NOAA Technical Memorandum GLERL-163

Beach Health Information Needs Assessment:

9 Years Later - Results from Follow-up Survey

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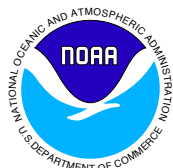Indiana Department of Environmental Management
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New York State Department of Health, Bureau of Community Environmental Health
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DEPARTMENT OF COMMERCE

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NOTICE

NOAA's Mission – To understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our nation's economic, social, and environmental needs

NOAA's Mission Goals:

- Protect, restore and manage the use of coastal and ocean resources through an ecosystem approach to management
- Understand climate variability and change to enhance society's ability to plan and respond
- Serve society's needs for weather and water information
- Support the Nation's commerce with information for safe, efficient, and environmentally sound transportation
- Provide critical support for NOAA's Mission

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BEACH HEALTH INFORMATION NEEDS ASSESSMENT:
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1. INTRODUCTION

The Beach Health Interagency Coordination Team (BHICT) representing NOAA, USGS, USEPA, and the Centers for Disease Control (CDC) developed a survey for distribution to determine issues important to beach managers. The survey was distributed during Fall 2013 (August 28 to November 8). Responses were obtained when it was believed that federal funding from the BEACH Act would no longer be available.

This survey is a follow-up to the Beach Health Research Needs Workshop held during the fall of 2005 at the Great Lakes Beach Association Conference in Green Bay (GLBA et. al. 2006, NOAA Technical Memorandum GLERL-138). The purpose of the survey is to assist BHICT member agencies in prioritizing their beach program based on input from the respondents on information, data, and tools they need to more effectively manage recreational water quality and beach health issues.

The 2005 workshop defined beach manager research needs and set the direction for beach health research and development (R&D) for federal agencies over subsequent years. The research work resulting from the 2005 workshop led to advances in the development of USEPA's standardized beach sanitary survey protocol, rapid analytical pathogen indicator and fecal indictor bacteria (FIB) testing protocols, identification of pathogens present at beaches, pathogen relationship to FIB concentrations, and pathogen contribution to disease, the quantification of bacterial runoff from Great Lakes watersheds, and training on standardized beach survey design, sampling methods, development and operation of predictive models, and further improvements to "Virtual Beach", which at that time was a new EPA expert software system used to predict beach closures. These advancements combined with ongoing beach research work has established a body of beach science (Nevers et al. 2014).

2. METHODS

The beach information needs survey focused on six areas to assess beach manager plans, activities, and needs in the following areas:

- Background of survey respondents
- Assess future beach monitoring
- Determine current beach manager research needs
- Assess beach manager adoption of new methods
- Assess beach manager use of tools and training needs
- Identify how communication links between beach managers and federal agencies and beach managers and swimmers can be improved

The roster for the respondents was developed using input from federal and state beach coordinators. This list contains e-mail addresses for 83 Great Lakes municipal agencies, county health departments, laboratories, and universities involved with managing Great Lakes beaches. The final list contained 90 individuals. The organizational roster is available in Appendix A.

More than one person could anonymously provide information for an organization. If the initial roster contact for an organization forwarded the response to other personnel, respondents were requested to provide contact names to maintain a correct roster. An example of this occurred when a health department contracted out the sampling and analysis functions.

Each respondent was asked to answer up to 52 questions. Short cuts were provided to skip questions if the organization was not using new methods such as Virtual Beach or Rapid Analytical Testing techniques. Six respondents were removed from the survey because they were responding for inland beaches, could not be tracked to the roster, or their response contained conflicting answers.

The survey provided respondents with an opportunity to inform federal agencies of their information needs, as well as to provide information on uses of new methods and plans for future monitoring in the event that federal support for the Beach Act was lacking.

3. RESULTS

3.1 Background of the respondents to the survey

Table 1. Survey response by state

State	Number of Respondents	Number on Roster	Percent Response
Illinois	7	7	100
Indiana	9	12	75
Michigan	24	27	89
Minnesota	3	3	100
New York	5	7	71
Ohio	6	8	75
Pennsylvania	2	2	100
Wisconsin	20	24	83

Table 2. What type of organization do you work for?

Type	Percent
Municipal or County Health Dept.	71
Other	14
College or University	4
Local Parks/Recreation Dept.	4
Wastewater Utility/Sewerage	4
NGO/Non-profit	2
Tribal Government	1

Respondents included in the "Other" category identified their organization as state park offices, environmental laboratories, other city governmental units, multiple county/districts/state health units and the Federal Government.

When asked about staff sizes for survey respondents' organization, 28.4% of respondents came from an organization of 50 staff, and 32.4% of respondents came from an organization with less than 10 staff. The most frequent organizational size was less than 10 staff.

Table 3. Number of Great Lakes beaches organization is responsible for

Number of beaches	Percent
More than 10	37.7
6 to 10	12.2
3 to 5	21.6
1 to 2	28.5

When asked where managed beaches are located, the types of Great Lakes beaches that the respondent's organization is responsible for managing included connecting channels, Lake St. Clair, as well as the Great Lakes coasts. The connecting channel designation was used for beaches that are located on rivers such as the Niagara and St. Lawrence Seaway.
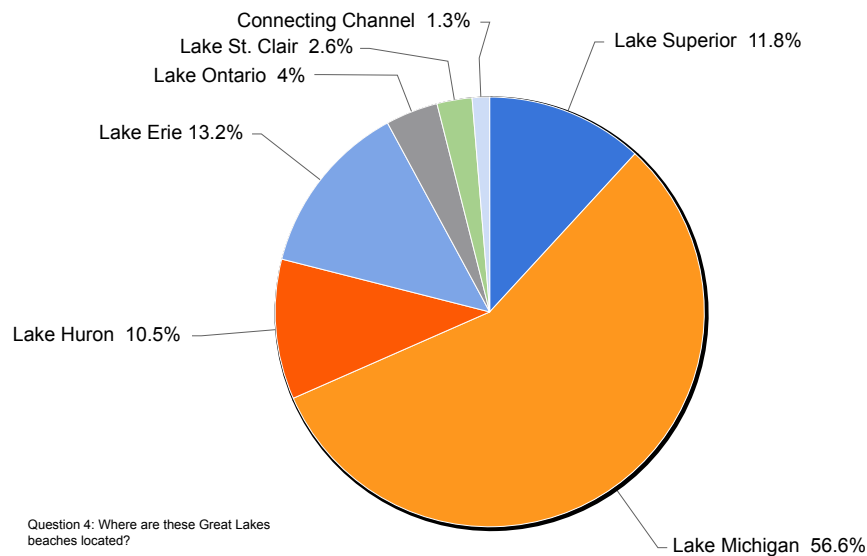
Figure 1. Where are the Great Lakes beaches located?
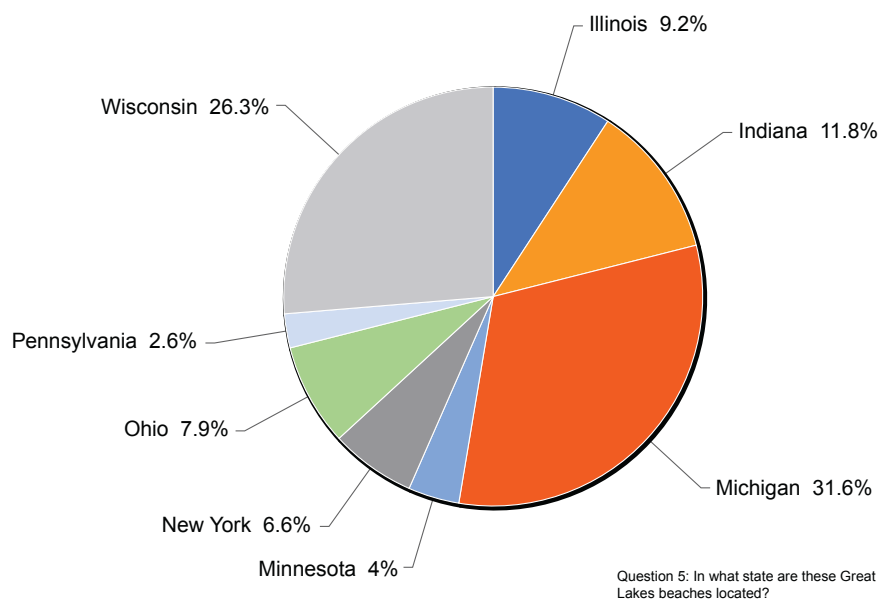
Figure 2. In which state are these Great Lakes beaches located?

Table 4 shows the distribution of results to the question on number of beaches located in county or counties per state. There are 158 Great Lakes Coastal Counties (NOAA List of Counties in Census Statistical Abstract), with 69 counties reported in the survey. Table 4 shows the distribution in the eight Great Lake states.

Table 4. Beach distribution from survey respondents by state

Great Lakes State	IL	IN	MI	MN	NY	OH	PA	WI	Total
Counties in Survey	2	3	31	3	9	6	1	14	69
Coastal Counties	2	9	74	4	21	24	1	23	158

Seven of the 28 tribal governments in the Great Lakes basin were identified with having beaches located within tribal areas.

Bay Mills Indian Community	Michigan
Grand Portage Band of Chippewa	Minnesota
Grand Traverse Band of Ottawa and Chippewa Indians	Michigan
Onondaga Nation	New York
Red Cliff Band of Lake Superior Chippewa	Wisconsin
Saginaw Chippewa Indian Tribe	Michigan
Sault Ste. Marie Tribe of Chippewa	Michigan

Management roles and responsibilities vary across respondents as can be seen from Table 5. There was also variation in terms of how much time respondents spent managing beaches and the tenure of their involvement in a decision-making role.

