Friday, October 15

8:10 a.m. – 9:50 a.m.

Session Twelve: Data Management and Communication

eBeaches

Charles Kovatch
U.S. Environmental Protection Agency

Biosketch

Mr. Charles Kovatch is in the Office of Science and Technology within the Office of Water at EPA headquarters in Washington, DC. He has been with the BEACH Program since joining EPA in 1999, working on the National Guidance document, the BEACH Act grant program, and the eBeaches data reporting system. He has also worked for 3 years in drinking water treatment with Pennsylvania Gas and Water. Mr. Kovatch received an M.S.P.H. in Environmental Health Science in 1998 from the University of South Carolina specializing in sediment toxicology and a B.S. in Biology in 1992 from Indiana University of Pennsylvania.

Abstract

In an effort to protect public health and improve beach monitoring and public notification, Congress passed the Beaches Assessment and Coastal Health (BEACH) Act in October 2000 to amend the Clean Water Act. The BEACH Act requires EPA to develop and maintain a public right-to-know pollution occurrence database to store and display state collected beach monitoring and notification data. To meet the BEACH Act requirements, EPA constructed eBeaches – EPA's beach data reporting system containing an electronic data pathway, databases, and Internet application. eBeaches database and website will better enable the public to view local beach monitoring and notification data and make educated decisions before going to the beach. This presentation will discuss eBeaches, the status of State data reporting system development, and future directions of EPA's data reporting system.

Acknowledgements

- Office of Water
  - Beach Program - R. Hoffmann, B.Leamond
  - Immediate Office - M. Plastino, L. Guerrigulen
  - STORET - K. Christian, B. King, L. Manning, C. McElhinney
- Office of Environmental Information
  - CDX - A. Battin, M. Hart, G. Mitchell
- Regional Coordinators
  - M. Liebman, H. Grebe, N. Grundahl, T.Crawford, J. Hansel, H. Winick, M. Schaub, S. Ritzky, T. Fleming, S. Roser, J. Hashimoto, R. Pedersen
- State Program Coordinators
  - S. Farr, R. Smith, E. Pasello, R. McCraw, L. Cooper, J. Dinneen, D. Murphy, J. Pingree, K. Carney, B. Bibler, B. Vincent, E. Cheney, J. Cruz, D. Lau, D. Mikami, J. Reilly, R. Osenbaugh, B. Champion, E. Stancioff, J. Backus, P. Whelan, B. Geeke, S. Briggs, H. Bauman, M. Rauner, C. McCullough, M. Morris, J. Connor, S. Sumner, D. Soule, V. Loftin, E. Franko, P. Mrozek, J.D. Potts, C. Miller, S. Binns, C. Gaines, J. Sherman, D. Wilson, R. Gonzalez, D. Burnett, L. Florom, E. Johnson, B. Traudt, L. Motta, M. Monti, M. Brooks, L. Schneider, J. Archer, T. Glymph

Overview

- Define eBeaches
- Benefits
- Milestones
- Future directions for eBeaches

What Is eBeaches?

- A new on-line system for electronically transmitting and displaying beach water quality and swimming advisory information
- Enables fast, easy and secure transmittal of information
- Improves public access to information about beach conditions and health risks associated with swimming in polluted water

Why eBeaches?

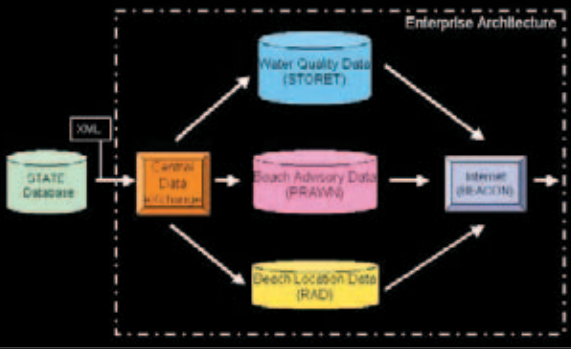
- BEACH Act
  - EPA must collect, store, maintain and display beach data
  - Grant reporting requirement & Report to Congress
- Clinger Cohen Act
  - Requires federal agencies to focus more on the results achieved
- Goals
  - Protect public health and reduce risk of illness
- Technology
  - Old Paper Survey to eGov; Enterprise Architecture
- Business process
  - Justification and budget

What Are the Benefits?

