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## Introduction

There are ten NSF Centers for Ocean Science and Education Excellence (COSEE). The COSEE Great Lakes project is the most recently established, beginning in January 2006. This ambitious and complex project involves the Sea Grant offices from eight states, which in the first year of the project provided over thirty educational events. Activities included setting up the project Web site, establishing a collection of Great Lakes/ocean sciences educational lessons, single state events, multi-state collaborative events, and activities in collaboration with a broad network of partners. Project audiences included: youth, educators (formal and informal), scientists, the general public, and underserved audiences (highlighting Native American audiences).

The role of the evaluator, as described in the original proposal to NSF, is to:

- Create the evaluation plan in collaboration with the education team; and with oversight by the Project PIs
- Assist the educator team to design and conduct many of the evaluation processes, with results to be accompanied by selected activities conducted only by the evaluator
- Collaborate with the COSEE Central Coordinating Office to ensure that Great Lakes COSEE evaluation procedures help to build answers to the national evaluation questions and contribute appropriate information
- Conduct a number of project overview activities, such as small focus groups and/or phone interviews with randomly selected representatives of each of the major project audiences in order to provide an independent source of information
- Provide an annual report and a final report describing progress toward evaluation goals and analysis of results.

It was anticipated that the principal evaluator would handle evaluation planning and management as well as observation-based studies (participant response, interviews, focus groups), which are her area of expertise, and that we would rely on a professional evaluator from the Environmental Resource Center, Jacob Blasczyk, to design and interpret evaluations that required more extensive surveys and statistical analysis. A master's degree student manages an activity log, data input, and report drafting. The annual evaluation budget is \$20,000 in direct funds. This provides 10% salary for the evaluator and some funds for expert advice, student help, internet survey fees, and postage.

Work in 2006, the first year, followed project evaluation procedures recommended in the NSF *2002 User-Friendly Handbook for Project Evaluation*<sup>1</sup>. The handbook documents steps required for “formative” and “implementation” evaluation – important for setting the stage for the following efforts. Later steps are described as “progress” evaluation and finally “summative” evaluation. Evaluation work began in April 2006, when funding became available, and has involved setting up systems for analyzing project activities against project goals; gathering data to clarify project understanding of audience needs and interests; some limited impact evaluation; and general familiarization with the COSEE Great Lakes Program, the work of other COSEE Centers, and with NSF requirements.

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<sup>1</sup> <http://www.nsf.gov/pubs/2002/nsf02057/nsf02057.pdf>

In general the purpose for 2006 evaluation activities was to:

- Determine if activities are designed to meet project goals
- Determine if activities can be better targeted to meet participant interests or project needs
- Refine evaluation questions and build baseline data for future comparisons
- Identify and refine questions appropriate to measuring change over time
- Identify at least one program suitable to measuring change over time related to goals:
  - In individual participant knowledge, skills, intentions, application

## **Methods**

COSEE Great Lakes activities were designed to address COSEE Great Lakes goals, which in turn were selected as geographically-specific purposes that complement NSF national COSEE goals. In 2006, we focused on developing mechanisms to track overall progress toward these goals. We also developed several event evaluation tools which enabled us to test whether we had appropriately identified the short term outcomes that we wanted, and to begin the development of a bank of evaluation questions. Finally, we are able to use the tracking tools, already for year one, to provide a formative evaluation for several program components and to begin to provide impact evaluation data. Ideally, the state PIs would review these tools on an annual basis to guide decisions about evaluation priorities for the future.

### ***Project tracking procedures***

#### **Purpose and tools**

There are several mechanisms that allow us to track evaluation purposes and progress across program activities.

Tools include:

- Evaluation matrix: linking Great Lakes activity types to evaluation purpose (Appendix A)
- Event list and related evaluation activities (Appendix B)
- Demographics summary by activity (Appendix C)
- Goals compared to results anticipated by the Logic Models, and selected evaluation strategy (Appendix D)
- Goals compared to evaluation questions for each activity (Appendix E)
- Goals compared to outcomes – narrative summary (Appendix F)

#### **The evaluation matrix**

When starting a new project, especially one as complex and large as the COSEE Great Lakes project, it is useful to try to imagine how the evaluation activities will fit into the overall effort. Since resources are limited, project managers need to assess the overall effort to determine where to best apply those resources. We developed the evaluation matrix in Appendix A to provide an initial plan for how we might approach this gargantuan opportunity to learn.

The matrix considers both formative and impact evaluation opportunities. Formative activities include: identifying participant expectations and readiness; an assessment of needs; and evaluation of event planning and implementation. Summative evaluation includes short and long term outcome or impact assessment, and assessment of overall project toward goals.

2006 evaluation activities focused primarily on formative evaluation, but built resources toward 2007 impact evaluation as well as providing an initial assessment of progress toward project goals. The matrix should be revised and expanded to express changes and recommendations for future years, and to integrate evaluation activities for additional project activities.

### Tracking 2006 events

With 8 states and 15 categories of activities, we needed to keep track of events (Appendix B). Appendix B lists 35 activities implemented in 2006, by date, and also indicates the category of activity and status of event evaluation. As the list shows, there was activity in 8 of the 15 categories identified in the project proposal (summarized in Table 1). The group provided feedback for 13 activities, providing some information about 5 of the 8 activity categories.

*Table 1. 2006 evaluation activity summary*

Event or resource	Events in '06	Events with demographic information	Evaluation by Logic Model	Evaluation by Instructor
Conference participation	3	n/a		
Curriculum	yes			
House Calls	1	1	2 (1 event, but separate questionnaires for educators and scientists)	
Lake Exploration/Guardian	2	2	2	
Marine Immersion	10	1		1
Presentations	3			
Scientist survey (baseline data)	yes	Yes*	NA	
Teachable Moments	9	7	2	6
Teacher survey (baseline data)	yes	Yes*	NA	
Web site	yes			
Workshops/conferences (see Appendix B)	3	2	2	
<b>TOTALS</b>	<b>35</b>	<b>13</b>	<b>8</b>	<b>7</b>

\* Separate reports by Kim and Fortner

### Tracking 2006 demographics

Several Great Lakes and NSF goals for the COSEE project have to do with engaging certain groups. Demographic information provides a general way to track who is doing what and when and where, but it can also provide data to answer very specific questions.

Table 2 lists Great Lakes and NSF goals that can be measured, at least in part, through demographic information. Sample measures are suggested for each item. Depending on the subtlety of the demographic information collected for each person, additional insight about

each measure can also be generated. Great Lakes goals and objectives are listed in Table 3. NSF internal and external goals are listed in Table 5.

The tracking system presented in Appendix C only manages data for educators and science professionals. It does not include any categories for tracking youth or public participation. It does provide a lot of detail for how educators and professionals are described; however, enabling project managers to investigate presence and absence of different groups as the project evolves.

The demographic table in Appendix C provides limited information about thirteen 2006 activities. Information is derived from data provided by instructors and by information referenced in narrative reports provided for the COSEE NSF reporting system.

*Table 2. Great Lakes and NSF goals that can be addressed via demographics*

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Great Lakes and NSF goals that can be addressed via demographics

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- Inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences. *(Count citizens who have changed.)*
  - Improve ocean/Great Lakes sciences education throughout the Great Lakes region. *(Count educators who have the skills and resources to make a difference.)*
  - Involve regional Tribal educational institutions, teachers and students in Great Lakes/ocean sciences. *(Count educators from Tribal education institutions or who support Tribal education in other ways who participate in COSEE Great Lakes events.)*
  - Facilitate collaborative relationships that improve communication between Great Lakes researchers and 4-10th grade educators and students. *(Count educators and researchers who are working toward or are in a collaborative relationship.)*
  - Assist research scientists in gaining better access to educational organizations and use appropriate pedagogy in relating the Great Lakes/ocean sciences story. *(Count science professionals who know how to access educational organizations and know how to relate to educators and their students.)*
  - Enhance teacher capabilities for accessing science information and delivering high quality educational programs in Great Lakes/ocean sciences. *(Count educators who have the skill and motivation to use and deliver Great Lakes/ocean sciences education programs.)*
  - Increase access to Great Lakes/ocean sciences information for underrepresented groups. *(Count individuals from underrepresented groups who know how to access Great Lakes/ocean sciences information.)*
  - Facilitate direct student connections to Great Lakes or ocean science experiences. *(Count youth who participate in a Great Lakes or ocean science experience.)*
  - Increase public understanding of the ocean and its importance to our social and economic well-being GL objectives and the quality of our lives. *(Count members of the public who demonstrate increased understanding in some way.)*
  - Increase access to and diversify the audience for ocean-related education. *(Count individuals from underrepresented groups who participate in Great Lakes/ocean sciences education events.)*
-

## **Tracking instruction design compared to project goals**

The COSEE Great Lakes project is using the Logic Model approach to define areas for impact evaluation. A Logic Model is a type of evaluation instrument that is constructed at the outset of a project or activity to show how programs, events, and resources link to project goals. Logic models are constructed backwards; that is, the instructor or PI first identifies desired long term impacts, then medium and short term impacts that are most likely to lead to the desired long term impact. Next, program design and resources are selected that are most likely to result in desired impacts.

The evaluation process is applied going the other direction, starting with program design and resources and potentially investigating each element of the specific logic model to identify opportunities and needs, successes or failures at every stage of implementation. The instructor or PI selects which part of the program design or implementation is most relevant for the evaluation investigation. The activity logic model also provides an outline that can help guide interpretation of evaluation results, and ultimately, the logic model is revised to reflect advice provided through the evaluation activity.

State PIs developed logic models for 10 out of 15 categories of activities proposed over the five years. Logic models for activities proposed for later in the five-year project will be developed as appropriate. All completed Logic Models were posted on the COSEE Web site in August 2006. Outcomes identified in each logic model were used to develop participant questionnaires for eight 2006 programs and for a long-term impact study. We summarize proposed outcomes in one place in order to easily compare activity expectations with project goals and objectives (Appendix D). The Appendix D comparison table organizes the list of proposed outcomes according to project tasks, as outlined in the proposal. COSEE Great Lakes goals and objectives related to that task are also itemized for reference. These are repeated as appropriate to the relevant task. This allows us to examine our ideas in an organized way and make adjustments to proposed outcomes.

An examination of short term outcomes or impacts proposed in the activity logic models also allows us to examine some general aspects of the program. If we are pursuing an objective strategy of carefully integrating activity design and outcome evaluation with project goals and objectives, we want to be sure that the foundation for each activity closely matches the project purpose.

Some general questions that arose in this process:

- Do proposed 2006 logic model outcomes adequately reflect the intention of each project goal?
- Are project goals likely to be met through successful implementation of each activity?
- Which activities need additional thought in terms of more closely identifying activities that are likely to lead to desired results?

## ***Evaluation of specific activities***

The group provided feedback for 13 activities. Of these, 8 event questionnaires were developed based on the activity logic model, the others were developed by instructors to provide information they were seeking in particular. Feedback response and pre and post

activity questionnaires were the only type of evaluation developed for 2006 programs. Table 1 provides an overview of sources of evaluation information for each category of activity. There is a report summarizing results and implications for eight event questionnaires (Appendix G). The appendices also include a summary of instructor designed feedback event questionnaires created for the online activity report required by NSF.