Table 5. Beach management roles (total responses = 76)

Role	Number	Percent
Monitoring – sampling field observations	61	80.3

Monitoring – lab analysis	34	44.7
Public notification/beach posting	67	88.2
Data reporting/analysis	63	82.9
Remediation planning/implementation	25	32.9
Management/supervision/administration	47	61.8
Other	3	4.0

Question 9: What proportion of time do you devote to the combined roles noted in Question 8?
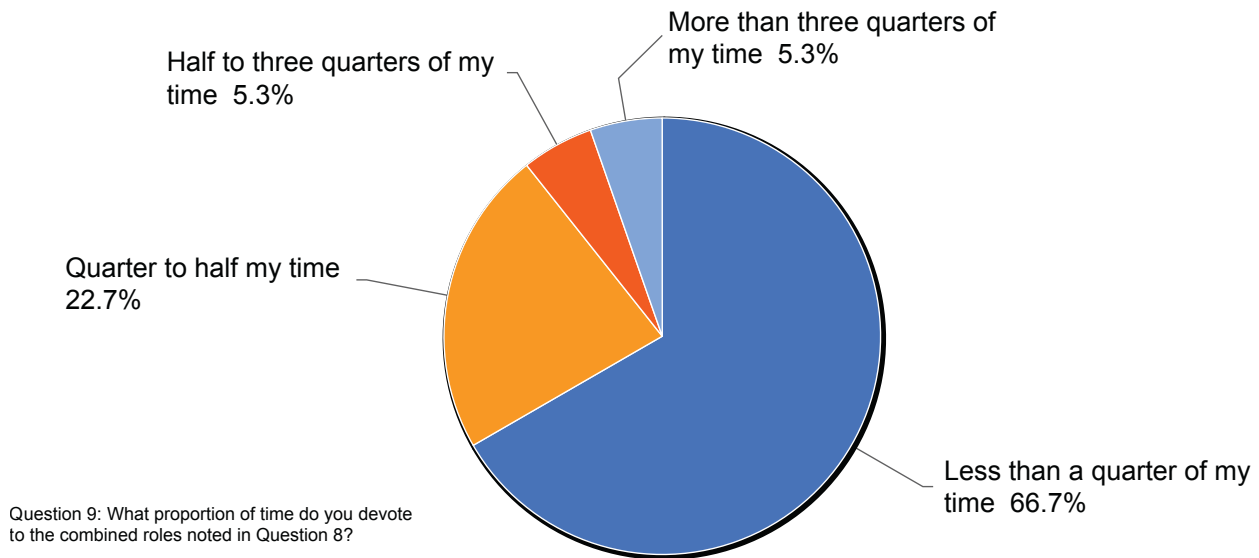
Figure 3. Proportion of time spent on beach management tasks
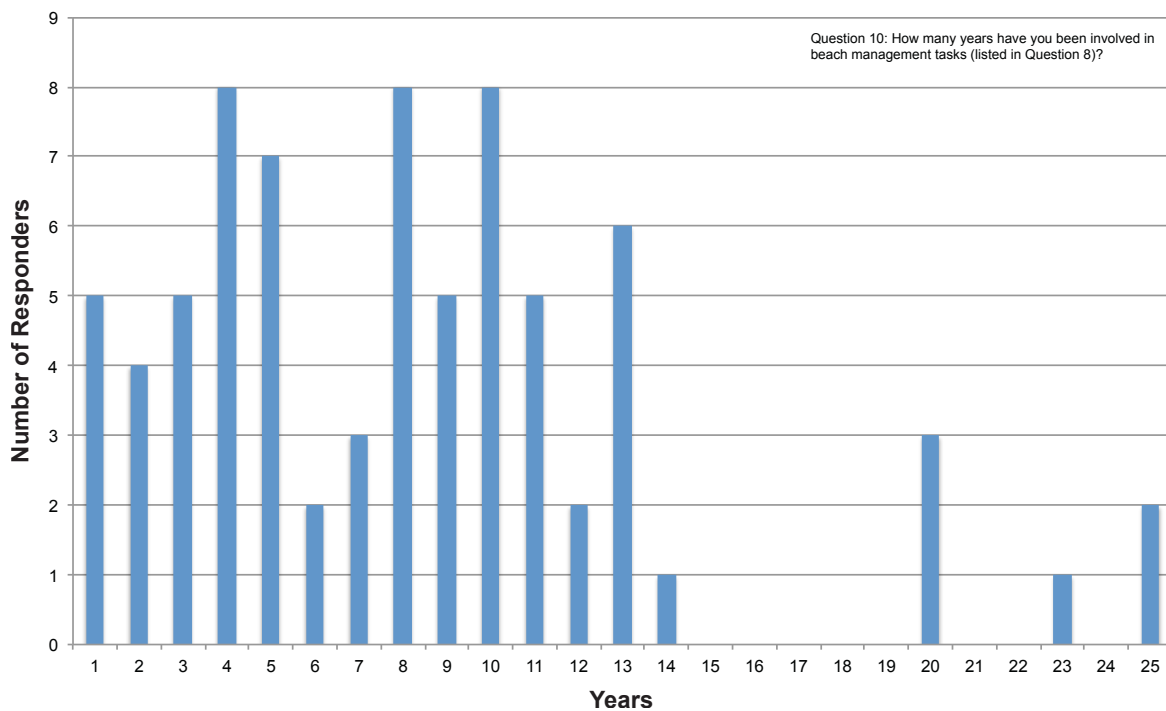
Figure 4. Years involved in beach management roles

Question 11: What proportion of overall staff time does your organization devote to beach management (tasks listed in Question 8)?

More than three quarters of overall staff time 5.4%
Half to three quarters of overall staff time 4.1%
A quarter to half of overall staff time 5.4%
10% to a quarter of overall staff time 16.2%
Less than 10% of overall staff time 68.9%
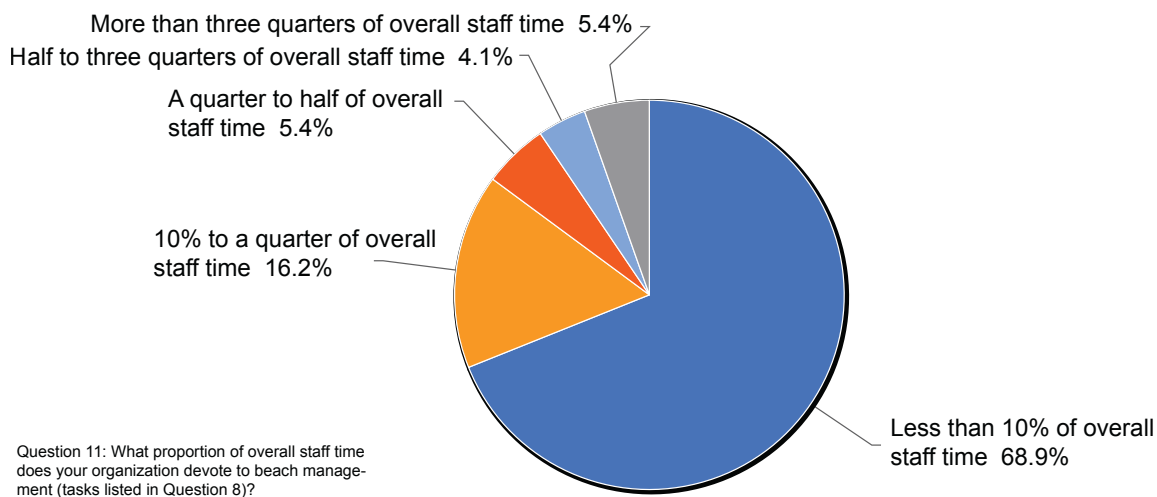
Figure 5. Total staff time devoted to beach management

The role of interns in conducting beach management tasks was also explored. Interns are involved in 50% or greater beach related work by 43.3% of respondents. Twenty-nine percent reported not using interns at all (Figure 6).

Question 12: What proportion of beach management tasks listed in Question 8 is conducted by interns?

More than three quarters of beach related work conducted by interns 9.5%
Three quarters of beach related work conducted by interns 13.5%
Half of beach related work conducted by interns 20.3%%
Do not use interns for beach related work 29%
Less than a quarter of beach related work conducted by interns 27%

Figure 6. Proportion of beach management tasks conducted by interns

3.2 Assess Future Beach Monitoring

The following questions addressed the potential effects of the possible reduction in federal BEACH Act funding would have on the ability to monitor water quality at coastal beaches.

The survey asked about continued bacterial indicator monitoring of Great Lakes beaches if federal support for the Beach Act is withdrawn. Respondents indicated that 33.3% would continue monitoring, 22.7% would not monitor, and 44% were unsure if they would continue monitoring.

Unsure 44%

Yes 33.3%

No 22.7%

Question 13: Will your organization continue monitoring Great Lakes beaches without this source of funding?
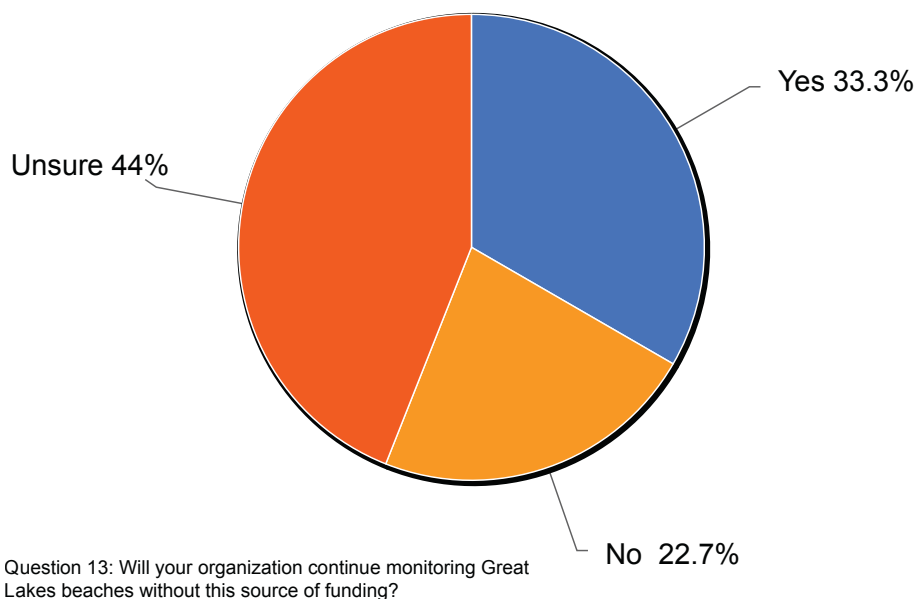
Figure 7. Will your organization continue beach monitoring without federal funding?

We also sought to understand how much reduction would occur in the overall number of water-quality tests conducted without federal funding. The following pie chart shows the anticipated level of continuing water-quality testing for the remaining 58 respondents.