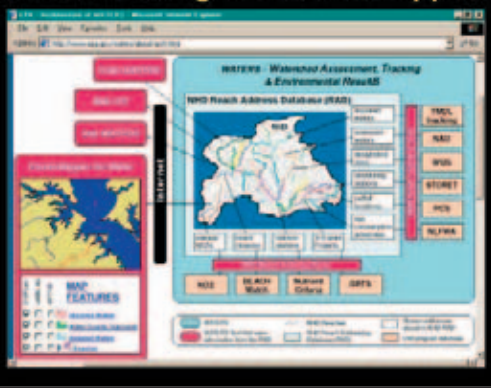
- Rapid and accurate data transmission
- Reduce reporting burden time and cost
- Provide electronic confirmation
- Improve security
- Display water quality and advisory data on maps
- Provide more time-relevant information to the public

Data Sharing Through eBeaches

Realizing eBeaches



WATERS Driving Watershed Approach



Common System Development Challenges

- Need to integrate technology and records
  - Paper records to electronic
- Records support immediate needs
  - Display for public; action to close
- Need for information security
- Need to share data
- Public scrutiny
  - High visibility, Advisories and closings, water quality data, beach location

Steps to Achieve eBeaches

- Communication and cooperation with states and agencies
- Shared vision
- Education
  - Users and management
- Time
- Funding
  - Staff and contractors
  - Hardware, software, equipment, licenses
  - Development and maintenance
  - Security

System Accomplishments - EPA

- Data standards and XML schema
- Water Quality data
  - STORET, WebSIM, WebRegistration
- Beach Advisory data
  - PRAWN, BEACON
- Beach Location data
- Enterprise Architecture
  - CDX, Exchange Network, Nodes

System Accomplishments - States

- Change business
- Hire and communicate with IT Staff
- Build database
- Identify beaches and locations
- Consolidate data
- Generate XML schema
- Submit data (*requirement)
- Construct Node

What Is a Node?

- Secure data Portal (doorway) which directs data into EPA data warehouse (super database)
  - Pushes and pulls data queries across Exchange Network
- States with constructed Nodes
  - CA, DE, MI, MS, NH, OH, OR, PA, SC, WA, WI
- States in the process
  - GA, IL, IN, LA, MA, MD, ME, MN, NC, NJ, NY, TX, VA
- Contact me if you would like to participate or need assistance
  - Kovatch.charles@epa.gov; 202-566-0399

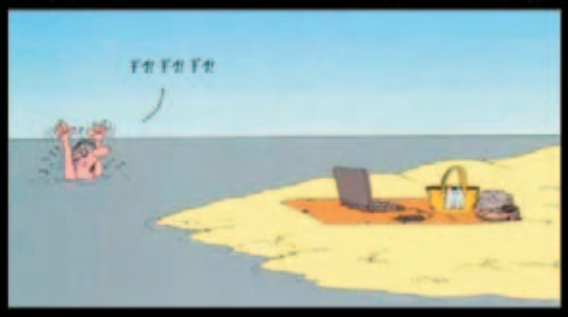
When Will We Know We Are There?

- Hardware and software installed
- States pass data to EPA
- Data is used as a tool by public and policy makers in making decisions
- Measured progress
- Data sharing among states over Network

Future for eBeaches

- Facilitate State data reporting for EPA and public
- 1-3 years – State and EPA systems fully operational
  - Databases, some nodes
- 3-5 years - nodes across states, data sharing
- Evolve with new technology
  - IT & water quality monitoring
- Communicate how IT helps meet goals
- Recognize the need for IT funding
- Change in business process with IT

Where Will We Be Without Your Help?



Questions and Answers

Q (Bob Peeples, Earth 911): Three major consulting companies are conspicuously absent. It may be a good idea, but if consultants want to continue to contract, it seems like a decent marketing effort for them to come and sort of hold our hands for a while. The segmentation in this project has cut curves between the elements where there is more finger pointing than helping going on, like sending us to the other consultant and we don't seem to be able to get these things resolved.

Charles Kovatch

EPA has a number of contractors that support the beach monitoring and notification data flows. These contractors participate on conference calls and contact states individually to identify and correct state data submission errors.