Appendix E itemizes event evaluation questions according to COSEE Great Lakes goals and objectives. This listing provides a mechanism for comparing questions across events and against the related COSEE GL goal or objective. This is to show how the evaluation questions relate to the goals and objectives, and also to provide a bank of questions that can be used again or modified. For example, we try to gather participant feedback about a particular goal statement in several different ways. Comparison of different formulations can help identify a question format that is most likely to produce the information we need.

In 2007, we developed an extensive follow up study for the Lake Exploration/Guardian 2006 workshops, to take place approximately one year after the original events. We also provided a draft rubric to measure the quality of 2006 Lake Guardian assignments as compared to desired activity outcomes and impacts. The project plans to apply the rubric in retrospect, as a means of judging whether assignments appropriately build on activity goals and contribute to desired impacts. Finally, the December 2006 online workshop resulted in an extensive collection of blog comments which were categorized into eleven main categories and several subcategories. Later in 2007, the project will apply a content analysis procedure to further analyze potential outcomes from that event.

## Results

This report provides an overview of outcomes as related to specific COSEE GL goals or objectives as well as to the broader NSF project goals. Findings address demographics (Appendix C), a cross-activity analysis of event evaluation results (Appendix F), and general comments.

Appendix F provides a listing of findings across all activities, organized according to each goal or objective. Appendix F was developed using Appendix E content, which itemizes event evaluation questions according to COSEE Great Lakes goals and objectives. Results often (and should) apply to both goals and objectives, but because the vision described by each differed, the list of findings is presented both ways. As a result, readers will note some duplication of results in the Appendix F table. To make it easier to understand the results, they are summarized simply by topic later in this report. We also use this information to provide commentary about the overall contribution of 2006 events toward each of the Great Lakes goals and objectives. We did not attempt to tabulate findings across activities precisely in this report, but we do provide statistical detail and analysis in individual activity reports (Appendix G). These single event evaluations provide additional feedback about preferences for specific activities or specific elements of particular sessions.

It's also important to look at what aspects of the Great Lakes program are less well addressed in 2006. The following section will provide suggestions for future focus needs or opportunities. Finally, it is important to note that this summary does not represent the total

picture of COSEE Great Lakes accomplishments in Year One. Refer to Table 1 for a summary of which activities were followed and in what detail.

## **2006 activity outcomes and impacts**

The purpose of surveying results for 2006 activities is to determine if events are designed to meet project goals and if they appropriately targeted to meet participant interests (or in other words to see if the event or resource will contribute to participant motivation to attend or to use resources).

### **Demographic outcomes**

Data collected in 2006 addressed only a few of the project goals listed in Table 2. The tracking system presented in Appendix C only reviews data for educators and science professionals, for example. **It does not include any system for tracking youth or public participation.**

Instructors collected at least some demographic data for 18 events, summarizing information for 356 educators and 118 science professionals. Of these, detailed information is available for five events tailored for educators. Sixteen events provided data about science professionals, and the information includes some detail. Additional information is found in narrative form and is also reported in the Appendix C table in the notes at the end.

Educator data is too limited to be able to identify any trends, but demographic plus narrative data offered an indication of the project's efforts in addressing the needs of underserved audiences. Of the five programs that provided detailed data, participants reported an average of 23% minorities in the schools where they taught. The data for those five programs further defines audiences included in the 23% figure.

Further description of minority participation is provided in the educator narrative data at the end of the table:

- Three educators for one event reported that more than 75% of their classes receive free or reduced lunch
- 120 participants of one event indicated that their student audiences included 40% or more who were members of minority groups
- Participants in two events were described as 25% and 20% ethnically diverse
- One event identified two women of African-American descent, one Hispanic male, and one female of Indian descent

From data reported about science professionals:

- All were from Federal or state agencies
- Most specialized in ecology, although all specializations were represented at least once except geology and engineering
- Ethnicity was 100% Caucasian
- Narrative data indicated over 500 additional science professionals participated in COSEE Great Lakes events
- One event reported that about 25% of the audience was culturally diverse

## Cross-activity response to similar evaluation questions

This section surveys results of evaluator and instructor evaluations for 15 events. Findings are summarized specifically, according to evaluation questions developed for each activity, and broadly, by arranging results to show how the 2006 activities supported Great Lakes goals and objectives, which are summarized in Table 3. Specific activity results are provided in reports in Appendix G. A summary of results of all 15 evaluations are listed in Appendix F. Readers can choose to review results by “measurement reference” (a Great Lakes goal or objective) or by “evaluation question.” As mentioned earlier in this report, some of the evaluation questions and their results are listed more than one time in order to be able to readily analyze achievements towards goals or objectives.

Below, we provide a descriptive summary of findings in Appendix F categories. For the most part, results listed in Appendix F include only participant top few choices in response to relevant questions. The summary below does not include any statistical analysis since question wording and choices differed across activities and since some results are gleaned from participant comments. All results referenced in this report are documented in the individual event reports.

*Table 3. COSEE Great Lakes goals and objectives*

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### **COSEE Great Lakes Goals**

- Inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences
- Create dynamic linkages between the education and research community
- Implement coordinated research, education and outreach initiatives connecting Great Lakes topics and issues with counterpart ocean science concepts
- Link COSEE science literacy and education/research goals with regional and national audiences
- Improve ocean/Great Lakes sciences education throughout the Great Lakes region
- Involve regional Tribal educational institutions, teachers and students in Great Lakes/ocean sciences

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### **COSEE Great Lakes Objectives**

- Facilitate collaborative relationships that improve communication between Great Lakes researchers and 4-10th grade educators and students
  - Assist research scientists in gaining better access to educational organizations and use appropriate pedagogy in relating the Great Lakes/ocean sciences story
  - Enhance teacher capabilities for accessing science information and delivering high quality educational programs in Great Lakes/ocean sciences
  - Integrate ocean and Great Lakes research into existing high quality educational materials
  - Make research findings about the Great Lakes available to the public to encourage public science literacy and appreciation of water resources
  - Increase access to Great Lakes/ocean sciences information for underrepresented groups
  - Facilitate direct student connections to GL ocean science experiences
-

## Survey of evaluation question responses

### *Educators*

#### ❖ **Learning about the event**

Personal communication via conversations, emails, or direct mail, figured as a major source of information about COSEE Great Lakes events. Several other choices were also mentioned repeatedly. The following appeared to be the most effective methods of attracting participants to 2006 events:

- *Personal* communication via conversations, emails, or direct mail
- Listserv
- General mailing to individuals
- Newsletter announcement
- Flyer in individual's school mailbox
- Listed on a targeted Web site
- A choice in a conference registration packet

When participating educators were asked how they would prefer to hear about future events: email alerts, listserv alerts organized by topic, and an announcement on the COSEE Great Lakes Web site were the most popular suggestions.

#### ❖ **Reason for attending**

We asked participants about their reason for attending a COSEE Great Lakes event in order to develop insight about what topics or reasons might attract future educators and science professionals. A high proportion of 2006 participants rated learning about the science and culture of the Great Lakes as the most important reason for attending.

Participants also wanted to learn more about human impacts on the Great Lakes system and experience aquatic research on the water. Working with other educators and with science professionals were priorities. Satisfying curiosity and gaining new ideas were also important.

#### ❖ **Participant goals**

We asked participants about their goals in several ways. We are looking to understand what attracts participants to attend the event and once having attended, what happened at the event that helped them to meet those goals. In some cases, we asked specifically how participants would use their experience to meet their goals, and in other cases we asked this indirectly by asking how they will integrate what they gained. We address this second perspective in a following section of the report. In general, if our work meets participant goals, then their motivation to use new ideas or resources or attend additional events is likely to be greater than if we do not meet their goals.

In some cases, participation in the event may have helped educators identify new priority goals. We didn't ask participants to actually list their goals pre and post event, but for future activities it may be helpful to learn if participant thinking evolves as they go

through the session. Asking educators to write their goals at the end of an event can also help participants reflect about their experience.

It is clear from the evaluation summaries, that participants found that the event experience and/or specific resources, presentations, or activities were very useful in meeting their goals. Some aspects of these events stand out and instructors will benefit from reading the longer list provided in Appendix F.

Key items that seemed to satisfy participant goals include:

- Activities, handouts, lesson plans, and internet resources
- Data
- Field and lab experience and other experiential segments
- Interaction with science presenters
- Specific information that participants wanted

❖ **Skills participants will use**

Only 3 of the 15 evaluations asked a question about skills. Also, it's not clear whether this is an effective question parameter. It may be difficult for participants to identify skills they learned or to identify skills as a separate item compared to other new information unless the instructor specifically identifies these skills at some point, such as during post activity reflection. Skill achievement is an important component to making a change, however, and participant self-assessment or instructor-observed assessment of participant skills can help instructors determine whether the event is appropriately designed.

Participants identified several new skills that mirror event components they identified as meeting their goals or that they found useful:

- Collecting/interpreting data
- Identification of fish, plankton, plants
- Seining for fish
- Storytelling
- Using internet sources

❖ **Resources participants will use**

Participants provided a lengthy list of resources they would use, an indication of the richness of the education events. These are listed in Appendix F with as much specificity as possible. Instructors may learn more for future planning by observing what is *not* included on the list.

❖ **Resources and information that participants need**

Participants provided an even lengthier list of resources they need. The fact that this list is so lengthy is not an indication of failure, but is more an indication of exuberance and should be considered an impact. Educators who know what they want are educators who are motivated to include Great Lakes and ocean science information into their programs.

The list of resources includes topics, resources, and skills.

### ❖ **Learning about other resources and skills – preferences**

In the more detailed follow up study of the Lake Exploration events, both survey and interview data indicated how much participants enjoyed email news that they received from PI Rosanne Fortner after the event.<sup>2</sup> Her communications service is clearly very satisfying to educators. Other preferences for learning about resources include informing by topic focused listserv communications and by postings on the COSEE Great Lakes Web site. Participants also want to learn new skills by spending time with individual scientists, doing research themselves, and by attending workshops.

### ❖ **Addressing ocean science concepts**

No evaluation questions specifically addressed the connection between Great Lakes and ocean science topics in 2006. This was, in part, because **it is not addressed in the Logic Models** for event activities. This concept should probably be added to Logic Models and event questionnaires in future years.

This connection is featured in the Logic Model for other parts of the COSEE Great Lakes project, especially the development of a collection of curriculum activities designed for this purpose. We also addressed it in the Lake Exploration one year follow-up study (Andrews, 2007). And it was addressed in several 2006 event presentations. Relevant topics included in 2006 events were:

- Chinook salmon management
- Invasive species
- Marine ecology presentations
- Zebra mussels

### ❖ **Infusing course content into youth education**

Asking participants how they will integrate what they gained into their work is a measure of the potential impact of event activities, and also helps to determine whether event activities interested participants, i.e. event activities met their goals – either spoken or unspoken. We asked this question in several different ways, but ultimately, all had to do with how the educator thought they would apply what they learned.