No reduction 5.2%

Less than 25% reduction in water quality testing 6.9%

Unsure 39.7%

25 - 50% reduction in water quality testing 19%

50 - 75% reduction in water quality testing 15.5%

Greater than 75% reduction in water quality testing 13.8%

Question 14: How much will your organization's beach monitoring be reduced without federal funding?
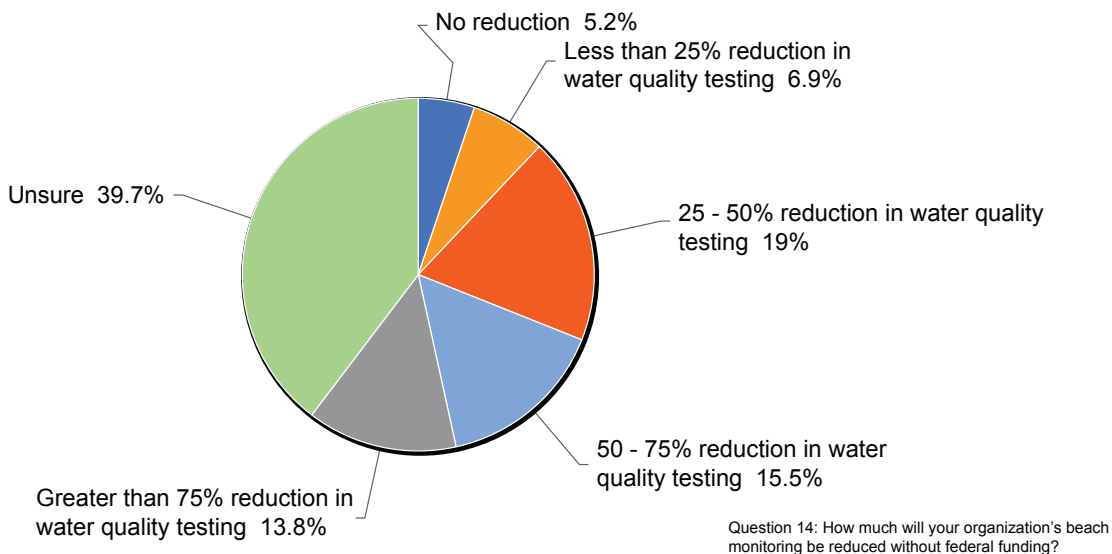
Figure 8. Anticipated reduction in the number of water quality tests without federal funding

Below is a table categorization of how the reduction in water-quality testing would occur. (Number of respondents = 58)

Table 6. Water quality categories where reductions in testing would occur

	Very likely	Fairly likely	Neutral or unsure	Fairly unlikely	Very unlikely
Reducing the number of beaches monitored?	31.0%	17.2%	27.6%	6.9%	17.2%
Reducing the number of days monitored?	36.2%	29.3%	22.4%	6.9%	5.2%
Using predictive models in place of sampling/testing on some days?	25.9%	19.0%	32.8%	12.1%	10.3%
Instituting blanket swim-at-your-own-risk, except for safety (e.g., lightning, waves, sewage spill)?	13.8%	12.1%	41.4%	20.7%	12.1%
Screening which days to sample/ not sample? (based on predictive models)	19.0%	29.3%	41.4%	1.7%	8.6%

We asked about voluntary submissions of beach monitoring data to EPA should federal support for the beach program end and 32.3% said yes, 13.9% said no, and 53.9% were unsure.

We also explored the possible data management backup capability of the responding organizations by asking if the respondent's organization has its own beach website where water quality data could be accessed and downloaded. Roughly half of the organizations could not store the beach water-quality monitoring results. About 30% of the organizations have a data management system capable of storing current year monitoring results and historical monitoring data.

Yes - current data only 24.6%

No 46.2%

Yes - current data plus past data 29.2%

Question 17: Does your organization have its own beach website, where water quality data can be accessed/downloaded?
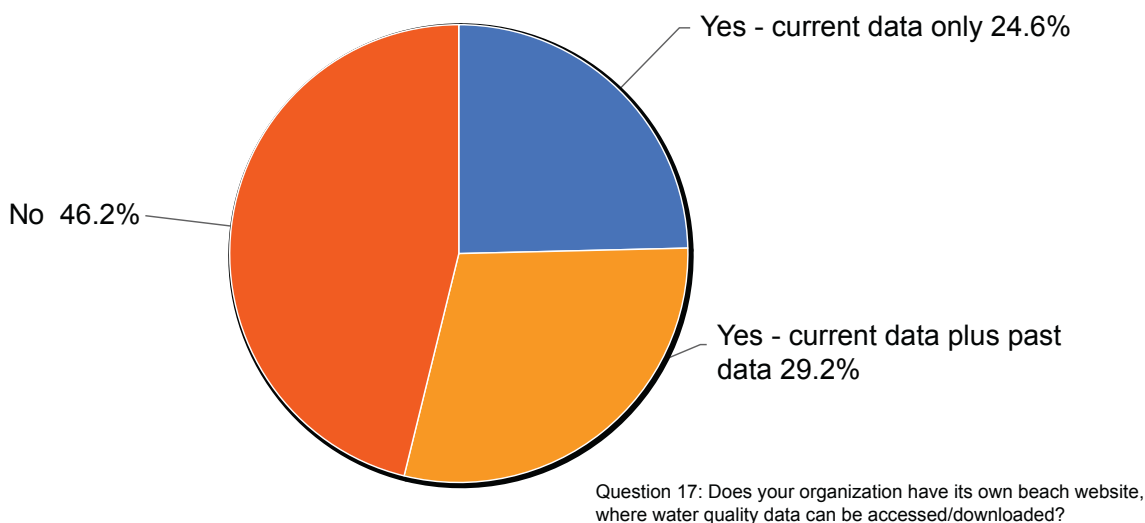
Figure 9. Does your organization have a beach website where water quality data can be accessed/downloaded?

Respondents were asked to describe other plans for dealing with reduced federal funding. Of the 33 respondents who were unsure of continued monitoring if federal support for the beach program was not renewed, 32 had plans to apply for funding from other local or federal sources. (See Appendix B).

3.3 Determine current beach manager research needs

The next questions addressed beach research needs by asking about the importance of research subject areas for the respondent organizations beach-related work.

Respondents were asked to describe the importance of 14 research areas for their organization's beach-related work.

Table 7. Importance of beach-related research in your organization

	Extremely important	Very important	Moderately important	Somewhat important	Not at all important	Not sure	Responses
Rapid testing techniques (e.g., qPCR)	28.0%	30.7%	18.7%	12.0%	5.3%	5.3%	75
Real-time water quality predictions and forecasts	34.7%	40.0%	3.3%	10.7%	0.0%	1.3%	75
Microbial source tracking/ identification	9.5%	44.6%	21.6%	13.5%	4.1%	6.8%	74
Quantitative microbial risk assessment	8.3%	36.1%	27.8%	18.1%	2.8%	6.9%	72
Human health impacts of beach pathogens	33.3%	46.7%	14.7%	2.7%	0.0%	2.7%	75
Cyanobacterial harmful algal blooms (HABs)	16.7%	18.1%	22.2%	26.4%	6.9%	9.7%	72
Cladophora impacts/management	9.5%	21.6%	28.4%	20.3%	10.8%	9.5%	74
Waterfowl impacts/management	17.6%	33.8%	25.7%	14.9%	4.1%	4.1%	74
Watershed Bacterial Contribution	25.7%	39.2%	21.6%	6.8%	1.4%	5.4%	74
Pollution remediation techniques	21.6%	35.1%	29.7%	5.4%	2.7%	5.4%	74
Rip currents, structural currents or dangerous conditions	12.3%	23.3%	24.7%	26.0%	9.6%	4.1%	73
Public perception/ effectiveness of water quality notification procedures	34.7%	45.3%	14.7%	4.0%	0.0%	1.3%	75
Economic Impacts	33.3%	37.3%	17.3%	6.7%	1.3%	4.0%	75
Safe use/disposal of algal biomass	9.5%	16.2%	21.6%	23.0%	18.9%	10.8%	74

Respondents were asked to identify other emerging issues that federal agencies should consider for research projects. Twelve suggestions were made (see Appendix C).

Respondents were also asked to evaluate the usefulness of several information service "tools" to perform their beach-related work by ranking them. When asked to rank, "Location specific/ Web-accessible data"

ranked highest followed by "Science based guidance on beach management issues or tasks." The table below depicts the respondents' evaluation of the usefulness of tools. (Number of respondents = 69).

Table 8. Usefulness of specific information services to performance of beach-related work

	Extremely useful	Very useful	Moderately useful	Somewhat useful	Not useful	Not sure
Synthesis/summary of all studies on a given topic or question	17.4%	33.3%	33.3%	10.1%	2.9%	5.8%
Science-based guidance on beach management issues or tasks	31.9%	44.9%	20.3%	0.0%	0.0%	2.9%
Location-specific/web-accessible data (e.g., water quality results; past and present rainfall, lake conditions, river discharge, etc..)	47.8%	34.8%	11.6%	4.3%	1.4%	0.0%
Tools (i.e., software, on-line applications, smart phone apps) for beach management tasks like conducting sanitary surveys, predicting water quality, or notifying the public.	30.4%	37.7%	14.5%	15.9%	1.4%	0.0%
Direct consultation/technical assistance	34.8%	30.4%	23.2%	8.7%	2.9%	0.0%

In order to identify other beach-relevant data, which the federal agencies could provide, respondents were asked to provide suggestions. Eleven suggestions were made (see Appendix D).

Respondents were asked whether they thought the federal agencies involved in beach-related research (USEPA, USGS, NOAA, and CDC) were, overall, meeting beach manager information needs.
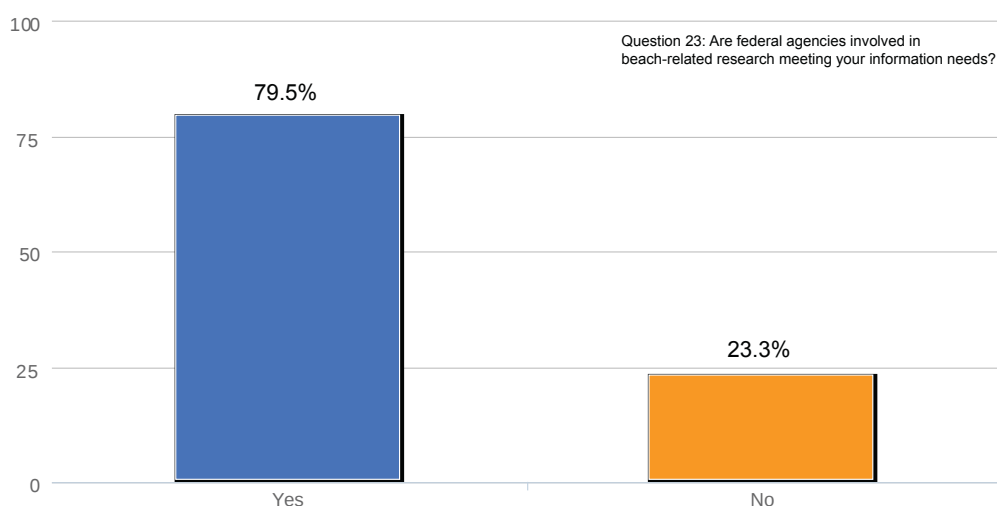
Figure 10. Are federal agencies meeting your beach-related research needs?

We also wanted to know how satisfied the respondents were with the beach information services provided by each agency. (See table below). None of our respondents reported being very dissatisfied and dissatisfied responses were the smallest percentages when each agency was ranked.

Table 9. Satisfaction with federal agencies involved in beach-related research

	Very satisfied	Satisfied	Neutral or unsure	Dissatisfied	Very dissatisfied	Responses
NOAA	21.6%	37.8%	39.2%	1.4%	0.0%	74
USGS	28.0%	45.3%	25.3%	1.3%	0.0%	75
EPA	14.7%	44.0%	33.3%	8.0%	0.0%	75
CDC	4.0%	34.7%	56.0%	5.2%	0.0%	75

Suggestions for how the federal agencies involved in beach-related research can better meet beach managers' organizational information needs are listed in Appendix E.

3.4 Assess beach manager adoption of new methods

This section of questions sought to understand the adoption of new and proposed water quality methods. The breakdown of the current use of the rapid method quantitative Polymerase Chain Reaction (qPCR) for monitoring any of the organization's beaches found that the majority (65.3%) of organizations are not managing beaches based on qPCR.