Q (Matt Liebman, US EPA Region I): A couple of the speakers mentioned that you'll have the capability to send the data to EPA in near real time. Is that the vision of the eBeaches system? Currently, the BEACH Act just says that it has to be reported to EPA, and right now we are only requiring that it be done annually. What is the vision of eBeaches?

Charles Kovatch

The BEACH Act says that the states have the primary responsibility for notifying the public on whether it is safe or not to swim. Therefore, the states should have the most recent or real time data on the conditions of their recreation waters. However, EPA recognizes that we are a central contact point for the public when they are going to the beach. We are trying to have the most time relevant or up-to-date data as possible, to help the public make a better decision on whether or not to go to the beach. One way that the Agency is moving toward real time information is through the Enterprise Architecture and Central Data eXchange. The Enterprise Architecture is the design that connects all EPA's program data. CDX is the portal or doorway for data to enter the Agency securely, seamlessly, and quickly. Once data is successfully submitted, the Enterprise Architecture allows the public and program managers to query data by a subject, like beaches or by a zip code to learn what is happening in your town right now on air and water quality. Beaches is just one piece of this system.

Comment (Blake Traudt, Texas General Land Office): I want to thank to Charles for hosting the web calls and putting up with all of us.

Managing, Storing and Sharing Beach Monitoring Data

Bill Geake
Windsor Solutions

Biosketch

Mr. Bill Geake is a systems analyst and software developer for Windsor Solutions in Oregon. Prior to joining Windsor Solutions in July of this year, Mr. Geake spent 4 years as a programmer and systems analyst for the State of Michigan Department of Environmental Quality. During his tenure at Michigan DEQ, Mr. Geake developed the Michigan Beach Monitoring Web Site, which now serves as a national model. The Michigan beach web site centralizes all beach sampling and notification activities for Michigan. Mr. Geake also prepared and submitted beach data to EPA under the BEACH Act grant program requirements. In addition to his work in the beach program area, he also is an active participant in National Environmental Information Exchange Network activities and workgroups.

Abstract

With all the responsibilities of managing a beach monitoring program, organizing data should be the least of your worries. But in the increasingly connected world, beach managers are being asked to provide their data in a variety of formats to numerous organizations, such as EPA, other units of government and non-profits. In this presentation, you will get "news you can use" on how to improve data management with a special focus on reporting beach data to EPA. You will walk away from this session with a better understanding of how your program can organize and share data more efficiently.

Managing, Storing and Sharing Beach Monitoring Data

Lessons from Michigan

- Bill Geake

Beach Monitoring Data Issues

- Communicating test results in a consistent format between data users
  - different data reporting formats
  - Different data distribution methods
  - Calculating daily, monthly geometric means
- Communicating beach notification and closure information to the public
  - Web, Newspaper, posting signs
- Consolidating monitoring data for
  - Trend analysis
  - Reports for public and EPA

Michigan Beach Monitoring Data Issues

- BEACH Act Grant recipient
  - Special reporting requirements to EPA
  - Higher volume of data than ever before
- Legislative mandate to post beach data online
  - In response to high profile beach closures
- Limited staff resources

Michigan's Solution

- Create a central, Web-based system
  - Data entry module for monitoring authorities
    - Limit users to only their beaches
    - Provide some simple tools for analysis
  - Public module for public access to information
    - Instant access to beach information
    - Link to/from DNR Parks web site
  - Decreased DEQ staff overhead
    - No more paper!

Would it work for me?

Maybe So...

- BEACH Act funds could possibly be used to subsidize the cost
  - Increase data quality and timeliness
  - Known issues for states with consolidating and preparing data submission to EPA
- Improved public image for a politically hot topic
- Reduced staff effort

Would it work for me?

Maybe Not...

- IT Infrastructure required
- Time and cost to develop
- Requires maintenance of user accounts and training of users
- Not feasible to develop EPA XML file submission routines since they are subject to change


DEQ Department of Environmental Quality
What Else Can I Do?
• Create standard reporting formats before the swimming season starts
– Use a widely available, structured reporting format (Excel)
– Provide a template
– Determine monitoring locations and sampling points as early as possible
– Promote data consistency


DEQ Department of Environmental Quality
What Else Can I Do?
• Act Preemptively
– Enlist IT help early in the process
• Design a simple database
• Strategize on how to aggregate beach data
• Get familiar with the EPA Web-based tools
• WebRIT
• CDX
• Buddy up to your state STORET DBA
Avoid a reporting nightmare at the end of the year!