In several evaluations, we asked this question pre and post event. In the pre event questionnaire, participants were often unsure of how they would integrate the new information or experience into their programs. **There was no such hesitancy indicated by the post event questionnaire results, which should be considered a project impact.**

Multiple choice questions led to a broad gamut of results, even when only the top two or three results from each evaluation are included. Participants will use information to generate new education ideas, as a specialized unit, or as course topics allow. Some will use lesson plans and activities directly. Open-ended questions provided more specific results, related to the activities that were part of the specific event. Creative ideas and active application characterize these responses.

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<sup>2</sup> Andrews, E., J. Blasczyk, & R. Kirby. 2007. Lake Exploration 2006 Workshops. One year follow-up study. Madison, WI: University of Wisconsin Environmental Resources Center.

In two events, we investigated factors important to teaching. Participants noted several important aspects. Two are within the purview of COSEE Great Lakes instructors: relevance of material to required curriculum and relevance of materials to students.

#### ❖ **Educator opportunity to interact with scientists**

We did not ask a direct question about the participants' value of the opportunity to interact with scientists in any of the evaluations described in this report, but answers to other questions indicates that this experience was highly valued. We did ask this question in the one year follow-up study, however (Andrews, 2007). Also, **we did not develop a system for external evaluation of the quality of the interaction between educators and science professionals** for 2006 events. This is potentially a worthwhile topic for future study.

In 2006 responses, participants indicated their opinion about the opportunity to interact with scientists when asked related questions, though, such as:

- Why they chose to attend (*to work with scientists*)
- How useful was the event in meeting your goals (*Items considered useful included: question and answer with science professionals; science presentations, presenter power point slides*)
- What resources do you need (*information on specific research*)
- How will you apply what you learned from the scientists (*work with scientists in the future*)
- What was new and what do they wished they learned (*Wished they had learned: information on specific research*)

#### ❖ **Quality of experience**

From the point of view of the evaluator, the quality of the experience is measured by whether the participant developed new skills, interest, or motivation. We also measure it by looking at the impact of the experience via questions about how educators will use the information. We've summarized those results in the section, "Infusing course content" on page 12. This section summarizes results where participants were directly asked to evaluate of the quality of their experience.

Participants were enthusiastic about the quality of individual activities and the experiences as a whole; especially the opportunity to interact with colleagues. Activities were considered "very useful." Participants particularly enjoyed the experiential sessions at events, such as boat trips and tours. Most presenters were given the highest rating.

Evaluations which specifically evaluated content, presenters, and format suggested several areas for future attention. **Event sessions need to pay attention to information overload and provide enough opportunity for reflection. Suggestions included reducing the length of lectures, and building in time for reflection. Content suggestions indicated a lack of interest in some very specific topics, such as fishing regulations. "Great Lakes in My World" activities received a low rating** – both for content and presentation at one event.

Another indication of participant evaluation of the quality of their experience is highlighted by participant comments about what information they found that was “new” and what participants’ “wished they had learned.” Educators said they gained knowledge of invasive species, information about prey fish research, information about trends for Lake Huron, and experience with hands-on investigation of various topics. Educators “wished they had learned” more information about funding, research about specific topics, and answers to event-specific topics.

### *Science professionals*

Because science professionals were personally invited to an event, usually to make a presentation, few evaluations asked science professionals directly about the following topics. We followed up on many of these questions in more detail in the Lake Explorations one year follow-up study (Andrews, 2007).

#### ❖ **Learning about the event**

None of the evaluations asked science professionals how they would prefer to hear about future events.

#### ❖ **Reason for attending**

Three evaluations out of 15 asked science professionals why they attended. Since most were personally invited, usually to make a presentation this question was less relevant. In the three evaluations where there were responses, participants indicated that they are interested in working with educators and learning about their interests and needs. They also want to learn how to work with young people and want to influence teacher use of science information about the Great Lakes.

#### ❖ **Participant goals**

Two evaluations out of 15 asked science professionals if the session was useful to meeting their goals. Participants indicated that the sessions were moderately useful.

#### ❖ **Skills participants will use**

None of the evaluations asked science professionals asked about skills that science professionals would use.

#### ❖ **Resources participants will use**

None of the evaluations asked science professionals asked about resources that science professionals would use.

#### ❖ **Resources and information that participants need**

None of the evaluations asked science professionals asked about resources and information that science professionals need.

#### ❖ **Learning about other resources and skills -- preferences**

None of the evaluations asked science professionals asked about resources and skill preferences among science professionals.

❖ **Infusing course content into youth education**

Three evaluations out of 15 asked science professionals how they might apply what they learned from the educators. Most participants had no specific plans or were unsure of what they might do. One participant suggested that they would integrate education information as requested.

❖ **Likelihood of scientists continuing work with educators**

This question was not addressed directly by any evaluations, but one evaluation asked science professionals what they gained that was new and what they “wished they had learned.” One evaluation asked about any educator needs that participants (science professionals) had identified during the session.

New information included: ideas for live science dives and simply meeting teachers. Participants wished they knew how to present material in an outreach form. There was also a suggestion to more actively communicate science from the Great Lakes research stations into the classroom. One participant suggested that their office should provide more facility tours.

## **Surveying of responses related to COSEE Great Lakes goals and objectives**

The purpose for project activities and events is to address the project goals and objects. These are itemized in Table 3. Comparison of proposed short term outcomes, evaluation questions, and responses to these goals and objectives in Appendices D, E, and F allows us to judge Year One progress towards proposed outcomes. The following section captures some highlights from this comparison, but further consideration is recommended. Result examples provided in the earlier section, pages 10 – 15, are not restated here.

### **Goals**

❖ **Inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences**

This goal is not intentionally addressed by any activities offered in 2006, although it is addressed indirectly through many activities. We tried to identify impacts by looking at how participants learned about an event, participant motivation to attend an event, and whether participants felt that the event had met their goals. Our assumption is that if participants were satisfied with their participation, they would be more motivated to inspire others.

Evaluation results suggest educator preferences that instructors could use to improve access and to motivate participation.

❖ **Create dynamic linkages between the education and research community**

This goal was addressed through the Lake Exploration and Guardian workshops, Marine Immersion, and Teachable Moments activities. Event evaluations investigated this goal through questions about how participants *prefer* to learn about events, what they felt they gained from the experience, what they wished they had learned in the experience, to what extent participants plan to use information they gained, what skills participants will use,

and what resources participants will use. There were no questions, however, that asked participants to address this goal specifically. The Lake Exploration follow up study (Andrews, 2007) investigates this question more directly.

Evaluation results give guidance for how to best alert educators to opportunities, but we have no results regarding science professional preferences. We are assuming with this type of question that if we know how to get people to access COSEE Great Lakes events and provide resources emphasizing the linkage, then we will be more successful in making the linkage happen.

Answers to other evaluation questions indicated how much educators valued science presentations and content. Favored content, skills, and resources, include: valuing science professionals as resources, specific data, and outcomes from specific research. Educators also want to observe research in action and wish that research materials could be more accessible by students.

The 2006 evaluations did not identify science professionals' needs or suggestions for improving linkages, but several 2007 evaluations addressed this goal.

❖ **Implement coordinated research, education and outreach initiatives connecting Great Lakes topics and issues with counterpart ocean science concepts**

This goal is addressed in the proposal primarily through curriculum activities and was not addressed through event evaluation questions or any other type of evaluation in 2006. It could be addressed through event evaluations, however, because the concept is integral to many Great Lakes topics and connections were illustrated throughout 2006 events. Outcomes and impacts related to this goal need study in future project years.

❖ **Link COSEE science literacy and education/research goals with regional and national audiences**

This goal was addressed through teacher enhancement activities, state PI conference presentations, and the COSEE Great Lakes Web site. To determine if event participants further this goal requires an impact study. Applying event self-assessment measurements to this objective assumes that event participants communicate with regional and national audiences. State PIs made at least three conference presentations in 2006 (see Table 1) and also conducted a pre-conference workshop. Of these, the pre-conference workshop implemented a pre and post event evaluation, which included questions about how participants planned to use new information.

The COSEE Great Lakes Web site was under development in 2006 and so was not evaluated. Event evaluation responses indicate that participants placed a high value on the Web site, however, as a source of information about Great Lakes resources and announcements about opportunities. A user analysis of the Web site will may also indicate impacts on regional and national audiences. We do have information about how many visitors the web pages received [as of 9/15/07]: Since its first full month of operation in February 2006, there have been 50,977 visitors, of whom 19,059 were unique. In 2007,

the site was visited by about 3800 people per month, with nearly 2000 of those unique for the month. Up-to-date statistics are available at <http://www.coseegreatlakes.net/mint>.

❖ **Improve ocean/Great Lakes sciences education throughout the Great Lakes region**

To determine if event participants furthered this goal requires an impact study. Applying event self-assessment measurements to this objective assumes that event participants provide information to audiences. It's possible to get some idea of whether this goal is addressed through event questions itemized in Table 4.

In general, ocean science topics were not identified in responses to these questions in 2006 except in response to content specific and presenter specific questions. Great Lakes sciences were broadly addressed throughout. The number and specificity of educator responses about their use of Great Lakes science topics and resources can be considered an impact.

❖ **Involve regional Tribal educational institutions, teachers and students in Great Lakes/ocean sciences**

This goal is addressed through teacher enhancement activities. Outcomes are reported through demographics information (Appendix C). Although details about demographics were collected for very few 2006 events, three events noted the participation of at least one person each with tribal affiliation. Narrative comments about event demographics indicated many additional individuals and school programs with diverse ethnicity, but Tribal institutions were not distinguished within this group.

*Table 4. Evaluation questions potentially addressing a Great Lakes ocean sciences education*

**GOAL: Improve ocean/Great Lakes sciences education throughout the Great Lakes region.**

Some relevant event questions include the following. Results are summarized elsewhere in this table:

- To what extent do you expect to integrate Great Lakes information into your existing curriculum or other youth education activities?
- Name some of the skills you learned at this workshop? Of all the skills you learned, which are you likely to use?
- Name some of the resources you reviewed at this workshop? Of all the resources you reviewed, which are you likely to use?
- What other resources or skills do you need?
- Please rate these factors as to their importance in how likely you are to use Great Lakes information in your teaching:
  - Relevance of material to required curriculum
  - Flexibility of the course of study
  - Trust of my teaching by administrators
  - Relevance of material to students
  - Logistical demands of the innovations [computers, student copies, equipment, etc]
  - Access to science updates

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**GOAL: Improve ocean/Great Lakes sciences education throughout the Great Lakes region.**

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- Availability of time or location for outdoor study
  - Content specific evaluation questions
  - Presenter specific evaluation questions
  - Workshop format specific evaluation questions
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### *Objectives*

#### ❖ **Facilitate collaborative relationships that improve communication between Great Lakes researchers and 4-10th grade educators and students**

In 2006, this objective is addressed through the teacher enhancement activities and the baseline survey. Evaluation questions investigated preferences for learning about new opportunities, why participants chose to attend an event, what other COSEE Great Lakes events caught their attention, and how participants expected to integrate what they learned into their programs. Outcomes for each are summarized in the prior section and listed specifically in Appendix F.

This objective focuses on whether instructors successfully implemented an event which brought science professionals and educators together. Responses indicate that this objective is addressed for educators through COSEE Great Lakes activities. Evaluation data does not indicate whether it is addressed for science professionals.