Question 26: Is your organization currently using quantitative Polymerase Chain Reaction (qPCR) for managing any of its beaches?
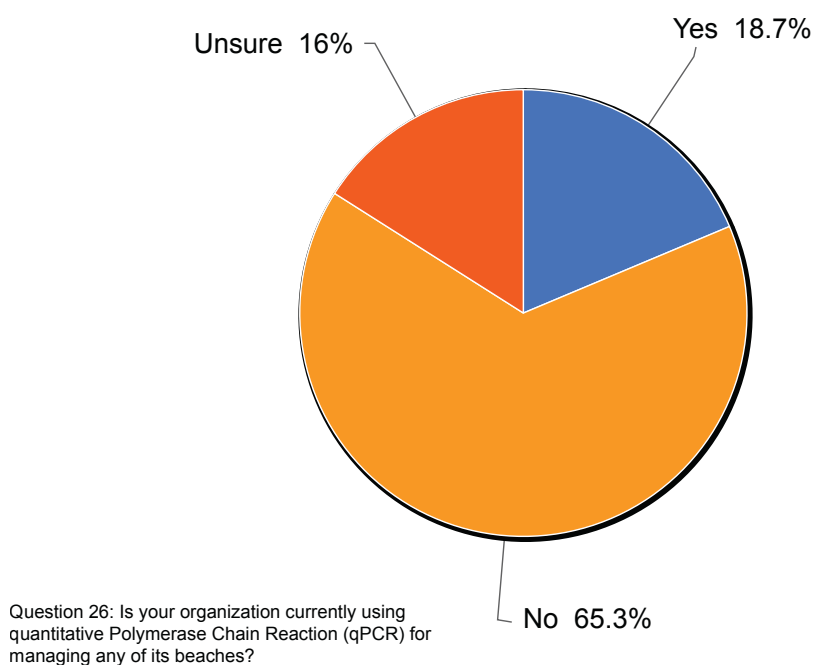
Figure 11. Is your organization using qPCR for managing beaches?

Organizations used qPCR for two primary purposes as illustrated in the figure below.
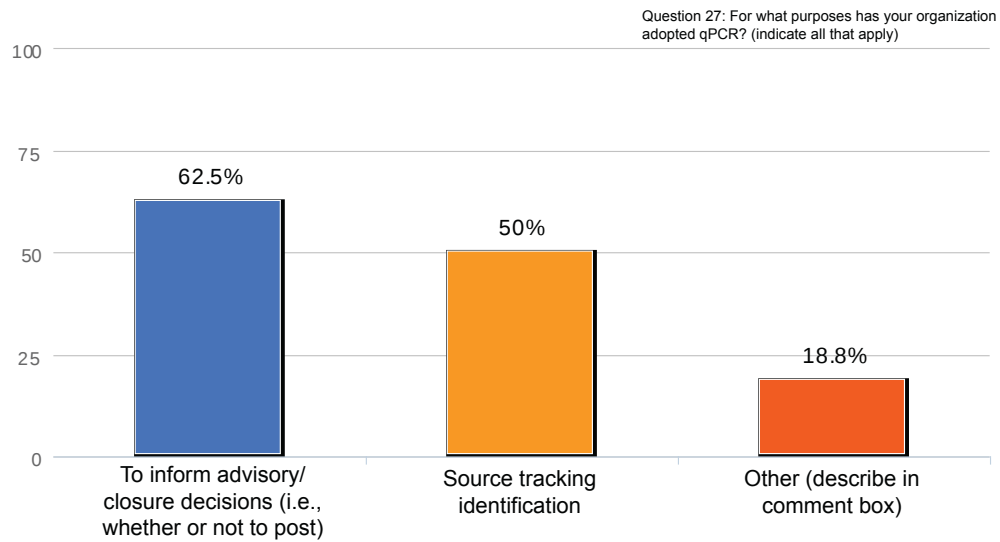
Figure 12. Purpose of using qPCR

When respondents were asked to identify the beach season when they first used qPCR for beach management, the vast majority started using qPCR in 2012.

Table 10. First use of qPCR for beach management

Number	Year
1	2009
2	2010
1	2011
11	2012

Below are barriers affecting organizational/ institutional adoption of qPCR.

Table 11. Reasons organizations are not using qPCR

	Extreme barrier	Significant barrier	Moderate barrier	Slight barrier	Not a barrier	Not sure	Respondents
Lack of technical capacity (equipment)	28.6%	28.6%	7.1%	0.0%	28.6%	7.1%	14
Lack of know-how/ trained personnel	26.7%	20.0%	26.7%	6.7%	13.3%	6.7%	15
Lack of funding for equipment	26.7%	20.0%	13.3%	0.0%	33.3%	6.7%	15
Lack of access to an outside qPCR facility	14.3%	7.1%	14.3%	7.1%	42.9%	14.3%	14
Lack of funding for analytical cost (in house)	40.0%	26.7%	13.3%	6.7%	6.7%	6.7%	14
Lack of funding for analytical cost (outsourced)	30.8%	38,5%	0.0%	0.0%	15.4%	15.4%	13
Lack of interest/ support	14.3%	7.1%	28.6%	7.1%	35.7%	7.1%	14

Respondents were asked to report current use of decision support tools such as Nowcast, Swimcast, or forecast predictive models. Rainfall alert decision support models were excluded because they are not new methods.
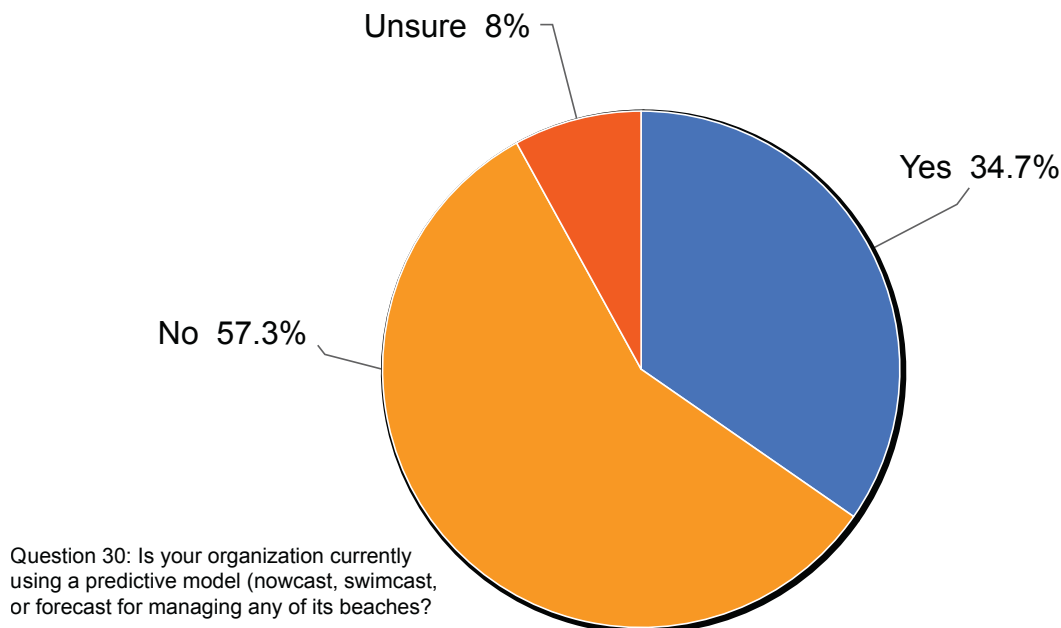
Figure 13. Organizations currently using predictive models for managing beaches

We also asked respondents to identify the purposes for using a predictive model as well as the year that the decision support tool was first implemented.

Table 12. Reasons for using predictive models

Reason	Number	Percent
Inform advisory decisions (whether or not to post) on days when samples are collected	21	75.0%
Inform advisory decisions on days when samples are NOT collected	12	42.9%
Inform sampling decisions (e.g., whether or not to re-sample following an exceedance)	12	42.9%
Inform testing decisions (e.g., whether or not to run one type of test vs. another)	3	10.7%
Receive forecasts of future (e.g., 48 to 120 hour) water quality conditions	2	7.1%
Provide the public with forecasts of future water quality conditions	4	14.3%
Other (Please describe in Comment Box):	4	14.3%

From 2010 onward the number of respondents using predictive models began to increase from 1 person in 2004 & 2005, 2 people from 2006-20010 to 5 in 2011, and 8 in 2013.

Respondents were asked to evaluate various barriers affecting adoption of predictive models. Lack of funding was the most significant barrier (42.3%) followed by lack of staff/ time for developing a model (32.1%). More specifically, 75% of respondents to do not use Virtual Beach software for their beach forecasting.

Table 13. Barriers to using predictive models

	Extreme barrier	Significant barrier	Moderate barrier	Slight barrier	Not a barrier	Not sure	Responses
Lack of technical capacity (computers, web access)	0.0%	3.6%	10.7%	21.4%	60.7%	3.6%	28
Lack of adequate data	3.6%	17.9%	14.3%	14.3%	46.4%	3.6%	28
Lack of know-how/trained personnel to develop a model	17.9%	17.9%	7.1%	14.3%	39.3%	3.6%	28
Lack of staff/time for developing a model (est. 1 week+)	32.1%	3.6%	14.3%	21.4%	25.0%	3.6%	28
Lack of funding for developing models with contractors	42.3%	26.9%	11.5%	3.8%	15.4%	0.0%	28
Lack of staff/time for making predictions (est. 10 min/day	7.1%	7.1%	21.4%	21.4%	42.9%	0.0%	28
Lack of staff/time for field observations needed to make predictions	18.5%	14.8%	18.5%	14.8%	33.3%	0.0%	27
Lack of interest/support	3.6%	0.0%	21.4%	14.3%	53.6%	7.1%	28

3.5 Assess beach manager use of tools and training needs

These questions covered EPA's Standardized Beach Sanitary Survey, online web based systems containing data relevant to managing beaches, Virtual Beach, and other beach management tools.

Table 14. Are federal agencies meeting your beach-related research needs?