Questions and Answers

Q (Carl Berg, Hanalei Watershed Hui): Your data organization had "less than" and "greater than" columns. It appeared that your numbers would be automatically calculated from those. How are values of "less than 10" automatically calculated? Are they used in your calculations as a 10?

Bill Geake

We do not automatically calculate in the database. In fact, we purposely left most of the business rules out of the system, because there is inconsistency in how closures are determined, and that type of thing. So, there is no automatic calculation.

Q (Lynn Schneider, Washington State Department of Ecology): My question is for the technical people. How have you gotten around the firewall issues with having people do the web?

Bill Geake

In Michigan, we didn't have an issue of the firewall. Of course for websites, which are pretty much transparent to firewalls, therefore it's not an issue. That is a nice thing about web technology. Bu it could be a firewall issue with the database itself. You need to have an infrastructure in your state that has a database server in same network segment as your web server. Most states have that kind of infrastructure. If you provide data to the public that comes out of a database, chances are you have that infrastructure set up.

Comment (Blake Traudt, Texas General Land Office): My comment concerns the firewall issue. What we are doing in Texas, is that it is going to be web accessible, but we're not going to post it on our public site where anybody can click on that and go through a pathwood. The people will have to know the exact address to get into it and see the data.

Leveraging Technology for Effective Beach Management

Eric Sacon
Rhode Island Department of Health

Biosketch

Mr. Eric Sacon is the GIS Data Manager for the State of Rhode Island Bathing Beaches Monitoring program. Mr. Sacon has over eight years experience managing, developing and participating in projects that deliver spatial solutions to natural resource concerns. Examples include land-use analysis, water/wastewater inventory management, regional transportation impact modeling, wetland assessments and environmental justice studies, among others. Mr. Sacon has an Associate of Science Degree in Landscape Management from the University of Massachusetts Amherst and a Bachelors of Science degree in GIS from the University of Massachusetts Boston. Mr. Sacon has continued his education as a graduate student, studying GIS, remote sensing, and programming since 2000.

Abstract

The Rhode Island Department of Health Beach Monitoring Program's application of Information Technology has significantly impacted the water quality monitoring processes and procedures for its 122 licensed bathing facilities. This presentation identifies how the influences of advanced technologies have forged powerful and practical tools, which in turn have shaped the effectiveness and roles of the bathing beaches program.

- Taking a GIS approach to meeting EPA's location data requirements
- Developing and using a web based daily operations system and decision support tool for the Bathing Beaches Program
- Automating EPA's required monitoring and notification data submissions
- Providing the public with real-time web access to beach info via the web
- Making informed decisions and conveying complex ideas by means of GIS
- How Beach Closures were effected by improved new technologies
- How these technologies have effected public perception and political response to beach closures


Leveraging Technology
For Effective
Beach Monitoring
Eric Soson
GIS Data Manager
RI Department of Health
PROTECTING OUR BEACHES
HEALTH.ri