In future project years it is probably no longer necessary to evaluate this dimension of the project for the educator audience. Isolating strengths and weaknesses of science professional experience is a priority, however. The baseline survey results should provide an initial idea of areas for further investigation for this audience.

#### ❖ **Assist research scientists in gaining better access to educational organizations and use appropriate pedagogy in relating the Great Lakes/ocean sciences story**

This objective is addressed through the baseline survey, educator house-calls, the school for scientists, and researcher conference presentation and publications. Event evaluation questions for researchers investigated what information they gained and what they wished they had learned. More detailed questions are presented through the baseline survey and the Lake Exploration follow-up study (Andrews, 2007).

Because few events directly queried science professionals about their experience, 2006 evaluation results provided little additional insight. A few points are listed in Appendix F and summarized above.

#### ❖ **Enhance teacher capabilities for accessing science information and delivering high quality educational programs in Great Lakes/ocean sciences**

This objective is addressed through the teacher enhancement activities and the work to gather curriculum materials which demonstrate the connection between Great Lakes and ocean sciences. Event evaluation questions investigated format, content, and presenter

specific reactions. Questions also investigated purpose for attending, skills learned, resources participants are likely to use, what other resources are needed, factors important to teaching about Great Lakes and ocean sciences, and plans for using new information or resources.

Many of the fifteen events asked these questions and results provide a rich description of event outcomes and impacts. Results demonstrate achievement of the goal through teacher enhancement activities, but outcomes and impacts from other planned activities, such as the curriculum projects, need to be evaluated.

❖ **Integrate ocean and Great Lakes research into existing high quality educational materials**

This objective is addressed through the educator baseline survey and development of curricula collections. Results of the baseline survey relevant to this question will be reported elsewhere. Although new curricula collections were developed in 2006, we did not conduct a related evaluation activity. Evaluation could investigate the quality of the process for collecting the materials, access to and acceptability of the material collections to educators and science professionals, and whether the availability of the materials changed educator willingness, self-confidence, or use in education programs.

Event questions investigated information that participants “wished they had learned” and resources or skills they need. Response forms identified a number of topics that educators would like more information about. These include a number of suggestions for curriculum. Details are listed in Appendix F.

❖ **Make research findings about the Great Lakes available to the public to encourage public science literacy and appreciation of water resources**

This objective is addressed through postings on the COSEE Great Lakes Web site, and by publicity for Web site content. Event evaluations investigated how educators would use new information, but there were no direct studies of impacts on “public” literacy. This objective can be accomplished, in part, through teacher enhancement activities if educators use the new information. Impact studies are required to evaluate the effectiveness of the Web site and teacher enhancement activities for meeting this goal. Logic Model outcomes summarized in Appendix D can serve as a foundation for developing an evaluation approach.

❖ **Increase access to Great Lakes/ocean sciences information for underrepresented groups**

This objective is addressed through teacher enhancement events and the COSEE Great Lakes Web site in Year One. Demographic information provides the most direct indication of project links with underserved audiences. Several event questions address this objective as well – to what extent to you expect to use new information, what new skills are you likely to use, etc. – if it was possible to segregate responses for members of underrepresented groups.

❖ **Facilitate direct student connections to GL ocean science experiences**

This objective was not addressed in Year One.

## **Discussion and Next steps**

### ***General feedback***

#### **Evaluation activity choices**

Evaluation resources for the project are limited, and as a result there is a need to prioritize where to focus and what to measure. As indicated in the introduction to this report, the project originally anticipated a strong role by state PIs to provide direction and ideas in developing the evaluation plan. This is noted by the “Lead Team” column in the Appendix A evaluation matrix. Evaluation leadership by state PIs was not feasible in Year One of the project. While there was some group discussion, state PIs needed to focus on the development of new activities, resources, or partnerships. State PIs took the initiative to evaluate as many activities as possible, however. Their findings are incorporated in report results.

The project will need to refine evaluation objectives for Years Two through Five and to consider how to best match evaluation resources with priorities. Gaps identified by this report provide some direction. COSEE Great Lakes Advisory Team suggestions later in this section will guide this revision, but the evaluator recommends a strong role for State PIs as well. State PIs are clearly expert in their topic and bring extensive experience to understanding outreach concerns and opportunities. They are best positioned to help target both the selection of evaluation activities and the content for evaluation questions. In addition, their cooperation is vital to establishing impact studies which may require additional effort not envisaged in the proposal, such as identifying comparison groups or creating a narrative.

To respond to this need, state PIs can begin by reviewing Appendices D, E, and F. An in-person planning session, where state PIs can interact with the project evaluator and potentially with some members of the Advisory Team, could provide a venue for in depth discussion.

Formative evaluation results of Year One activities indicate several gaps that need to be addressed at some point during the project. A preliminary list includes:

- Formative evaluation to better assess progress towards demographic goals
- Attention to how to address goals related to science resource professionals
- Attention to transferability of participant experiences to broaden project impacts to include the general public

#### **Evaluation questions and baseline data**

Appendices D and E provide a valuable resource that will allow state PIs and instructors to refine event questions to more closely match intended outcomes and to create a coherent line of similar questions that can be used to build baseline data for future comparisons. Question results itemized in Appendix F allow some assessment of the accuracy and value of particular questions. New questions are needed for project areas so far unevaluated, such as the Web site and the curricula collection. State PIs will also need to begin to identify and refine questions appropriate to measuring change over time.

## **Assessing project impact**

Although we were able to measure some impacts through event questionnaires, ultimately the project needs to measure change over time or determine other methods for demonstrating project impact. The Lake Exploration follow-up study (Andrews, 2007) provides one example for how this can be done. Measuring change over time requires identification of opportunities now, to set the stage for a follow up study. Individual participant knowledge, skills, intentions, application are appropriate for study. The project can also look for opportunities to compare annual event results with baseline data developed during year one.

## **2006 progress towards COSEE goals**

### **Great Lakes goals and objectives**

In spite of substantial progress in 2006, most project goals and objectives would benefit from development of a focused evaluation plan. Clearly teacher enhancement program models are highly successful at meeting educator needs and creating enthusiasm for educating about Great Lakes sciences. These were adequately studied in 2006. Future evaluation about enhancing teacher capabilities can focus more on success in supporting those who have attended events, and widening the group of future attendees. Progress toward this goal can be tracked through demographic information. COSEE Great Lakes Advisors ask some interesting questions, below, about the transferability of the information once participants take the lead. And this type of question could also produce informative results, but may not be a priority given the many other key areas where little information is currently available.

Areas where there is little information – formative or summative – mainly have to do with the integration of science professionals into the mix. Almost nothing is known about science professionals' interests and needs relevant to this project. Little is known about how to improve integration between educators and science professionals either.

Other areas for further study include:

- Improving ocean sciences education in the Great Lakes area and linking to Great Lakes topics
- Involving Tribal education institutions
- Linking to regional and national audiences and to the “public”
- Improving science professional access to educational organizations
- Increasing access to Great Lakes and ocean sciences information for underrepresented groups

### **NSF COSEE goals**

NSF COSEE goals listed in Table 5 mirror COSEE Great Lakes goals, of course. But they also raise different questions about the purpose and methods of a regional COSEE project. NSF goals focus more on public understanding, policy support, and work force objectives, for example. Future evaluation activities could consider one or more of the draft goals to show how the Great Lakes model enhances progress there. Another direction posed by NSF goals is a focus on establishing and expanding an effective network infrastructure. Planning for and

evaluating COSEE Great Lakes progress towards this goal could result in exciting new and perhaps unanticipated regional synergies.

Table 5. COSEE Network Goals [“Blueprint”]

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**COSEE External Goals**

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- Increase public understanding of the ocean and its relevance to our social and economic well-being and the quality of our lives
- Better integrate the ocean research and science education enterprises
- Increase and diversify the ocean workforce
- Increase the access to, and participation in, ocean sciences and ocean sciences education by underrepresented and underserved populations
- Improve the quality of K-12 ocean sciences teaching

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**COSEE Internal Goals, draft**

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- Establish and expand an effective network infrastructure
  - Build financial strength
  - Build leadership capacity
  - Form strategic and diverse partnerships with organizations that have complementary goals to establish a systemic approach to ocean sciences education
- 

### ***COSEE GL Advisor 2006 recommendations***

A subgroup from the COSEE Great Lakes Advisor group met with the project evaluator in October 2006. Advisors had a number of questions and suggestions that can help direct future evaluation efforts. Some questions are answered in this report, but continue to serve as benchmarks for annual consideration.

#### **Foundations**

Advisors suggested that the project team review evaluation goals and procedures enumerated in the proposal. Assumptions underlying project goals statements need to be identified, for example, and checked for links to evaluation goals. Project evaluation goals are presented at the beginning of this report. And this report indicates steps taken in 2006 and early 2007 to follow proposed procedures.

An element missing from 2006 activity is a coordinated effort with other NSF COSEE projects. This is an area that needs to be clarified in future years. The COSEE Great Lakes project anticipated receiving leadership and direction from NSF COSEE to accomplish that goal, but none was received. It is very difficult for each project to create this synergy and coordination on its own.

Advisors asked a related question about the role of the COSEE Great Lakes Team in the evaluation development process. Advisors suggested that Team member interests need to be an important source of guidance. While this has happened to some extent, it was difficult to provide a coordinated approach in the first year. It is hoped that the 2006 report will provide

tools and content that will enable the state PIs to provide direction about their preferences in future.

### **Methods**

Advisors suggested development of a more detailed evaluation plan that discusses methodology details, building on support and suggestions from experienced educators and researchers. The plan needs to create or address any criteria or benchmarks that the project must meet, and include standards for selecting samples for study, for example.

Advisor experience also indicated that NSF would require projects to follow research rules similar to that required by the Department of Education Office of Education and Research. The Department of Education imposes project research requirements to include: replicable trials, randomized trials, or matched comparison groups. This type of focus can be accomplished within the COSEE Great Lakes project, but requires a different kind of event design and a different use of funds than currently proposed. The current proposal design emphasizes a variety of activities identified through substantial prior study and understanding of Great Lakes education needs. According to the project proposal, developing and implementing these activities is the foundation of the project. Evaluation activities designed to investigate impacts of those projects can and should follow Department of Education research standard requirements, however.

### **Baseline study and project investigations**

The project has undertaken a baseline study which is not the subject of this report, but advisors reviewed the study and had several suggestions which are recorded here due to the study's potential impact on the project's ability to measure outcomes. Essentially, advisors identified the baseline study as an opportunity suggesting some aspects that could be studied statistically with more rigor, presumably because the questions they raise have potential to develop knowledge useful to project direction. They focused particularly on the Scientist Survey which includes a series of questions (#34-44) about professional preparation and experiences. They also wondered whether the project built awareness among the tested population, prior to implementing the survey.

Advisors suggested several avenues for potential study.

- How to get at the value of “learning how to teach” and other relevant skills?
- What is the value for the teacher of project topics and events?
- What is the value with the scientist? And for the scientist?
- Unit of analysis – individuals, groups, or networks? Is there a priority?
- Perceived barriers actual barriers, incentives
- Is this project telling a story – identify?
- Is it realistic to measure beyond activity events?