Yes	No	Unsure
72%	10.7%	17.3%
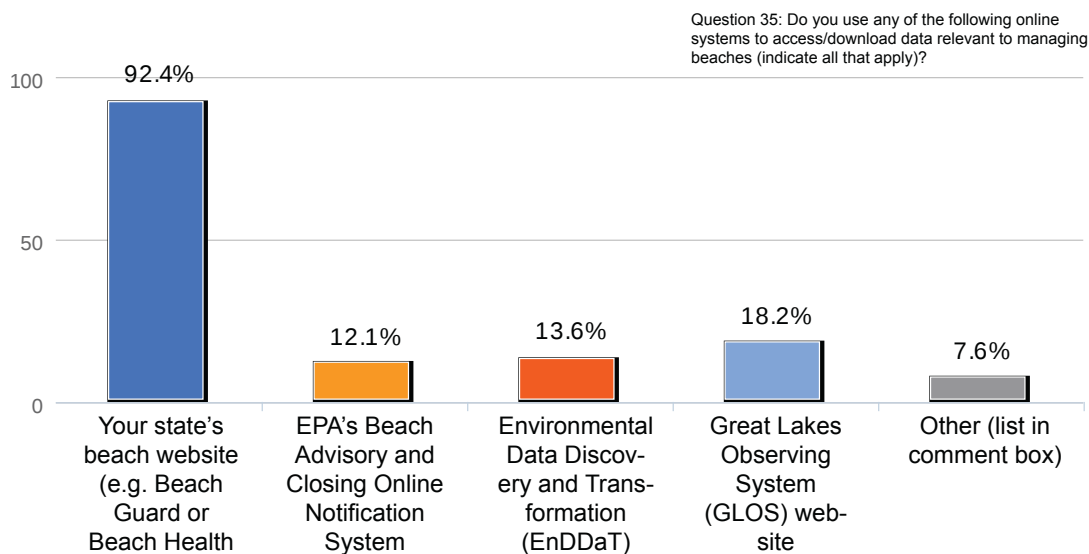
Figure 14. Which online beach management data system do you use?

We also sought an evaluation of four organizational purposes for Virtual Beach as well as the year Virtual Beach was first used.

Table 15. How do you use Virtual Beach software?

Reason	Number	Percent
To operate (run predictive models provided ay an outside partner/contractor	8	40%
To develop predictive models for use in-house	10	50%
To develop predictive models for use by outside partners/clients	5	25%
To develop analytical models (e.g., for evaluating the relative influence of different sources of beach water pollution)	5	25%
Other (Please list in Comment Box)	3	15%

Table 16. Year Virtual Beach software first used

Number	Year
2	2009
4	2010
4	2011
5	2012
4	2014

We asked the relative importance of 15 considerations in the decision by respondents to use Virtual Beach.

Table 17. Reason for using Virtual Beach

	Extremely important	Very important	Somewhat important	Minimally important	Not important	Respondents
Decreasing funds for traditional (sample-based)	21.1%	26.3%	31.6%	10.5%	10.5%	19
Directive from a supervisor/ management	5.6%	11.1%	38.9%	16.7%	27.8%	18
Its use at a number of other beaches	10.5%	21.1%	26.3%	31.6%	10.5%	19
Relative accuracy/timeliness of its outputs compared to lab	31.6%	42.1%	10.5%	5.3%	10.5%	19
Ease-of-use (time required, level of complexity) to develop	35.0%	30.0%	20.0%	15.0%	0.0%	20
Ease-of-use to operate a model; i.e. make a daily	36.8%	31.6%	15.8%	15.8%	0.0%	19
Compatibility of operating a model with routine workflow	22.2%	33.3%	22.2%	16.7%	5.6%	18
Software cost (free)	42.1%	21.1%	15.8%	21.1%	0.0%	19
Use of the software and its outputs being	21.1%	15.8%	36.8%	21.1%	5.3%	19
Ability to test the software	16.7%	27.8%	38.9%	11.1%	5.6%	18
Ability to provide direct or indirect feedback/suggestions to software developers	22.2%	33.3%	22.2%	22.2%	0.0%	18
Availability of online data that can be used to build/operate a	36.8%	26.3%	26.3%	5.3%	5.3%	19
Availability of ready-to-use models (provided by an	27.8%	16.7%	27.8%	16.7%	11.1%	18
Availability of training	31.6%	42.1%	10.5%	15.8%	0.0%	19
Availability of technical assistance	42.1%	31.6%	10.5%	15.8%	0.0%	19

Below is the ranking of primary means respondents learned about Virtual Beach.

Table 18. How did you learn about Virtual Beach?

How	Number	Percent
From a conference presentation or poster	9	39.1%
From an email listserve (i.e. BeachNet)	2	8.7%
From a colleague who had used or tested it	8	34.8%
From a state or federal outreach specialist/extension agent	8	34.8%
From a scholarly journal article	0	0.0%
From a technical report	0	0.0%
From a media report (e.g., Great Lakes Echo)	0	0.0%
Other (describe in comment box)	2	8.7%
Don't know/recall	1	4.4%

Respondents (primarily managers) were asked if more than one person used Virtual Beach. Virtual Beach is primarily used by one individual in each of the organizations responding to the survey. But what is important to note is the vast majority of respondents do not use Virtual Beach.

Table 19. Does more than one person in your organization use Virtual Beach?

	Number	Percent
Yes	5	7.4%
No	56	82.4%
Not sure	8	11.8%

Below is the familiarity of the respondents with Virtual Beach.
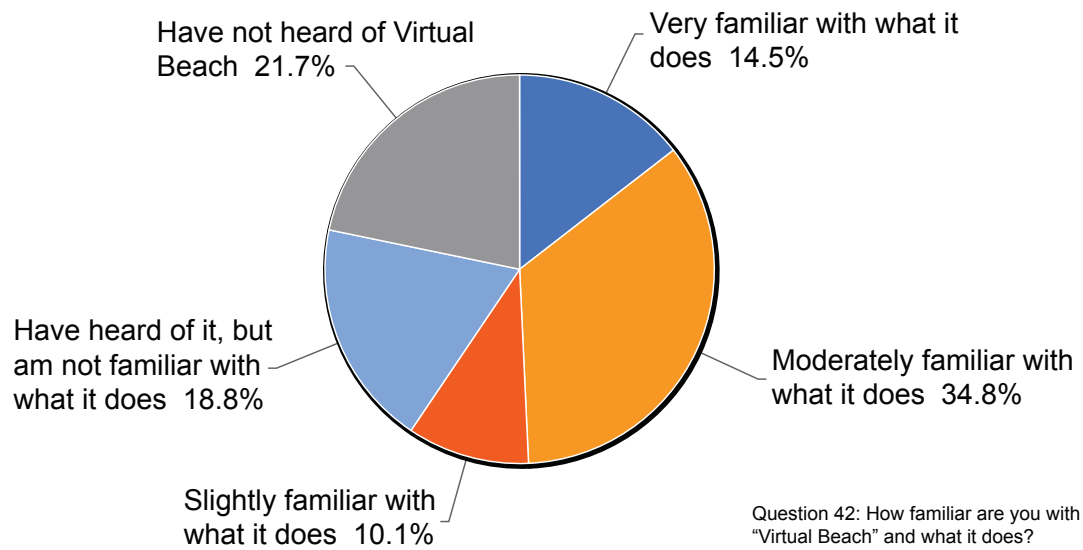
Figure 15. How familiar are you with Virtual Beach software?
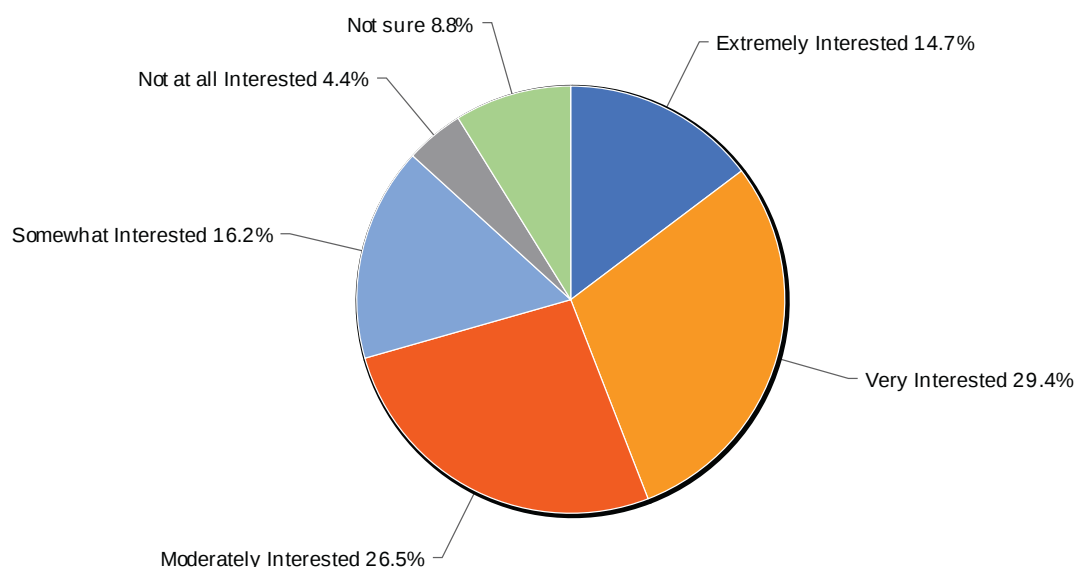
Figure 16. How interested are you with using Virtual Beach software?

To identify the utility of on-line resources to assist with beach management activities, we found that majority of respondents would find improved predictive modeling the most helpful (46.5%) followed by improved public notification (41.7%).

Table 20. Beach management tools that would be helpful

	Extremely helpful	Very helpful	Moderately helpful	Somewhat helpful	Not at all helpful	Respondents
Source identification	30.6%	41.7%	22.2%	5.6%	0.0%	72
Remediation planning	22.5%	32.4%	38.0%	4.2%	2.8%	71
Improved predictive modeling	46.5%	32.4%	16.9%	2.8%	1.4%	71
Optimized sample collection	27.8%	38.9%	25.0%	6.9%	1.4%	72
Improved online data access	31.0%	35.2%	23.9%	8.5%	1.4%	71
Improved public notification (e.g., smart-phones, electronic	41.7%	34.7%	15.3%	6.9%	1.4%	72
Safety-related forecasts/notification	26.8%	39.4%	29.6%	4.2%	0.0%	71

Question 45 gave insight into the need for training in these areas: rapid testing, methodology for discovery of microbial risks, decision support systems, and management of beach water quality data.