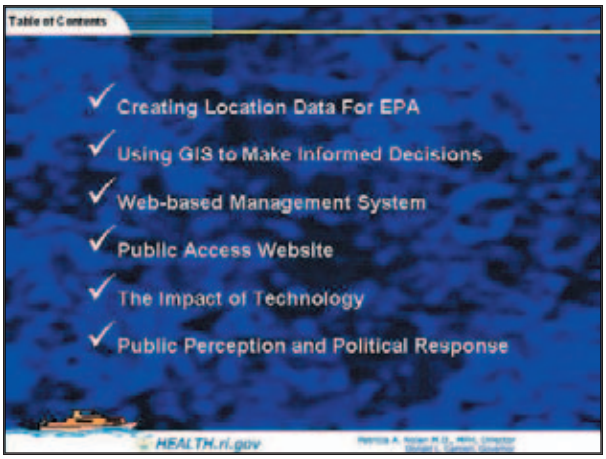


Table of Contents
Creating Location Data For EPA
Using GIS to Make Informed Decisions
Web-based Management System
Public Access Website
The Impact of Technology
Public Perception and Political Response
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Creating Required Location Data
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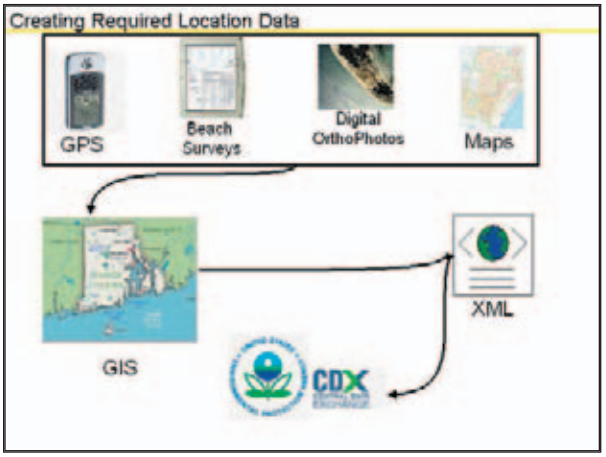
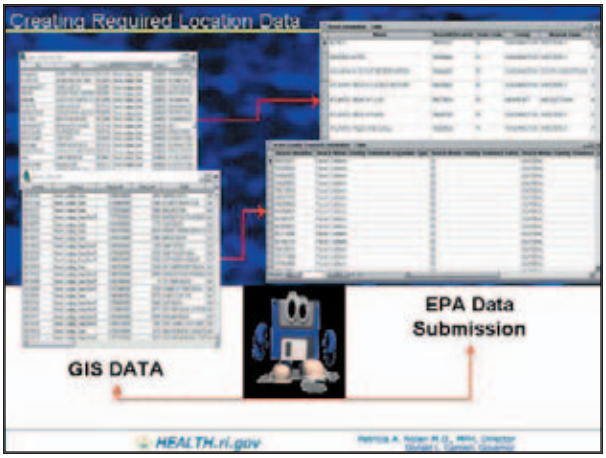

Creating Required Location Data
GPS
Beach Surveys
Digital OrthoPhotos
Maps
XML
GIS
CDX


Creating Required Location Data
Positioning
Sampling Stations
digitizing
Defining Beach
Geography
Mileage Data
Beach
Centroids
HEALTH.ri.gov


Creating Required Location Data
GIS DATA
EPA Data
Submission
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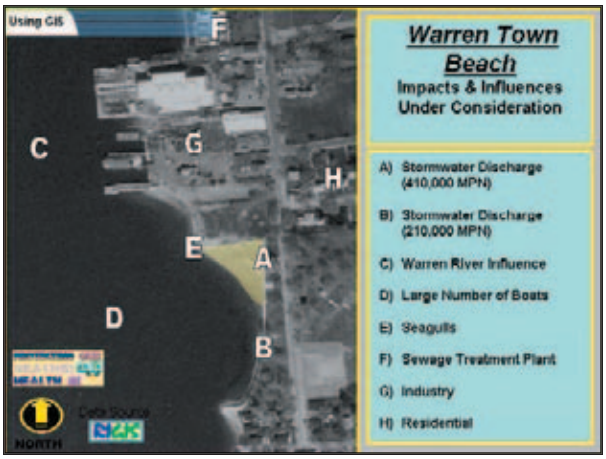
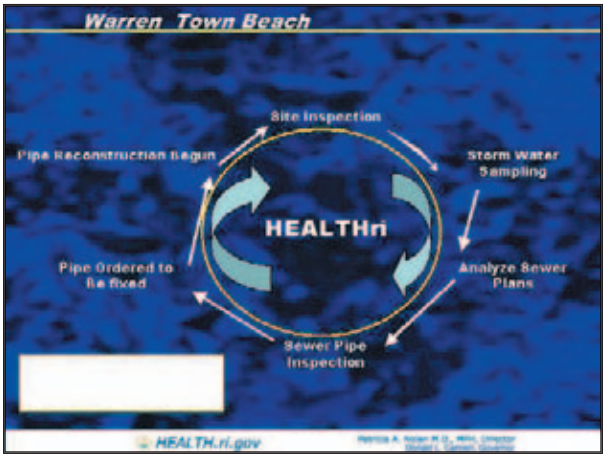
Using GIS
FIELD REFERENCE
PUBLIC MEETINGS
GIS ANALYSIS
HEALTH.ri.gov