### **NSF goals**

Advisors requested clarification about the NSF proposed network of COSEE sites. NSF project coordination efforts did not address these questions in 2006. The COSEE Great Lake project can work to ready itself to respond when further guidelines are provided.

Advisor questions about the proposed network included the following:

- Is this a model or a recommendation for how to develop networks of networks?
- Are all the key people involved?
- Are there guidelines for effective practice of a networks of networks?
- What are expectations of collaborators?
- Are there scales for rating the quality and impact of scientist collaboration?

## ***Project Needs***

In upcoming years, findings from 2006 indicate that the project should consider activities related to the following needs:

- Review Great Lakes Advisory Committee recommendations
- Check Logic Model goals, revise as needed
- Improve collection of demographic details and create the opportunity for cross activity analysis of demographic information
- Consider strategies for expanding project capacity to engage educators with a Tribal affiliation and minorities
- Develop an evaluation tool related to the Web site
- Consider how and whether to evaluate the curricula consolidation activity
- Consider how to more overtly link Great Lakes science to ocean science so that the educator understands that this is a project goal
- Focus more attention on how to address goals related to science resource professionals
- Develop a system to evaluate the quality of the interaction when educators and science professionals are together during a project event
- Consider whether to continue with evaluation of specific activities and if so, which? Consider whether questions need to be revised to get at participant change related to goals more effectively.
- Interview state PIs to learn their impression of strengths and weaknesses of efforts and network development
- Look for opportunities to discover how educator experiences can or should be extended to the “public”
- Look for additional opportunities to measure impacts from COSEE GL activities
  - In individual participant knowledge, skills, intentions, application
  - In conditions, as described by goals (improvement in trends related to educator willingness to contact a science resource professional, etc.)
  - In the effectiveness of COSEE Great Lakes network in promoting access to Great Lakes and ocean science education

## **Summary**

2006 evaluation activities focused on developing mechanisms and tools for tracking project progress towards goals. Elements important to that effort included event tracking, demographics tracking, tracking instructor proposed event outcomes and their relationship to project goals, tracking evaluation activities and specific questions developed for individual purposes, and tracking evaluation responses compared across events. Fifteen single event evaluation projects created the opportunity to assess progress, and also to learn whether project managers had articulated the purpose of their work as accurately as they hoped to.

Activities in the first year clearly met teacher enhancement goals. The project also created a substantial infrastructure during Year One including a Team decision process, coordinated events across several states, a Web site, and a collection of education resources and curricula designed to improve access to Great Lakes and ocean sciences for educators. The project also actively engaged science professionals throughout its activities, although it produced little objective information on the effectiveness of that effort.

Substantial information about teacher enhancement efforts gathered in Year One minimizes the need for future evaluation of these activities. But findings need to be put to use to improve event publicity, to refine program design and implementation, and to provide and increase access to resources.

Several areas for future work are identified through comparison of Year One evaluation outcomes with project goals and by external advisors to the project.

Demonstrated impacts resulting from Year One activities include:

- Providing experiences that educators found highly satisfying, and that created educator motivation to learn more and to apply what they learned.
- Supporting educators who felt sure of how they would apply what they learned
- Engaging many science professionals, across eight states, who were willing to participate in work with educators

Hats off to the COSEE Great Lakes Team for a very fine and innovative effort!

## APPENDICES

- A. Evaluation activity matrix
- B. Event list and related evaluation activities
- C. Demographics summary by activity
- D. Goals compared to results anticipated by the Logic Models, and selected evaluation strategy
- E. Goals compared to evaluation questions for each activity
- F. Goals compared to outcomes – narrative summary
- G. Activity evaluation reports

## Appendix A. Evaluation activity matrix

TASK	OBJECTIVES From grant proposal	ACTIVITIES	EVALUATION ACTIVITY and PURPOSE					
			Identify participant expectations and readiness	Needs assessment: collect baseline data & demographics	Evaluate planning	Evaluate implementation	Report outcomes & impacts	Lead/ Team
Teacher enhancement	<p>1. Facilitate collaboration between GL researchers and educators and students</p> <p>3. Enhance teacher capabilities for accessing science information and delivering high quality educational programs in Great Lakes/ocean sciences</p> <p>4. Integrate ocean and GL research into existing high quality science education materials</p> <p>6. Increase access to GL/ocean science information for under represented groups</p>	<ul style="list-style-type: none"> <li>• <b>Lake Exploration Workshops.</b> Topics include: coastal processes, climate and weather, life in the water, hydrology and remote sensing, special habitats and special issues (AIS, etc.)</li> <li>• <b>Lake Guardian Workshop.</b> Teachers aboard the <i>R/V Lake Guardian</i></li> <li>• <b>Marine Immersion.</b> A scholarship program for teachers</li> <li>• <b>Teaching with GLOS.</b> Develop tools and educational materials to facilitate the use of GLOS/IOOS datasets for teaching about Great Lakes/ocean sciences</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Guardian and Lake Exploration workshops registration form and “first day” feedback form</li> </ul>	<ul style="list-style-type: none"> <li>• COSEE GL science literacy study</li> <li>• Collect demographics data for each activity</li> <li>• Lake Exploration workshops “last day” feedback form</li> </ul>		<ul style="list-style-type: none"> <li>• Lake Exploration workshops “last day” feedback form</li> </ul>		

TASK	OBJECTIVES From grant proposal	ACTIVITIES	EVALUATION ACTIVITY and PURPOSE					Lead/ Team
			Identify participant expectations and readiness	Needs assessment: collect baseline data & demographics	Evaluate planning	Evaluate implementation	Report outcomes & impacts	
Research scientist interactions	<p>1. Facilitate collaboration between GL researchers and educators and students</p> <p>2. Integrate ocean and GL research into existing high quality science education materials</p> <p>5. Make current research findings about the GL available to the public to encourage public science literacy and appreciate of water resources</p>	<ul style="list-style-type: none"> <li>• <b>LimnoLinks.</b> Research scientist interactions with educators and students via workshops, “house-calls” and a school for scientists at the annual meeting of the International Association for Great Lakes Research</li> </ul>		<ul style="list-style-type: none"> <li>• COSEE GL science literacy study</li> <li>• Collect demographics data for each activity</li> <li>• Educator House Call: <i>Lake Michigan Field Station</i> Educator Evaluation &amp; Researcher Evaluation; 8/16/06</li> </ul>		<ul style="list-style-type: none"> <li>• Educator House Call: <i>Lake Michigan Field Station</i> Educator Evaluation &amp; Researcher Evaluation; 8/16/06</li> </ul>		
Great Lakes/ocean science communication via informal settings and internet	<p>5. Make current research findings about the GL available to the public to encourage public science literacy and appreciate of water resources</p> <p>6. Increase access to GL/ocean science information for under represented groups</p> <p>7. Facilitate direct student connections to GL ocean science experiences</p>	<ul style="list-style-type: none"> <li>• <b>Teachable Moments.</b> Facilitating connections to events external but relevant to COSEE-Great Lakes</li> <li>• <b>Great Lakes and Ocean Sciences for the Public, Media and Schools.</b> Facilitating free-choice learning through project</li> </ul>		<ul style="list-style-type: none"> <li>• Collect demographics data for each activity</li> </ul>		<ul style="list-style-type: none"> <li>• Teachable Moment: <i>Understanding the Benefits and Risks of Eating Fish</i> evaluation form; 6/28/06</li> </ul>		

TASK	OBJECTIVES From grant proposal	ACTIVITIES	EVALUATION ACTIVITY and PURPOSE					Lead/ Team
			Identify participant expectations and readiness	Needs assessment: collect baseline data & demographics	Evaluate planning	Evaluate implementation	Report outcomes & impacts	
		collaborators, featuring an Inland Seas Science Seminar series  <ul style="list-style-type: none"> <li>• <b>COSEE-Great Lakes Online.</b> Information via the Internet to promote program activities and help increase awareness of opportunities for researchers, teachers, students, and the public; link to other COSEE programs; provide access to Great Lakes curriculum materials; and host ecology course materials for teachers and students</li> </ul>						
Engaging teachers in curriculum	3. Enhance teacher capabilities for accessing science information and delivering high quality educational programs in Great Lakes/ocean sciences  4. Integrate ocean and GL research into existing high quality science education materials	<ul style="list-style-type: none"> <li>• <b>Engaging Teachers in Curriculum Development and Enhancement.</b> Teachers examine and select Great Lakes curriculum materials, match these materials with ocean topics, and</li> </ul>		<ul style="list-style-type: none"> <li>• Collect demographics data for each activity</li> </ul>				

TASK	OBJECTIVES From grant proposal	ACTIVITIES	EVALUATION ACTIVITY and PURPOSE					Lead/ Team
			Identify participant expectations and readiness	Needs assessment: collect baseline data & demographics	Evaluate planning	Evaluate implementation	Report outcomes & impacts	
		assist in developing a new <i>Fresh and Salt Curriculum</i>						
Student experiences	7. Facilitate direct student connections to GL ocean science experiences	<ul style="list-style-type: none"> <li><b>Student Connections to Great Lakes/Ocean Sciences &amp; Research.</b> Includes O'LAKERS, Student Summits, Great Lakes Ecology Course</li> </ul>		<ul style="list-style-type: none"> <li>Collect demographics data for each activity</li> </ul>				
Contribute to the profession								

***Appendix B. Event list and related evaluation activities***

Excel file <Appendix B GL event list update>

## ***Appendix C. Demographics summary by activity***

Excel file <Appendix C GL event demographics>

Educator tab

Science professionals tab

**Appendix D. Goals compared to anticipated results, and selected evaluation strategy**

Excel file <Appendix D GL LogicModel short term results>

***Appendix E. Goals compared to evaluation questions for each activity***

Excel file <Appendix E 2006 Evaluation goal measures final>

## Appendix F. Goals compared to outcomes – narrative summary

Measurement reference	Evaluation questions Audiences: educators, science resource specialists	Logic Model based evaluations <sup>3</sup> Summarizes event feedback <i>N = 8 events</i>	Instructor evaluations <sup>4</sup> Summarizes event feedback <i>N = 7 events</i>
<b>COSEE Great Lakes Goals</b>			
Inspire citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences	<ul style="list-style-type: none"> <li>How did you learn about the event?</li> </ul>	<b>Learned about event (top two) (N=5):</b> Listed on a targeted Web site Listserv Mailings to individuals Newsletter Personal communication (conversation, emails, mail) Promotion at conference/ workshop/ inservice Registration packet choice	<b>Learn about event (top two) (N=2):</b> Listserv Personal communication Flyer in school mailbox
<i>[Questions related to this goal have to do with understanding what it takes to develop internal motivation among educators and science professionals.]</i>	<ul style="list-style-type: none"> <li>Why did you choose to attend?</li> </ul>	<b>Educators choose to attend (top two or three) (N=6)</b> Curiosity Experience aquatic research on the water Gain new ideas Learning about human impacts Obtaining materials for teaching Science and culture of the GL Work with other educators Work with scientists	<b>Educators choose to attend (N=0)</b>

