Was pre-restoration monitoring conducted? [Yes/No/I don't know]

> 23a) If Yes, Were those data/measurements specifically related to project goals and quantifiable targets – that is, your answers to Q3 and Q4? [Yes/No/I don't know]
>
> 23b) If Yes, Was pre-restoration monitoring information used as baseline data for your evaluation? [Yes/No/I don't know]
>
> 23c) If Yes, Was a control site also monitored that served as a spatial reference? [Yes/No/I don't know]
>
> 23d) If Yes, What type(s) of pre-restoration monitoring was (were) conducted? [I don't know/See monitoring report]
>
> > 23di) Are pre-restoration data currently available, or can they be made available?
> > [Yes/No/I don't know/Source [Text]]

24) Was post-restoration monitoring conducted? [Yes/No/I don't know]

> 24a) If Yes, Were those data/measurements specifically related to project goals and quantifiable targets? [Yes/No/I don't know]

24b) If Yes, Was a control site also monitored that served as a spatial reference? [Yes/No/I don't know]

24c) If Yes, What type(s) of post-restoration monitoring was (were) conducted? [I don't know/See monitoring report]

24ci) Are post-restoration data currently available, or can they be made available?
[Yes/No/I don't know/Source [Text]]

25) Were there constraints that prevented you from collecting any additional data in order to evaluate the restoration project? [Yes/No/I don't know]

25a) If Yes, What were the constraints? [Check all that apply]

- Lack of funding
- Lack of people power or staff time
- Lack of materials needed for data collection
- Lack of technology for data analysis
- Not hired to do data collection
- Not part of organizational mission
- Other [Text]

25b) If Yes, What additional variable would you have most wanted to monitor if constraints had not existed? [Select one]

- Physical
- Chemical
- Biological (does not include monitoring of vegetation)
- Vegetation
- Photo monitoring
- Other [Text]

26) Was the monitoring part of a regional monitoring effort? [Yes/No/I don't know]

27) How did you choose your monitoring protocol(s)? [Check all that apply]

- Protocol for previously collected data
- Federal protocol (EPA)
- State protocol
- Local/regional conservation group developed protocol
- Book/manual/report/scientific literature
- Expert advice
- Mandate
- Other [Text]
- I don't know

28) Were the results of your monitoring reported? [Yes/No/I don't know]

28a) If Yes, through what specific media? [Check all that apply]

- Website [Text]
- Scientific journal [Text]
- Popular press [Text]
- Agency or funder report [Text]
- Public report
- Meeting presentation [Text]
- Newsletter
- Other [Text]

PART IV – Evaluation

29) Has there been a major perturbation in this system since the project was constructed, such as flood, drought, sewage overflow, invasion of non-native species, fire, rupture of a sediment pond? [Yes/No/I don't know]

29a) If Yes, How did the project respond?
[No change/Change] AND [Maintenance needed/Maintenance not needed]
Optional [Text] for interesting stories

30) Were success criteria explicitly stated in the project design plan? [define 'success criteria' as measurable project objectives] [Yes/No/I don't know]

30a) If Yes, What were they? [Text - REQUIRED]

30b) If Yes, Can you tell me BRIEFLY why these were selected?
[Text - REQUIRED]

30c) If Yes, Did this project achieve its stated success criteria?
[No, not at all/Partially/Yes, completely/Too soon to tell/No information available]

30d) If No, Was success based on completing the project's goal(s)?
[Yes/No/I don't know]

30di) If Yes, Was the project's goal(s) completed? [No, not at all/Partially/Yes, completely/Too soon to tell/No information available]

31) Do you consider this project successful? [No, not at all/Partially/Yes, completely/Too soon to tell]

31a) If Partially or Yes, What made this project successful? [Check all that apply]
[If specific success criteria listed in Q30c were accomplished, ask "Are there additional ways in which this project was successful?"]

- Overall positive effects on river morphology
- Overall positive effects on hydrology
- Overall positive effects on water quality

- Overall positive effects on fish, wildlife, plants
- Overall positive effects on target species
- Positive effects on human community
- Increased understanding of water systems
- Capacity building [increase organization's ability to implement future project, improve interagency collaboration, etc.]
- Ecological indicators point to yes
- Improving appearance
- Other [Text]
- I don't know

31b) If Partially or No to Q31, What prevented this project from being completely successful?
[Check all that apply]

- Invasive species
- Structural failure
- Public disapproval
- Human disturbance
- Natural disturbance
- Inadequate design [inadequate consideration of environmental context]
- Inadequate funding
- Ecosystem didn't respond as expected to specific success criteria not met
- Wasn't implemented correctly
- Plants died
- Other [Text]

32) IF YES TO Q20, Were monitoring data used to evaluate project success? [Yes/No/I don't know]

32a) If Yes, How were monitoring data used to evaluate project success? [Check all that apply]

- Expert opinion
- Visual observations or photos
- Data comparing pre- to post-restoration condition for the restored site (with no control site)
- Data comparing the restored site to a control site (only post-restoration)
- Data comparing pre- to post-restoration for restored and control sites (e.g. BACI)

33) How [OR IF YES TO Q32, how else] did you assess whether the project was successful?
[Check all that apply]

- Past Experience – How many similar projects you have done?
- Observations (Photographic/Site Visits)
- Measurements

- Independent Review - describe [Text]
- Positive Public Opinion/Awareness
- Positive Participant Reactions
- Other [Text]

34) Were there additional benefits of this project? [Check all that apply]
- Increased ability to do more restoration projects
- Increased adjacent property values
- Community awareness
- Developed new partnerships with other industry partners/community groups
- Learned new information that supports or refutes current scientific ideas or highlighted a key knowledge gap
- Learned more about the life history or process of the organism targeted for restoration
- Other [Text]
- None

35) Would you make changes to any of the following aspects of the project?
I will read each item in turn:
- Partners/Team/Personnel (questions about technical expertise, input from scientists here)
  [Yes/No] [Text]
- Project management process (as opposed to the particular players, etc. in the previous bullet)
  [Yes/No] [Text]
- Funding Sources and their associated requirements [Yes/No] [Text]
- Design Process [Yes/No] [Text]
- Implementation process [Yes/No] [Text]
- Permitting [Yes/No] [Text]
- Monitoring [Yes/No] [Text]
- Evaluation [Yes/No] [Text]
- Public involvement [Yes/No] [Text]
- Size of project [Yes/No] [Text]
- Other [Text]

36) Was information about this project disseminated outside your organization? [Yes/No/I don't know]

36a) If Yes, through what specific media? [Check all that apply]
- Website [Text]
- Scientific journal [Text]
- Popular press [Text]
- Agency or funder report [Text]
- Public report
- Meeting presentation [Text]
- Newsletter
- Other [Text]

PART V – Additional Input and Advice

37) Is there anything else that I haven't asked that you feel we should know about this project? [Text]