Table 21. Training that would be helpful

	Extremely Helpful	Very Helpful	Moderately Helpful	Somewhat Helpful	Not at all helpful	Respondents

Conducting sanitary surveys	13.9%	30.6%	22.2%	18.1%	15.3%	72
qPCR	14.9%	26.9%	19.4%	19.4%	19.4%	67
QMRA	10.8%	18.5%	24.6%	27.7%	18.5%	65
Accessing online data (e.g., GLOS, EnDDaT, etc.)	12.5%	29.2%	33.3%	16.7%	8.3%	72
Source identification	24.3%	41.4%	18.6%	10.0%	5.7%	70
Virtual Beach – developing predictive models	26.0%	32.9%	20.5%	9.6%	11.0%	73
Virtual Beach – operating predictive models	24.7%	37.0%	20.5%	8.2%	9.6%	73
Other (Please describe in Comment Box)	25.0%	16.7%	16.7%	8.3%	33.3%	12

We asked how many days per year respondents are available for training.
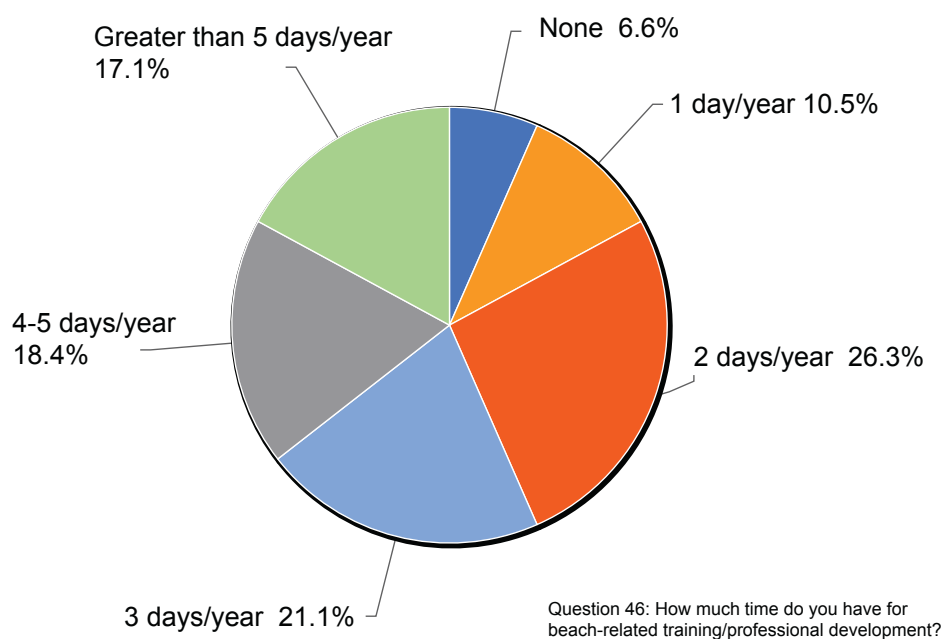
Figure 17. Number of days available for training

The following graph provides an overview of available budget for beach related training and professional development at conferences and travel expenses.
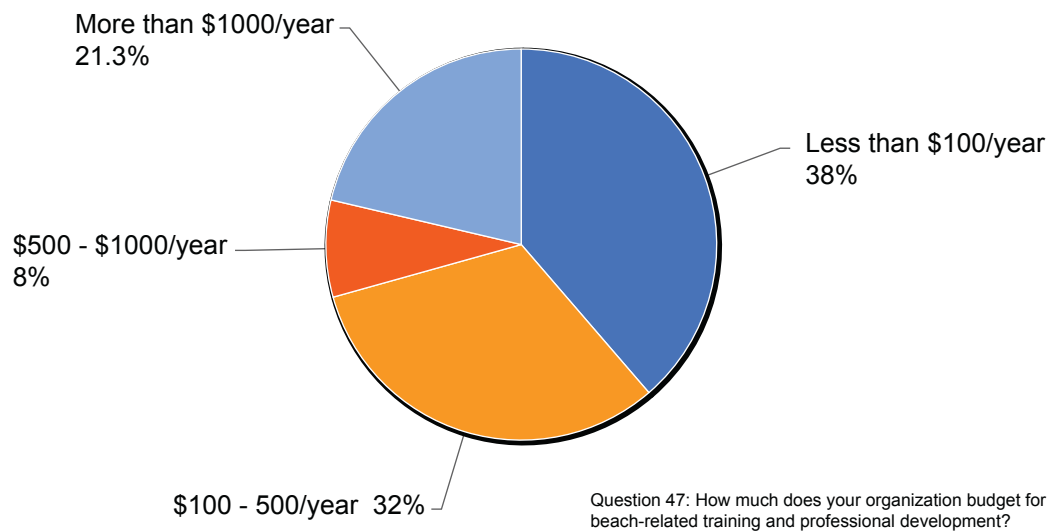
Figure 18. Budget for beach-related training

3.6 How federal agencies can improve communication with beach managers?

Respondents were asked their opinion regarding the ability of federal agencies to improve communication with beach managers and with the swimming public as well as where communication needs attention and increased linkages. Seventy-six percent of respondents believe that federal agencies can improve communication with beach managers and the swimming public.

Table 21. Quality of communication

	Very good	Good	Neutral	Poor	Very poor	Responses
Federal Agencies and Beach Managers	3.4%	24.1%	44.8%	19.0%	8.6%	58
Federal Agencies and Swimming Public	0.0%	10.3%	50.0%	27.6%	12.1%	58
Beach Managers and Swimming Public	17.2%	48.3%	22.4%	12.1%	0.0%	58

Five communication tools to assist in communication improvement are evaluated below.

Question 50: How can federal agencies improve communication with beach managers?
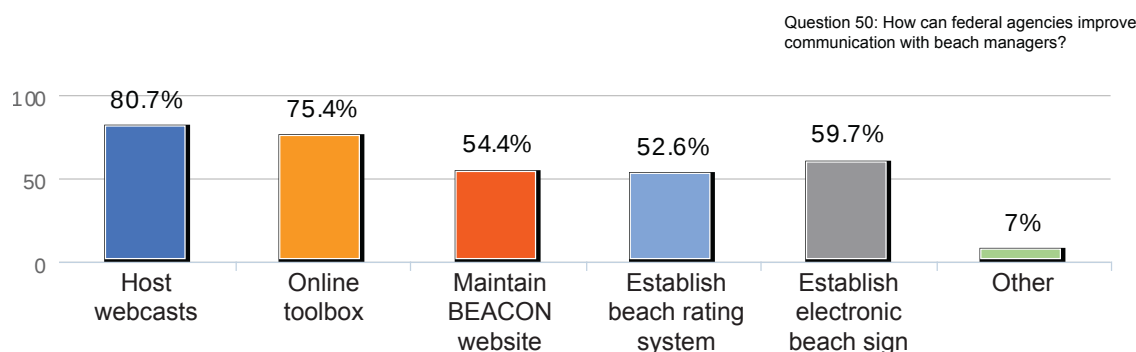
Figure 19. How can federal agencies improve communication with beach managers?

See Appendix F for a breakdown of "other" responses to question 50.

We also asked for recommendations on how notification and communication between beach managers and the public could be improved.

Question 51: How can notification links between beach managers and the public be improved?
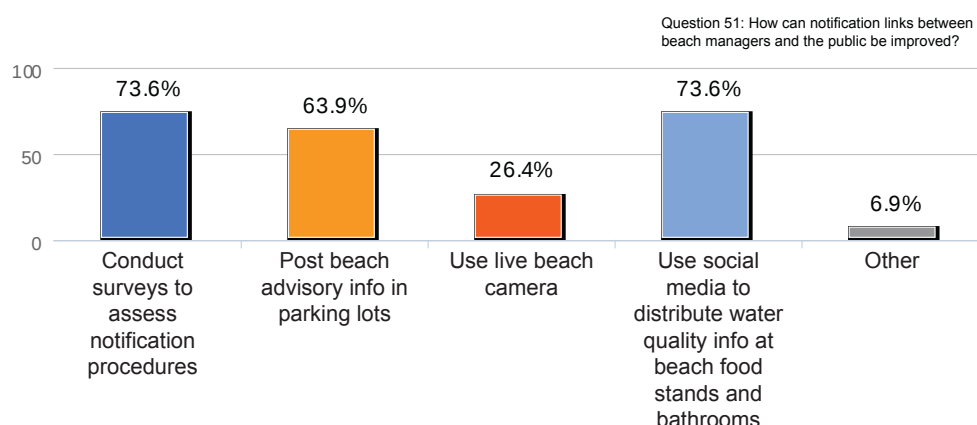
Figure 20. How can communication be improved?

See Appendix G for a breakdown of "other" responses to question 51.

4. DISCUSSION

4.1 Background of the survey respondents

The response to the survey resulted in 76 qualified Great Lakes beach management professionals completing the survey out of 90 respondents on the roster for an overall response rate of 84%. Acceptable response rates vary by how the survey is administered. For e-mail surveys, response rates of 40% are considered average, 50% response rates are considered good, and 60% response rates are considered very good. Each individual state response rates were above 70%.
(https://www.utexas.edu/academic/ctl/assessment/iar/teaching/gather/method/survey-Response.php).

Ninety percent of the respondents have worked on beach management for 14 or fewer years and were roughly evenly distributed over these years. Half of the respondents have worked eight or fewer years.

Almost 80% of the respondents worked in health units directly involved with beach management issues. The majority of the health units were small organizations with 30 or fewer staff. One third of all respondents had worked in organizations with less than 10 staff.

Half of the respondent organizations were responsible for five or fewer Great Lakes beaches. Almost 40% of the organizations were responsible for more than 10 beaches.

The majority of the beach management organizations responding were adjacent to Lake Michigan. Michigan and Wisconsin have the most beaches in the Great Lakes and had the largest number of municipal and county health departments represented on the roster.

Over 80% of the respondents' roles were involved in the day to day sampling, public notification, and data analysis activities of the personnel responding to the beach information needs survey. Because of the limited staff, management activities (>60%) are also a significant portion of the respondents' activities. Lab analysis and remediation planning and implementation comprise less than 50% of the activities, in part due to health departments contracting out this work, although with tightening budgets some health departments were projecting doing laboratory work with health department staff. Because of the many tasks required of the County Health Departments, two thirds of the respondents spend less than two hours a day on beach management activities. Over two thirds of the respondents indicated their organization spends less than 10 percent of total staff time on beach management tasks. Interns played a sizeable role in completing health department beach management tasks for almost half of the 74 respondents.

It is important to note that not all respondents answered every single question. Therefore we can only assess results and report on findings for individual questions. In addition, the results of this survey can help guide what the needs and priorities of the beach management and decision-making community are, but does not capture all needs.

4.2 Assess future beach monitoring

These survey results suggest that a severe reduction in water quality testing may result if federal monitoring support is withdrawn from the BEACH Act. Thirty percent or more of the organizations project reduction of water-quality testing by more than 50%.

Seventeen organizations (~20%) indicated they would not continue water quality testing if BEACH Act funds were not available. One third of the remaining respondents indicated their organizations would continue monitoring. Three organizations indicated they would maintain the current level of water-quality testing. Two beaches were located in New York where rules and regulations require a public recreational swimming beach monitoring program to be in accordance with the frequency, locations, and procedures specified by the permit-issuing official (New York State Sanitary Code 2011). Thirty-three respondents (45%) were uncertain whether they would receive monitoring support should the BEACH Act funding not be available. Thirty-two had plans to seek funding from other local or federal sources.

When ranking how the reduction in water quality testing would occur, "reducing the frequency of monitoring" was selected as "most likely." The option identified as "least likely" was "instituting blanket swim-at-your-own-risk, except for safety (lightning, waves, sewage spill)." Other options of monitoring reductions were closely ranked, suggesting likely management responses to reduced funding could

include fewer beaches monitored, using predictive models in place of water quality testing, and screening when to sample based on predictive models.

Storage of beach monitoring data will be a problem if the federal BEACON data management system is not maintained. Approximately 90% of the respondents indicated data would be voluntarily submitted to USEPA. However, about half of the organizations cannot store the beach water-quality monitoring results. About 30 percent of the organizations indicated that they have a data management system capable of storing current year monitoring results and historical monitoring data.