<sup>3</sup> References findings presented in individual activity reports for R/V Lake Guardian workshop; Lake Superior Exploration workshop; Educator House Call (*Enhancing GLERL Science in the Classroom*, Lake Michigan field station); NAAEE pre-conference workshop (*EE for the Inland Seas*; Teachable Moment (*Waves and Beaches*, Tom Ridge Environmental Center in Erie, PA); *What's so great about the Great Lakes* online workshop

<sup>4</sup> References findings presented in individual activity reports for Teachable Moments (*Lake Huron Regional Fisheries* in Alpena; *Understanding the benefits and risks of eating fish* at Chicago Shedd Aquarium; *Educators and the Erie Canal* in Lockport, NY; *Great Lakes Institute 2006*; *Educators and the Erie Canal* at Montezuma National Wildlife Refuge; *Nab the Aquatic Invader* in East Chicago, IN;); Marine Immersion events (*Tropical marine ecology* workshop in Honduras)

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
		<p><b>Science professionals choose to attend (top two or three) (N=3)</b></p> <ul style="list-style-type: none"> <li>Work with educators</li> <li>Learn how to work with young people</li> <li>Learn about teacher interests and needs</li> <li>Influence teacher use of science information about the Great Lakes</li> </ul>	
	<ul style="list-style-type: none"> <li>• How useful was the event in meeting your goals?</li> </ul>	<p><b>Useful to meeting educator goals (N=5)</b></p> <p>Experience and/or specific resources, presentations, or activities were “very useful” in meeting goals for each of the events where this was evaluated (N=7). Specific items that were considered most useful were:</p> <ul style="list-style-type: none"> <li>• Activities and field activities</li> <li>• Curriculum materials</li> <li>• Data</li> <li>• Experiential segments</li> <li>• Handouts</li> <li>• Interaction with other educators</li> <li>• Internet resources</li> <li>• Overview activities</li> <li>• Question and answer with science professionals</li> <li>• Science presentations</li> <li>• Scientific collection (plankton tows, water quality)</li> <li>• Shipboard experience</li> </ul>	<p><b>Useful to meeting educator goals (top three or four) (N=3)</b></p> <p>Specific items that were considered most useful were:</p> <ul style="list-style-type: none"> <li>• Data</li> <li>• Field experience</li> <li>• Information about invasive species</li> <li>• Invasive species activities</li> <li>• Lab experiences</li> <li>• Lesson plans</li> <li>• Presenter power point slides</li> <li>• Specimens available for borrowing</li> </ul>
		<p><b>Useful to meeting science professional goals (N=2)</b></p> <p>Moderately useful</p>	

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
	<ul style="list-style-type: none"> <li>What other resources do you need?</li> </ul>	<b>Other resources needed (N=4)</b> Access to sampling equipment Curriculum integration Exotic species Identification guidance and skills Information about funding opportunities Information on specific research Land use management game Local contacts Music CD Succession Technology guidance Visual aids, particularly maps	<b>Other resources needed (all listed) (N=4)</b> Activities aligned with state science standards Activities provided by grade level Canal field programs Classroom materials – especially to address student activities, specific disciplines and methods Dam removal issues DVDs instead of video tapes Handouts and video tape information on internet Invasive species – details about specific good and bad impacts Invasive species video Localized activities Nab the Aquatic Invader Web site – make an engaging tool for students Nonpoint source pollution – more information Research in action Research materials – information on accessible by students Salt water discharge Stewardship activities for “indoor people” Stream/river ecology Tribal issues Virtual field trips via video conference Visuals
Create dynamic linkages between the education and research community  <i>(Questions related to this goal are designed</i>	<ul style="list-style-type: none"> <li>As a researcher/educator, how would you prefer to learn about opportunities to work with educators/researchers?</li> </ul>	<b>Educator prefers to learn about opportunities (top two or three) (N=6)</b> COSEE Great Lakes Web site Email alerts Listserv by topic  <b>Science professional prefers to learn</b>	<b>Educator prefers to learn about opportunities (N=0)</b>

Measurement reference	Evaluation questions Audiences: educators, science resource specialists	Logic Model based evaluations <sup>3</sup> Summarizes <b>event feedback</b> <i>N = 8 events</i>	Instructor evaluations <sup>4</sup> Summarizes <b>event feedback</b> <i>N = 7 events</i>
<i>to improve COSEE GL understanding for how to create these linkages and whether activities effectively make the link.)</i>	<ul style="list-style-type: none"> <li>As an educator, to what extent do you plan to integrate Great Lakes information into your existing curriculum or other youth education activities?</li> <li>As an educator, how will you apply what you learned from the scientists? What specific information that you gained today will be useable with your students -- immediately, as is? -- With some adjustments? -- Probably never?</li> </ul>	<p><b>about opportunities (top two or three) (N=0)</b></p> <p>None of the evaluations asked this question to science professionals.</p> <p><b>Educator application (top two or three) (N=5)</b></p> <p>Generate new education ideas Unsure (especially noted in the pre-event surveys) Use as a specialized unit Use lesson plans and activities Use the information as an occasional point of interest Use the information on a regular basis as course topics allow Work with scientists in the future</p> <p><i>The December Online course led to 230 comments about specific presentations and resources in 12 categories. These have yet to be analyzed for content. Many provide clues for how educators will integrate the information presented by science professionals.</i></p>	<p><b>Educator application (N=6)</b></p> <p>Add to or enhance curriculum Create an after-school program to explore and provide stewardship for Lake Michigan Create an invasive species classroom unit Create programs at the beach Develop lesson plans based on workshop resources Guide students in developing a community outreach or stewardship or service-learning project Make students more aware of the importance of keeping our beaches clean and healthy Plan field trips Share information with fellow teachers Use activities in the classroom Use Nab the Aquatic Invader Web site</p> <ul style="list-style-type: none"> <li>As a foundation to develop a community stewardship project</li> <li>For science and language arts study groups</li> <li>Games for the ecology unit</li> <li>High school students will share community stewardship projects with elementary students</li> </ul>
	<ul style="list-style-type: none"> <li>As a researcher, how do you expect to integrate education information into project outreach opportunities?</li> <li>As a researcher, will you use</li> </ul>	<p><b>Researcher application (top two or three) (N=3)</b></p> <p>Integrate education information as requested No specific plans</p>	<p><b>Researcher application (N=0)</b></p>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
	any information you gained in developing educational outreach? How will you apply what you learned from the educators?	Unsure of what they might do	
	<ul style="list-style-type: none"> <li>As a researcher, please list any educator needs you identified during the session.</li> </ul>	<b>Educator needs identified by science professionals (N=1)</b> Facility tours	<b>Educator needs identified by science professionals (N=0)</b>
	<ul style="list-style-type: none"> <li>As a researcher/educator, what specific information that you gained today was new for you?</li> <li>As a researcher/educator, what do you wish you had learned in addition to this day's information?</li> </ul>	<b>Information: New and missing for educators (N=1)</b> <i>Wish they had learned:</i> <ul style="list-style-type: none"> <li>Information about funding opportunities</li> <li>Information on specific research</li> </ul>	<b>Information: New and missing for educators (N=5)</b> <i>Gained:</i> Knowledge about invasive species Prey fish research Trends for Lake Huron Hands-on experience, i.e. algae collection and investigation A great deal of new information  <i>Wish they had learned:</i> Effects of pesticides on watersheds/aquatic ecosystem Ornithology, limnology, and ichthyology related to the Erie Canal Human impact on island More direction for what to look for on dives related to classroom study More time for reflection and brainstorming after each activity or presentation Recreational catch in Lake Huron