4.3 Determine current beach manager research needs

Of the research subject areas deemed important to respondents, "human health impacts of beach pathogens" was ranked first. This is important to note because of new criteria for determining beach water quality safety and the proposed change from using *E. coli* to *Enterococci* as the indicator bacteria to monitor for in the Great Lakes. Part of the reason to change the indicator bacteria to Enterococci is because of the idea that *Enterococci* may be a better indicator of pathogens and human health impacts at the beach. Sixty of the 75 respondents said this research subject area was extremely or very important to their organizations. Public perception/effectiveness of water quality notification procedures, economic impacts, and real-time water quality predictions and forecasts were ranked second, third, and fourth, respectively.

In addition to research needs, communication and information needs were explored. The utility of five information services for performing beach-related work was evaluated by two similar approaches. One approach asked respondents to indicate how useful information services are, and the other approach asked respondents to rank (prioritize) them in terms of their usefulness. The first approach selected web accessible data service and science-based guidance as the most useful. A web accessible data service was selected as extremely or very useful by 57 respondents. Science-based guidance on beach management issues was selected as extremely or very useful by 54 respondents. The ranking approach yielded similar results for these two information services, also ranking them first and second.

Results on the respondents' satisfaction with the information services provided by the federal agencies involved in beach-related research show overall federal agencies are perceived as doing well in supporting beach-related research needs. No respondent was very dissatisfied with any of the four federal agencies. A majority of the respondents generally were very satisfied or satisfied for all the agencies except the CDC. Lack of knowledge about CDC services in the Great Lakes was greater than 55% and higher than the other agencies, and this is mainly because in the Great Lakes, CDC is not heavily involved in beach water quality. However, a significant minority (25% - 39%) of the respondents were unsure or neutral about information services available to them from the other federal agencies. This provides an area of growth for the federal agencies to identify information services available to the swimming community and beach managers. The use of webcasts was reported as a highly effective mechanism for federal improve communication with the beach management community.

4.4 Assess beach manager adoption of new methods

At the time of the survey, adoption of quantitative Polymerase Chain Reaction (qPCR) was limited. Less than 20% of the 75 respondents were using this rapid analytical test technique. When adopted, qPCR was used for multiple purposes by 13 organizations. qPCR is being used in predictive models and as a part of a suite of tools to provide guidance for beach management. Of the 15 organizations reporting using

qPCR, over 70% of them first started using qPCR in 2012. qPCR use in several organizations is still in the development stage. Lack of funding for analytical cost is cited as the biggest barrier for adopting qPCR whether for in-house use or for contracting for outside laboratory support.

Significant GLRI funding for decision support systems was provided in 2010.

Table 22. Beach Forecasting Models Nearshore Health and Nonpoint Source Pollution

Proposal #	Proposal Name	Applicant	
EPAGLNPO-2010-NS-1-779-456	60 Hour Beach Forecasting Models	The Regents of the University of Michigan	$140,586
EPAGLNPO-2010-NS-1-1179-1076	Beach Forecasting Model & Supporting Weather Station Network	Erie County Department of Health	$91,440
EPAGLNPO-2010-NS-1-1030-757	Development of Swimcast Models at Four Chicago Beaches	Chicago Park District	$245,420
EPAGLNPO-2010-NS-1-914-900	Forecasting Beach and Nearshore Health Effects Using QMRA	Michigan State University	$65,000
EPAGLNPO-2010-NS-1-813-574	Michigan Beaches-Developing and Integrating Models	Michigan Department of Environmental Quality	$282,707
EPAGLNPO-2010-NS-1-289-217	Nowcast Modeling across Wisconsin	Wisconsin Department of Natural Resources	$249,998
EPAGLNPO-2010-NS-1-1349-687	Presque Isle Beaches-Bacterial Forecasting Model	Regional Science Consortium at the Tom Ridge Environmental Center at Presque Isle	$124,346
EPAGLNPO-2010-NS-1-1367-1037	Process Based Predictive Models for Complex Urban Beaches	Northeast Ohio Regional Sewer District	$248,060

The number of organizations adopting Multiple Linear Regression (MLR) predictive models began to rapidly increase starting in 2011. Twenty of the 28 organizations using this decision support tool started after 2010.

The rapid change in use demonstrates the health departments' acceptance of MLR predictive models in beach management. MLR predictive model use is directly tied to better management decisions (Francy et al. 2013). The leading reason cited by respondents for use of predictive models was to inform beach managers when to allow or not allow swimming. This decision support tool was used both on days when sampling occurred and on days when samples were not collected. Another reason cited was to evaluate when to sample after an exceedance was observed.

The two most significant barriers cited for using predictive models were lack of funding for developing models with contractor support and lack of staff or time to develop a model. There was no perceived barrier due to the lack of technical capacity such as computers or access to the web, however training on using predictive models was reported as an important need by survey respondents.

4.5 Assess beach manager use of tools and training needs

The tools surveyed include EPA's Standardized Beach Sanitary Survey, online web based systems containing data relevant to managing beaches, Virtual Beach, and other beach management tools.

Remarkably, the Standardized Beach Sanitary Survey is widely employed by the beach management community with only 10% of the respondents indicating it was not used. Over 70% of the respondents indicated they knew USEPA's beach sanitary survey was used to guide data collection and recording.

There were 66 responses about use of websites. Sixty-one respondents use the local state's beach website, which is primarily BeachGuard, a database used by four Great Lake states. The second website cited as most frequently used was the Great Lakes Observing System, NOAA regional Integrated Ocean Observing System site for the Great Lakes.

Virtual Beach is used in over two thirds of the MLR predictive models developed in the Great Lakes. Virtual Beach is personally used by 25% of the respondents who indicated that it is primarily used to develop predictive models to manage their beaches. The top three considerations cited by respondents for using Virtual Beach were availability of technical assistance, ease-of use to operate a model in making the daily prediction, and free software cost. Respondents using Virtual Beach indicated they found out about the software from essentially three sources: conference workshop presentations, a colleague, or from a state or federal outreach specialist. The survey revealed that knowledge about Virtual Beach and what it can do was available to nearly half of the respondents. About 20 percent of the respondents had not previously heard about Virtual Beach. However, interest in using Virtual Beach was strong even among those who had not previously heard about the modeling software. Less than 5% of the respondents were not interested in using Virtual Beach. Over 70% of the respondents showed moderate to extreme interest in using Virtual Beach.

The most important beach management tool identified by respondents was one to improve predictive modeling. A tool to improve public notification (e.g., smart-phones, electronic signage) was cited as the second most important tool, with over 40% of the respondents indicating that it would be extremely helpful.

Training needs were assessed for seven areas and gave insight for training amongst these areas: rapid testing, methodology for discovery of microbial risks, decision support systems, and management of beach water quality data.

Respondents indicate training would be most helpful in source identification, operation of a Virtual Beach model, and development of a Virtual Beach predictive model.

It appears that resources are available to train municipal and county health department personnel. More than half of the respondents said their organizations had three or more days for training each year. About 30% of the organizations can provide $500 to more than $1000 for training. This level of funding would support attending a two to three day regional workshop. Another 32% of the organizations can provide $100-$500 for training. This level of funding could support training provided by webinar or at a local training site.

4.6 How communication links between beach managers and federal agencies and beach managers and swimmers can be improved.

More than three quarters of the respondents indicated the federal agencies could improve communication with them and the swimming public. The weakest communication link, according to respondents, was between the federal agencies and the swimming public. Survey responses indicated that the federal agencies have good or better communication with slightly greater than 25% of the beach managers, and poor or worse communication with a similar percentage of beach managers.

Seventy five to 80% of the respondents indicated that webinars to demonstrate innovative beach water quality communication methods, and creation of an online tool box of innovative communication products would be ways to improve federal agency communication links with beach managers. Over half of the respondents would like EPA to continue to maintain the BEACON website and to encourage states to submit the beach monitoring and notification data. Close to 60% of the respondents would like an electronic sign system available at beaches to alert swimmers to beach water quality and hazardous conditions.

Almost three quarters of respondents thought notification links among beach managers and the public could be improved by assessing the effectiveness of beach water quality notification procedures. Improvement in communication of beach water quality information could rely on social media links that are broadcast at the beach at or near vendor locations.

5. RECOMMENDED NEXT STEPS

The Beach Health Interagency Coordination Team (BHICT) is forming a coordinating subcommittee that includes representatives of the four federal agencies, state, local agencies, and public health officials to develop a website to address the Beach Manager information needs and to provide the information outlined below. This website would be an online tool box of innovative communication products, methods, and tools, and will include online training videos, beach mitigation success stories, and FAQs from BeachNet. Links for this web site would include:

- Training tools on rapid testing techniques developed by Michigan State University through the MDEQ's Great Lakes Restoration Initiative (GLRI) grant including a "How To" manual for using the rapid method quantitative Polymerase Chain Reaction (qPCR) and a video demonstrating EPA's Method 1611 for enterococci qPCR at: http://cws.msu.edu/qPCR.htm.

- EPA's Beach Sanitary Survey Tool and manual, which helps beach managers identify sources of bacterial contamination at their beaches, so these sources can be corrected or cleaned up, resulting in more days that beaches are open.
http://water.epa.gov/type/oceb/beaches/sanitarysurvey_index.cfm.

- "A Guide to Conducting Beach Sanitary Surveys in Wisconsin" video developed by University of Wisconsin-Oshkosh: https://docs.google.com/a/uwosh.edu/file/d/0B67-zpv81XK2Y0tIblo2cllKNm8/edit?pli=1

- The "Healthier Beaches - Using Sanitary Surveys to Mitigate Pollution" video, which highlights several beaches in Wisconsin where sanitary surveys were conducted to identify pollution sources affecting beach water quality. Mitigation measures are being implemented at these beaches to significantly reduce or eliminate the contamination.   https://www.youtube.com/watch?v=GoCEsXTgKxI

- "Beach Models: Predicting Water Quality" video developed by the Illinois Department of Public Health, which describes three predictive models used in the Great Lakes to estimate when bacteria levels exceed the state's water quality standards: https://www.youtube.com/watch?v=2qJco1NJF5A

- Link to CDC's website, which contains creative "healthy swimming" posters and brochures that can be downloaded by beach managers.

- USGS Beach Health Webinar - Feb. 2014: http://cida.usgs.gov/glri/videos/GLRI%20Webinar_Feb11.2014_edited.wmv

Proposed additional tools and activities to be conducted by the BHICT include:

- Provide a training workshop on how to develop Nowcast models using Virtual Beach with a mechanism of capturing the workshop for beach managers to use electronically for training at a later time.

- Host webcasts to demonstrate innovative beach water quality communication methods and tools.

- Highlight GLRI beach mitigation project success stories online or through webcasts.

- Update CDC's water contact page to include publications and resources related to beaches and more information about health risks associated with pathogens at beaches from humans and non-human sources.

6. REFERENCES

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NOAA's List of Coastal Counties for the Bureau of the Census Statistical Abstract Series http://www.census.gov/geo/landview/lv6help/coastal_cty.pdf

A. Organization Roster

Allegan Co. HD(MI)
Ashland Co. (WI)
Avon Lake Municipal Utilities (OH)
Avon Lake Recreation and Parks (OH)
Bay County Health Dept. (MI)
Bayfield County Health Dept. (WI)
Berrien County Health Dept. (MI)
Beverly Shores Town (IN)
Brown County (WI)
Cardinal Envtl, Inc. (WI)
Central MI Dist. Health Dept.
Chautauqua County (NY)
Chicago Park District (IL)
Chippewa County Health Dept. (MI)
City of Marquette WWTP (MI)
City of Whiting Parks Dept (IN)
Commonwealth of PA - State Park
Cuyahoga County Health Dept. (OH)
Delta & Menominee Co's Public Health (MI)
District Health Dept. #10 (MI)
District Health Dept. #2 (MI)
District Health Dept. #4 (MI)
Door Co. (WI)
Douglas Co. (WI)
East Chicago City (IN)
Erie County (NY) Health Dept.
Erie County (OH) Health Dept.
Erie County (PA)
Evanston (Muni) Health Dept (IL).
Gary Parks Dept (IN)
Gary Sanitary District (IN)
Glencoe (Muni) Park District (IL)
Grand Portage Tribe (MN)
Grand Traverse County Health Dept. (MI)
Hammond Pt. Auth. (IN)
Huron County Health Dept. (MI)
IN Dunes St. Pk.
Iron Co.(WI)
Kenosha County Health Dept. (WI)
Kewaunee Co. (WI)
Lake County (IL) Health Dept.
Lake County (OH) Health Dept.

LaPorte Co. – HD (IN)
Luce-Mackinac-Alger-Schoolcraft Dist. Health Dept. (MI)
Macomb County Health Dept. (MI)
Manitowoc Co. (WI)
Michigan City - Parks Dept (IN)
Microbac Laboratories Inc.
Milwaukee City (WI)
Monroe County (MI) Health Dept.
Monroe County (NY)
Muskegon County, Public Health (MI)
Niagara County (NY)
Northeast Ohio Regional Sewer District (OH)
Northland Coll.(WI)
Northwest Michigan Health Dept. (MI)
Oak Creek City (WI)
Ogden Dunes Twn. (IN)
Oswego County (NY)
Ottawa County (MI) Health Dept.
Ottawa County (OH) Health Dept.
Ozaukee County Public Health (WI)
Racine (City) Health Dept. (WI)
RHD
Sanilac County Health Dept. (MI)
Sheboygan County (WI)
Shorewood Village (WI)
South Milwaukee City (WI)
St. Clair County Health Dept. (MI)
State of MN
State of NY
The Watershed Center Grand Traverse Bay (MI)
U Toledo (OH)
University of Illinois Chicago (IL)
USGS (WI)
UWM (WI)
UWO (WI)
Village of Kenilworth (IL)
Wayne County Health Dept. (MI)
Western Upper Peninsula Health Dept. (MI)
Whiting City - Parks Dept. (IN)
Wilmette (Muni) Park District (IL)

Appendix B. Beach Manager Plans for Replacing Beach Act Funding

Q18 Please describe any other plans you have for dealing with reduced funding. County or Counties (State).

18.01 We do not receive funding. We are doing this as a public service from our water and wastewater utility for the betterment of the community and also for park and recreation department.

18.02 Looking for alternative sources of funding, such as state coastal programs or state sources.

18.03 May invoice municipalities for monitoring.

18.04 We will be asking the municipalities to bring samples to our lab for analysis if they wish to continue having their beaches monitored. We will also be looking for grants to help offset the laboratory costs.

18.05 If Federal funding is gone entirely, we plan to ask local municipalities (city, township, county, tribal) for funding to continue monitoring. If that does not provide enough funds, we will discontinue our beach monitoring program.

18.06 Applied for and received Coastal Mgmnt grant for 2013-14 to partially find beach monitoring.

18.07 If Federal funding does not materialize, we will look to local governmental entities for possible funding. If that does not happen, we will likely suspend our monitoring efforts.

18.08 Attempt to obtain funding from parks systems and/or local non-profits.

18.09 Asking for funding from municipalities for the 34 beaches that we test.

18.10 We are hoping to use our predictive modeling to conduct nowcasting and collect water quality samples 2-3 times a week to test the model.

18.11 Respond to water quality complaints only.

18.12 Unsure.

18.13 We have been mandated by health dept. to conduct the level of monitoring and maintenance of the logic based predictive model we employ, and see no change in that mandate. We will do a side by side comparison of our traditional model and the Virtual Beach model developed by USGS, and we may be able to switch, but I think health dept. will still want to see the same level of sampling.

18.14 Will cut back on sampling and monitoring and rely more on the predictive model to inform beach visitors of current conditions.

18.15 2015 beach program budget being prepared for consideration by the Commissioner of Health. If endorsed it is sent to the County Executives' Office for consideration. The beach program has been fully funded through State and Federal grants since 2003. Chance of County funding is unknown.

18.16 Look for funding elsewhere. Reduce frequency of monitoring.

18.17 We are currently working with County to monitor and test our beaches.

18.18 Without the funding, it is very likely our department will not monitor the beaches. It will be extremely detrimental to our area. Local and seasonal residents depend on the monitoring results and look for the advisories and closures to determine whether or not it's safe to swim. In addition, the data collected assists in soliciting point source pollution that may occur within a certain area.

18.19 Contracting with townships to cover the costs of monitoring.

18.20 This would be a local decision, I would prevent the cost and benefits of continuing beach monitoring. I do believe the public would pressure to continuing to do some monitoring.

18.21 Inform public so there is no assumption that water quality monitoring is being done. Provide information to guide swim at own risk decisions.

18.22 Will try to monitor maybe 1-2x per week ,which is down from 7 days per week with federal funding.

18.23 The main issue is that we have been reduced in staff from 40 to 20 in the last 5 years. Currently we have an intern assigned to water collection. Without funding this task would now need to be performed by a sanitarian and we are not at capacity to accept new responsibilities.

18.24 Find other funding for other projects.

18.25 Consult with the State.

18.26 Applying to supplement work with additional grants, partnering with other academic institutions.

18.27 Hopefully we will locate alternative funding sources to continue our work.

18.28 Use of prediction models, working with stakeholders, and NGO's for funding.

18.29 We are not sure if we will continue beach water testing if funding is reduced or eliminated.

18.30 Would use predictive models as a tool daily for potential "Precautionary Advisories", and return to State mandated testing protocols for regulatory cultured *E. coli* testing to once per week.

18.31 If the program is not taken over by contractor then it will not be done.

Appendix C. Emerging Research Issues

Q20. Please describe any other or emerging issues that you believe should
   be researched?

20.01 Determine pathogen survivability in a beach water environment.

20.02 Develop program to educate public regarding Best Management Practices for storm-water water quality improvement and the Best Management Practices for storm-water water quality improvement.

20.03 Determine Relationship between HAB's and *E. Coli.*

20.04 Impacts of land use/development on coastal water resources.

20.05 Relative risk at non-point source dominated beaches (vs point source beaches?)

20.06 More Epi studies and develop local rip current info.

20.07 Develop BMP for septic system operations.

20.08 Determine sanitary surveys impacts.

20.09 Develop beach construction assessments.

20.10 Combined storm water discharge.

20.11 Micro pollutants levels.

20.12 Nitrogen and Phosphorous loading near shore.

Appendix D. Beach Manager Requests for Federal Agency Supplied Beach-Relevant Data

Question 22. Are there particular beach-relevant data that you would like the federal agencies to provide more of?

22.01 Provide all beach-relevant data combined in one website that is easy to use and are easily uploaded into Virtual Beach.

22.02 Localized beach rip current info which can be updated as conditions change.

22.03 Automated storm water discharge levels on storm water drains and discharge amounts/dates on sewage treatment plants that discharge directly into the great lakes.

22.04 Genetic testing.

22.05 Science based data on beach management. Summary of studies on a topic.

22.06 More specific weather condition for each beach site.

22.07 More information on actual levels of illness occurring as a result of swimming in contaminated water.

22.08 More information on algae.

22.09 Accurate source of local weather, i.e. rainfall, wind, temp, etc. Our area has no reliable and nearby weather monitoring.

22.10 Watershed information.

22.11 Nearshore current and wave predictions closer to some of the Lake Erie beaches.

Appendix E. Beach Manager Requests for Additional Federal Agency Supplied Information Needs

Question 25. Ideas for Federal Agencies to better meet Beach Information Needs

25.01 Help develop predictive model.

25.02 CDC's water contact page is almost exclusively about pools, with links to old EPA stuff about natural water systems. I would like to see more publications and resources related to beaches and more information about risks to humans from non-human sources of *E. coli*.

25.03 Require all sewage treatment plants to notify the local health department when they have discharges that exceed their permitted amounts within 24 hrs.

25.04 We need guidance and information on the best and most up to date BMPs to reduce *E. coli* on beaches... we know we have problems, but how do we fix them? What are some ideas?

25.05 Newsletters.

25.06 Multi-agency, integrated basin-wide information collection and pooling to help predict water quality. Dose, transport and fate; modeling.

25.07 EPA developed a tool in VB. Apply standards consistently to public and private beaches. Need much better coordination of the four federal agencies to eliminate redundancy in effort and develop more consistent policy.

25.08 I would like to know what information is available.

25.09 From a public health perspective, rapid results and communication to the public are the #1 key priorities for beach management.

25.10 Provide more funding that would allow for source tracking analysis, remediation activities, and monitoring. (Combination of several suggestions for more funding)

25.11 Stop utilizing a tool and standards to issue public notices that do not correlate to actual risk from pathogens, i.e. 18 hr coliform testing.

25.12 Develop a real time test for *E. coli* -- results in less than 2 hrs.

Appendix F. Other Comments for Federal Agencies Communication with Beach Managers

Q50. How can Federal Agencies Improve Communication with Beach Managers. County or Counties

50.01 Having tools, resources such as research summaries or real time data access, archived webinars or trainings all in one website would be incredibly helpful.

50.02 Communicate on the local level.

50.03 Construct and promote a unified system to enter, maintain, upload, transmit data and display it to the public.

50.04 Establish and communicate the risk of swimming in water indicated to be risky by indicator bacteria measurements in the context of monitoring frequency effort.

50.05 Develop tools to help explain monitoring to the public.

Appendix G. Other Comments for Improved Notification Links Between Beach Managers and the Public

Q51. Requested recommendations on how notification links between the beach managers and the public could be improved. County or Counties (State)

51:01 Electronic signs at beach areas with messages regarding beach conditions throughout the swimming season.

51.02 Use of social media as a means of public notification.

51.03 Simple advisory signage at entrance drive into the beach.

51.04 Post beach advisory information at our parking lots.