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
			<ul style="list-style-type: none"> <li>• Chinook management updates</li> <li>• Prey fish populations</li> <li>• Proof of natural reproduction</li> <li>• Updates on recreational catch</li> </ul> Training for using the zebra mussel kit Tribal issues details
		<b>Information: New and missing for science professionals (N=1)</b> <i>Gained:</i> <ul style="list-style-type: none"> <li>• Ideas for producing live science dives</li> <li>• Met new teachers</li> </ul> <i>Wish they had learned:</i> <ul style="list-style-type: none"> <li>• How to present material in an outreach form</li> <li>• A plan to move science from the GL research stations into the classroom</li> </ul>	<b>Information: New and missing for science professionals (N=0)</b>
	<ul style="list-style-type: none"> <li>• How would you prefer to learn about other Great Lakes science resources or skills?</li> </ul>	<b>Educator prefers to learn about resources or skills (top two or three) (N=5)</b> Time with individual scientists Workshops (week long, weekend, half-day) Hands-on research COSEE GL Web site (lists or training and discussion board) Emails Listserv by topic	<b>Educator prefers to learn about resources or skills (top two or three) (N=0)</b>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
<p>Implement coordinated research, education and outreach initiatives connecting Great Lakes topics and issues with counterpart ocean science concepts</p> <p><i>[This is a two-part goal addressing: (1) the need to implement and coordinate outreach initiatives; and (2) the need to link Great Lakes topics with ocean science concepts.]</i></p>	<p>Each event addressed this goal to some extent. See 2006 Event list in Appendix B</p> <p>The Lake Exploration follow up study (two questions) was the only 2006 related study to evaluate the quality of specific efforts to make a connection between Great Lakes and ocean science topics.</p>	<p><b>Addressing ocean science concepts (N=0)</b> No evaluation questions specifically addressed this connection.</p>	<p><b>Connecting to ocean science concepts (N=6)</b> Relevant topics were addressed by feedback to other questions are listed below. No evaluation questions specifically addressed this connection.</p> <p>Potentially relevant topics with participant feedback:</p> <ul style="list-style-type: none"> <li>• Chinook salmon management</li> <li>• Invasive species</li> <li>• Marine ecology presentations</li> <li>• Zebra mussels</li> </ul>
<p>Link COSEE science literacy and education/research goals with regional and national audiences</p>	<p>The Great Lakes project made 3 conference presentations in 2006.</p> <p>To determine if event participants furthered this goal requires an impact study such as a one year follow up study.</p>	<p>See summary of responses to relevant questions elsewhere in this table.</p>	<p>See summary of responses to relevant questions elsewhere in this table.</p>
<p>Improve ocean/Great Lakes sciences education throughout the Great Lakes region</p>	<p>To determine if event participants furthered this goal requires an impact study such as a one year follow up study.</p> <p>Applying event self-assessment</p>	<p>See summary of responses to relevant questions elsewhere in this table.</p>	<p>See summary of responses to relevant questions elsewhere in this table.</p>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
	measurements to this objective assumes that event participants provide information to audiences.		
Involve regional Tribal educational institutions, teachers and students in Great Lakes/ocean sciences	Measured with demographic information  The one year follow up study of presenters and participants at 2006 Lake Exploration workshops also addressed this objective.	18 events provided some level of demographic data. Each event collected different amounts and categories of data. Tribal educators were identified in the following: <ul style="list-style-type: none"> <li>• Tribal schools – 3 educators in 5 events</li> <li>• School diversity – 3 schools in 3 events</li> <li>• Participant ethnicity – 1 educator in 4 events</li> <li>• For the December 2006 online course with over 300 participants: <ul style="list-style-type: none"> <li>○ 120 participants indicated that their student audiences included 40% or more who were members of minority groups</li> <li>○ 9 participants self-identified as non-Caucasian</li> </ul> </li> </ul> One year follow-up study completed in 2007	
<b>COSEE Great Lakes Objectives</b>			
Facilitate collaborative	<ul style="list-style-type: none"> <li>• How helpful was the COSEE workshop in gaining new insight into the fish consumption issues</li> </ul>	<b>Fish consumption issues (N=1)</b> Gave new insight	<b>Fish consumption issues (N=0)</b>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
relationships that improve communication between Great Lakes researchers and 4-10 <sup>th</sup> grade educators and students	<p>in the Great Lakes?</p> <ul style="list-style-type: none"> <li>How would you prefer to learn about other Great Lakes science resources or skills?</li> <li>As a researcher/educator, how would you prefer to learn about opportunities to work with educators/scientists?</li> </ul>	<p><b>Educator prefers to learn about opportunities (top two or three) (N=6)</b></p> <p>COSEE Great Lakes Web site Email alerts Listserv by topic</p>	<p><b>Educator prefers to learn about opportunities (N=0)</b></p>
		<p><b>Science professional prefers to learn about opportunities (top two or three) (N=0)</b></p> <p>None of the evaluations asked this question to science professionals.</p>	<p><b>Science professional prefers to learn about opportunities (N=0)</b></p>
	<ul style="list-style-type: none"> <li>As a researcher/educator, why did you choose to attend this session?</li> </ul>	<p><b>Educators choose to attend (top two or three) (N=6)</b></p> <p>Curiosity Experience aquatic research on the water Gain new ideas Learning about human impacts Obtaining materials for teaching Science and culture of the GL Work with other educators Work with scientists</p>	<p><b>Educators choose to attend (N=0)</b></p>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
		<b>Science professional prefers to learn about opportunities (top two or three) (N=0)</b> Work with educators Learn how to work with young people Learn about teacher interests and needs Influence teacher use of science information about the Great Lakes	<b>Science professional prefers to learn about opportunities (N=0)</b>
	<ul style="list-style-type: none"> <li>During or prior to this event, have you learned about at least one other COSEE event or resource that interests you?</li> </ul>	<b>COSEE events that interest the participant (N=1)</b> 36% found another event that interested them. 45% did not find an event 18% did not respond to the question.	<b>COSEE events that interest the participant (N=3)</b> No evaluation questions specifically addressed this connection, but several asked about what else participants could use and responses included support for additional similar activities.
	<p>As a researcher</p> <ul style="list-style-type: none"> <li>How do you expect to integrate education information into projects outreach opportunities?</li> <li>Will you use any information you gained in developing educational outreach?</li> <li>How will you apply what you learned from the educators?</li> </ul>	<b>Researcher application (top two or three) (N=3)</b> Integrate education information as requested No specific plans Unsure of what they might do	<b>Researcher application (N=0)</b>
	<p>As a researcher</p> <ul style="list-style-type: none"> <li>List any educator needs you identified during the session.</li> </ul>	<b>Educator needs identified by science professionals (N=1)</b> Facility tours	<b>Educator needs identified by science professionals (N=0)</b>
Assist research scientists in gaining better access to	<p>As a researcher</p> <ul style="list-style-type: none"> <li>What specific information that you gained today was new for you?</li> </ul>	<b>Information: New for science professionals (N=1)</b> <ul style="list-style-type: none"> <li>Ideas for producing live science dives</li> </ul>	<b>Information: New for science professionals (N=0)</b>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
educational organizations and use appropriate pedagogy in relating the Great Lakes/ocean sciences story	<ul style="list-style-type: none"> <li>As a researcher <ul style="list-style-type: none"> <li>What do you wish you had learned in addition to this day's information?</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Met new teachers</li> </ul>	
	<ul style="list-style-type: none"> <li>Content specific evaluation questions</li> </ul>	<p><b>Information: Missing for science professionals (N=1)</b></p> <ul style="list-style-type: none"> <li>How to present material in an outreach form</li> <li>A plan to move science from the GL research stations into the classroom</li> </ul>	<p><b>Information: Missing for science professionals (N=0)</b></p>
	<ul style="list-style-type: none"> <li>Presenter specific evaluation questions</li> </ul>	None addressed this topic with science professionals	None addressed this topic with science professionals
Enhance teacher capabilities for accessing science information and delivering high quality educational programs in Great Lakes/ocean sciences	<ul style="list-style-type: none"> <li>Workshop format-specific evaluation questions</li> </ul>	<p><i>The December Online course led to 230 comments about specific presentations and resources in 12 categories. These have yet to be analyzed for content. Several categories provide feedback about workshop format.</i></p>	<p><b>Workshop format (N=4)</b></p> <p>Allow more free time in schedule Build in reflection and brainstorming sessions to allow for networking and sharing Extend the workshop in order to include more free time Pay attention to the problem of information overload Reduce length of lectures Three workshops provided a Likert type scale</p> <ul style="list-style-type: none"> <li>56% described the format as excellent</li> <li>87% described the format as excellent</li> <li>100% described the overall trip organization as excellent</li> </ul>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
	<ul style="list-style-type: none"> <li>Why did you choose to attend this workshop?</li> </ul>	<p><b>Educators choose to attend (top two or three) (N=6)</b></p> <ul style="list-style-type: none"> <li>Curiosity</li> <li>Experience aquatic research on the water</li> <li>Gain new ideas</li> <li>Learning about human impacts</li> <li>Obtaining materials for teaching</li> <li>Science and culture of the GL</li> <li>Work with other educators</li> <li>Work with scientists</li> </ul>	<p><b>Educators choose to attend (N=0)</b></p>
	<ul style="list-style-type: none"> <li>Name some of the <u>skills</u> you learned at this workshop? Of all the skills you learned, which are you likely to use?</li> </ul>	<p><b>Educators tended to list only skills they would use (top two or three) (N=3)</b></p> <ul style="list-style-type: none"> <li>Collecting/interpreting data</li> <li>Identification of fish, plankton, plants</li> <li>Seining for fish</li> <li>Storytelling</li> <li>Using internet sources</li> </ul>	<p><b>Educators skills they would use (N=0)</b></p> <p>No evaluation questions specifically addressed this question.</p>
	<ul style="list-style-type: none"> <li>Name some of the <u>resources</u> you reviewed at this workshop? Of all the resources you reviewed, which are you likely to use?</li> </ul>	<p><b>Educators tended to list only resources they would use (top three or four) (N=5)</b></p> <ul style="list-style-type: none"> <li>Activities from GOGL and SeaCOOS</li> <li>GLOS</li> <li>Beach profiling</li> <li>Don't pick up hitchhikers</li> <li>Exotic species activity</li> <li>Fish key/fish characteristics activities</li> <li>Games</li> <li>Global warming activities</li> <li>Hands on/interactive student activities</li> <li>"How big is a crowd" activity</li> <li>Lesson plans</li> <li>Longshore current/waves activity</li> <li>Project WILD activities</li> <li>Science professional's power point presentations</li> </ul>	<p><b>Educators tended to list only resources they would use (N=4)</b></p> <ul style="list-style-type: none"> <li>Information sheets</li> <li>Lesson plans</li> <li>Nab the Aquatic Invader Web site</li> <li>Zebra mussel kit</li> </ul>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
		Story telling activities Web sites (specific Web sites were often mentioned that were particular to each event) "Who can harvest a Walleye" activity	
	<ul style="list-style-type: none"> <li>What other resources or skills do you need?</li> </ul>	<b>Other resources needed (N=4)</b> Access to sampling equipment Curriculum integration Exotic species Identification guidance and skills Information about funding opportunities Information on specific research Land use management game Local contacts Music CD Succession Technology guidance Visual aids, particularly maps	<b>Other resources needed (all listed) (N=4)</b> Activities aligned with state science standards Activities provided by grade level Canal field programs Classroom materials – especially to address student activities, specific disciplines and methods Dam removal issues DVDs instead of video tapes Handouts and video tape information on internet Invasive species – details about specific good and bad impacts Invasive species video Nab the Aquatic Invader Web site – make an engaging tool for students Nonpoint source pollution – more information Research materials – information on accessible by students Salt water discharge Stewardship activities for "indoor people" Stream/river ecology Tribal issues Virtual field trips via video conference Visuals

Measurement reference	Evaluation questions Audiences: educators, science resource specialists	Logic Model based evaluations <sup>3</sup> Summarizes event feedback <i>N = 8 events</i>	Instructor evaluations <sup>4</sup> Summarizes event feedback <i>N = 7 events</i>
	<ul style="list-style-type: none"> <li>Rate these factors as to their importance in how likely you are to use Great Lakes information in your teaching:               <ul style="list-style-type: none"> <li>Relevance of material to required curriculum</li> <li>Flexibility of the course of study</li> <li>Trust of my teaching by administrators</li> <li>Relevance of material to students</li> <li>Logistical demands of the innovations [computers, student copies, equipment, etc]</li> <li>Access to science updates</li> <li>Availability of time or location for outdoor study</li> </ul> </li> </ul>	<p><b>Factors important to teaching (top three) (N=2)</b></p> <ul style="list-style-type: none"> <li>Flexibility of the course of study</li> <li>Relevance of material to required curriculum</li> <li>Relevance of materials to students</li> <li>Trust of my teaching by administrators</li> </ul> <p><i>The December Online course led to 230 comments organized according to 12 categories. These have yet to be analyzed for content. Many provide clues for issues that concern educators in applying Great Lakes and ocean sciences information in their programs.</i></p>	<p><b>Factors important to teaching (N=0)</b></p> <p>No evaluation questions specifically addressed this question.</p>
	<ul style="list-style-type: none"> <li>As an educator, to what extent do you plan to integrate Great Lakes information into your existing curriculum or other youth education activities?</li> <li>As an educator, what specific information that you gained today will be useable with your students -- immediately, as is? - - With some adjustments? -- Probably never?</li> <li>As an educator, how will you apply what you learned from the scientists?</li> <li>Will you use any information gained with your students?</li> </ul>	<p><b>Educator application (top two or three) (N=5)</b></p> <ul style="list-style-type: none"> <li>Generate new education ideas</li> <li>Unsure (especially noted in the pre-event surveys)</li> <li>Use as a specialized unit</li> <li>Use lesson plans and activities</li> <li>Use the information as an occasional point of interest</li> <li>Use the information on a regular basis as course topics allow</li> <li>Work with scientists in the future</li> </ul> <p><i>The December Online course led to 230 comments about specific presentations and resources in 12 categories. These have yet to be analyzed for content. Many provide clues for how educators will integrate the</i></p>	<p><b>Educator application (N=6)</b></p> <ul style="list-style-type: none"> <li>Add to or enhance curriculum</li> <li>Create an after-school program to explore and provide stewardship for Lake Michigan</li> <li>Create an invasive species classroom unit</li> <li>Create programs at the beach</li> <li>Develop lesson plans based on workshop resources</li> <li>Guide students in developing a community outreach or stewardship or service-learning project</li> <li>Make students more aware of the importance of keeping our beaches clean and healthy</li> <li>Plan field trips</li> <li>Share information with fellow teachers</li> <li>Use activities in the classroom</li> <li>Use Nab the Aquatic Invader Web site</li> </ul>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
		<i>information presented by science professionals.</i>	<ul style="list-style-type: none"> <li>• As a foundation to develop a community stewardship project</li> <li>• For science and language arts study groups</li> <li>• Games for the ecology unit</li> <li>• High school students will share community stewardship projects with elementary students</li> </ul>
	<ul style="list-style-type: none"> <li>• As an educator, what do you wish you had learned in addition to the day's information?</li> </ul>	<p><b>Information: educators wish they had learned(N=1)</b></p> <ul style="list-style-type: none"> <li>• Information about funding opportunities</li> <li>• Information on specific research</li> </ul>	<p><b>Information: educators wish they had learned (N=5)</b></p> <p>Effects of pesticides on watersheds/aquatic ecosystem Ornithology, limnology, and ichthyology related to the Erie Canal Human impact on island More direction for what to look for on dives related to classroom study More time for reflection and brainstorming after each activity or presentation Recreational catch in Lake Huron</p> <ul style="list-style-type: none"> <li>• Chinook management updates</li> <li>• Prey fish populations</li> <li>• Proof of natural reproduction</li> <li>• Updates on recreational catch</li> </ul> <p>Training for using the zebra mussel kit Tribal issues details</p>
	<ul style="list-style-type: none"> <li>• Content specific evaluation questions</li> </ul>	<p><b>Content that educators rated “high” (listed generically) (N=2)</b></p> <p>Experiential segments The Rite Bite activity</p> <p><i>The December Online course led to 230 comments about specific presentations and</i></p>	<p><b>Content that educators rated “high” (listed generically) (N=4)</b></p> <p><i>Activities</i> Boat trips Snorkling Tours</p>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
		<i>resources in 12 categories. These have yet to be analyzed for content. Several categories provide feedback about content.</i>	<p><i>Topics</i></p> <ul style="list-style-type: none"> <li>2005 recreational fish catch</li> <li>AdoptABeach</li> <li>Boat driver knowledge</li> <li>Coral reef</li> <li>Cormorant control</li> <li>COSEE GL activities</li> <li>Data, all kinds</li> <li>Information about specific organisms</li> <li>Lighthouses</li> <li>Marine ecology</li> <li>Marine knowledge</li> <li>Prey fish research/trends</li> <li>Recreational fish species information</li> <li>Recruitment/retention of anglers</li> <li>Remote operated vehicle research</li> <li>Sea turtle preservation</li> <li>Shedd Aquarium activities</li> <li>Shipwrecks</li> </ul> <p><b>Content that educators rated “low” (listed generically) (N=3)</b></p> <ul style="list-style-type: none"> <li>Fisheries regulations</li> <li>Great Lakes in My World activities</li> <li>Recruitment/retention of anglers</li> <li>Some locations</li> </ul>
	<ul style="list-style-type: none"> <li>• Presenter specific evaluation questions</li> </ul>	<p><b>Presentations that educators rated “high” (listed generically) (N=1)</b></p> <p>Two out of three presenters were highly rated for this workshop</p> <p><i>The December Online course led to 230 comments about specific presentations and resources in 12 categories. These have yet to be analyzed for content. Several categories provide feedback about presenters.</i></p>	<p><b>Presentations that educators rated “high” (listed generically) (N=3)</b></p> <ul style="list-style-type: none"> <li>2005 recreational catch</li> <li>Adopt-a-Beach</li> <li>Education vessel cruise</li> <li>Lighthouse tour</li> <li>Marine science presentations</li> <li>Prey fish research and trends in lake Huron</li> <li>Remote operated vehicle</li> <li>Shedd Aquarium</li> <li>Shipwrecks</li> </ul>

Measurement reference	Evaluation questions Audiences: educators, science resource specialists	Logic Model based evaluations <sup>3</sup> Summarizes <b>event feedback</b> <i>N = 8 events</i>	Instructor evaluations <sup>4</sup> Summarizes <b>event feedback</b> <i>N = 7 events</i>
			Using research in the classroom  <b>Presentations that some educators rated “poor” to “average” or “unsatisfactory” (listed generically) (N=3)</b> Great Lakes in My World activities Managing cormorants Recruitment and retention of anglers
Integrate ocean and Great Lakes research into existing high quality educational materials  <i>A specific COSEE GL activity addressed this objective, but information gathered from events can also be informative. Information can indicate what educators might need to be able to do in order to develop their own educational materials.</i>	<ul style="list-style-type: none"> <li>What other resources or skills do you need to help you teach this subject?</li> </ul>	<p><b>Information: educators wish they had learned(N=1)</b></p> <ul style="list-style-type: none"> <li>Information about funding opportunities</li> <li>Information on specific research</li> </ul> <hr/> <p><b>Other resources needed (N=4)</b></p> <p>Access to sampling equipment Curriculum integration Exotic species Identification guidance and skills Information about funding opportunities Information on specific research Land use management game Local contacts Music CD</p>	<p><b>Information: educators wish they had learned (N=5)</b></p> <p>Direction for what to look for on dives related to classroom study Effects of pesticides on watersheds/aquatic ecosystem Ornithology, limnology, and ichthyology related to the Erie Canal Human impact on island Recreational catch in Lake Huron</p> <ul style="list-style-type: none"> <li>Chinook management updates</li> <li>Prey fish populations</li> <li>Proof of natural reproduction</li> <li>Updates on recreational catch</li> </ul> <p>Reflection and brainstorming after each activity or presentation Training for using the zebra mussel kit Tribal issues details</p> <hr/> <p><b>Other resources needed (all listed) (N=4)</b></p> <p>Activities aligned with state science standards Activities provided by grade level Canal field programs Classroom materials – especially to address student activities, specific disciplines and methods Dam removal issues DVDs instead of video tapes</p>

<b>Measurement reference</b>	<b>Evaluation questions</b> Audiences: educators, science resource specialists	<b>Logic Model based evaluations<sup>3</sup></b> Summarizes <b>event feedback</b> <i>N = 8 events</i>	<b>Instructor evaluations<sup>4</sup></b> Summarizes <b>event feedback</b> <i>N = 7 events</i>
		Succession Technology guidance Visual aids, particularly maps	Handouts and video tape information on internet Invasive species – details about specific good and bad impacts Invasive species video Nab the Aquatic Invader Web site – make an engaging tool for students Nonpoint source pollution – more information Research materials – information on accessible by students Salt water discharge Stewardship activities for “indoor people” Stream/river ecology Tribal issues Virtual filed trips via video conference Visuals
Make research findings about the Great Lakes available to the public to encourage public science literacy and appreciation of water resources	<ul style="list-style-type: none"> <li>To what extent do you expect to integrate Great Lakes information into your existing curriculum or other youth education activities?</li> </ul>	<b>Educator application (top two or three) (N=5)</b> Generate new education ideas Unsure (especially noted in the pre-event surveys) Use as a specialized unit Use lesson plans and activities Use the information as an occasional point of interest Use the information on a regular basis as course topics allow Work with scientists in the future	<b>Educator application (N=6)</b> Add to or enhance curriculum Create an after-school program to explore and provide stewardship for Lake Michigan Create an invasive species classroom unit Create programs at the beach Develop lesson plans based on workshop resources Guide students in developing a community outreach or stewardship or service-learning project Make students more aware of the importance of keeping our beaches clean and healthy Plan field trips Share information with fellow teachers Use activities in the classroom Use Nab the Aquatic Invader Web site <ul style="list-style-type: none"> <li>As a foundation to develop a community stewardship project</li> </ul>

Measurement reference	Evaluation questions Audiences: educators, science resource specialists	Logic Model based evaluations <sup>3</sup> Summarizes <b>event feedback</b> <i>N = 8 events</i>	Instructor evaluations <sup>4</sup> Summarizes <b>event feedback</b> <i>N = 7 events</i>
			<ul style="list-style-type: none"> <li>For science and language arts study groups</li> <li>Games for the ecology unit</li> <li>High school students will share community stewardship projects with elementary students</li> </ul>
	<ul style="list-style-type: none"> <li>Name some of the skills you learned at this workshop? Of all the skills you learned, which are you likely to use?</li> </ul>	<p><b>Educators tended to list only skills they would use (top two or three) (N=3)</b></p> <ul style="list-style-type: none"> <li>Collecting/interpreting data</li> <li>Identification of fish, plankton, plants</li> <li>Seining for fish</li> <li>Storytelling</li> <li>Using internet sources</li> </ul>	<p><b>Educators and skills they would use (N=)</b></p> <p>No evaluation questions specifically addressed this question</p>
<p>Increase access to Great Lakes/ocean sciences information for underrepresented groups</p>	<ul style="list-style-type: none"> <li>To what extent do you expect to integrate Great Lakes information into your existing curriculum or other youth education activities?</li> </ul>	<p><b>Educator application (top two or three) (N=5)</b></p> <ul style="list-style-type: none"> <li>Generate new education ideas</li> <li>Unsure (especially noted in the pre-event surveys)</li> <li>Use as a specialized unit</li> <li>Use lesson plans and activities</li> <li>Use the information as an occasional point of interest</li> <li>Use the information on a regular basis as course topics allow</li> <li>Work with scientists in the future</li> </ul>	<p><b>Educator application (N=6)</b></p> <ul style="list-style-type: none"> <li>Add to or enhance curriculum</li> <li>Create an after-school program to explore and provide stewardship for Lake Michigan</li> <li>Create an invasive species classroom unit</li> <li>Create programs at the beach</li> <li>Develop lesson plans based on workshop resources</li> <li>Guide students in developing a community outreach or stewardship or service-learning project</li> <li>Make students more aware of the importance of keeping our beaches clean and healthy</li> <li>Plan field trips</li> <li>Share information with fellow teachers</li> <li>Use activities in the classroom</li> <li>Use Nab the Aquatic Invader Web site <ul style="list-style-type: none"> <li>As a foundation to develop a community stewardship project</li> </ul> </li> </ul>

Measurement reference	Evaluation questions Audiences: educators, science resource specialists	Logic Model based evaluations <sup>3</sup> Summarizes <b>event feedback</b> <i>N = 8 events</i>	Instructor evaluations <sup>4</sup> Summarizes <b>event feedback</b> <i>N = 7 events</i>
			<ul style="list-style-type: none"> <li>• For science and language arts study groups</li> <li>• Games for the ecology unit</li> <li>• High school students will share community stewardship projects with elementary students</li> </ul>
	<ul style="list-style-type: none"> <li>• Name some of the skills you learned at this workshop? Of all the skills you learned, which are you likely to use?</li> </ul>	<p><b>Educators tended to list only skills they would use (top two or three) (N=3)</b></p> <ul style="list-style-type: none"> <li>Collecting/interpreting data</li> <li>Identification of fish, plankton, plants</li> <li>Seining for fish</li> <li>Storytelling</li> <li>Using internet sources</li> </ul>	<p><b>Educators and skills they would use (N=0)</b></p> <p>No evaluation questions specifically addressed this question</p>
Facilitate direct student connections to GL ocean science experiences	No activities evaluated in 2006		

***Appendix G. Activity evaluation reports***