Using GIS
F
C
G
H
E
A
D
B
Warren Town Beach
Impacts & Influences
Under Consideration
A) Stormwater Discharge (410,000 MPN)
B) Stormwater Discharge (210,000 MPN)
C) Warren River Influence
D) Large Number of Boats
E) Seagulls
F) Sewage Treatment Plant
G) Industry
H) Residential
NORTH


Warren Town Beach
Site Inspection
Pipe Reconstruction Begun
Storm Water Sampling
HEALTHri
Pipe Ordered to be fixed
Analyze Sewer Plans
Sewer Pipe Inspection
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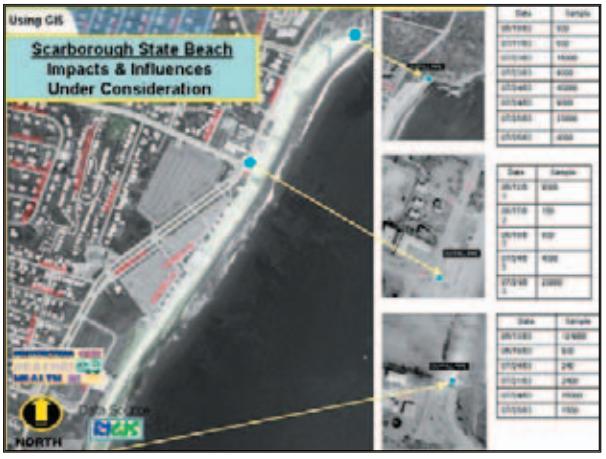
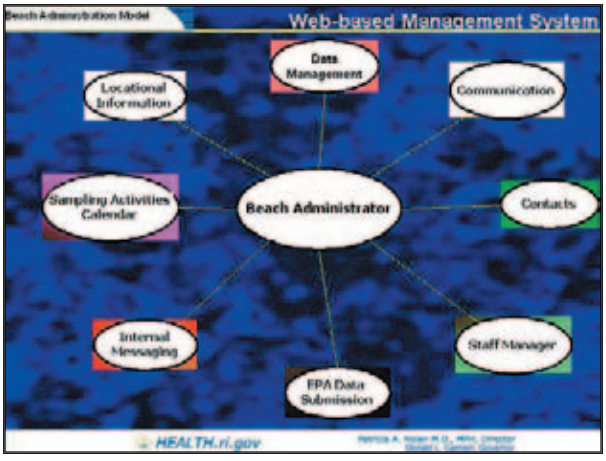
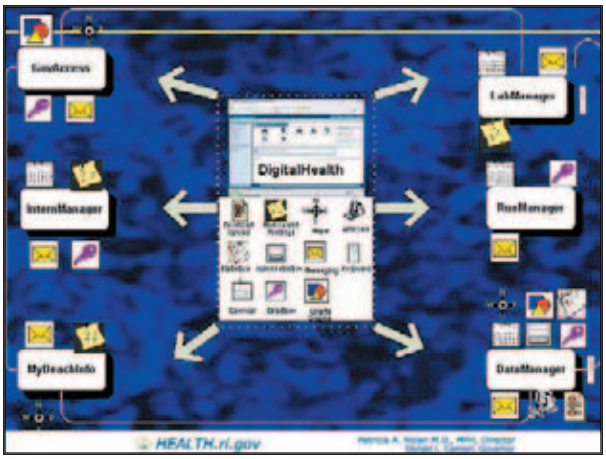

Using GIS
Scarborough State Beach
Impacts & Influences
Under Consideration
NORTH


Using GIS
A
D
B
C
Easton's Beach
Impacts & Influences
Under Consideration
A) Middletown Sewer Pump Station
B) Stream Runoff
C) Stormwater Runoff
D) Seagulls
NORTH


Web-based Management System
Data Management
Locational Information
Communication
Sampling Activities Calendar
Beach Administrator
Contacts
Internal Messaging
Staff Manager
EPA Data Submission
HEALTH.ri.gov


DigitalHealth
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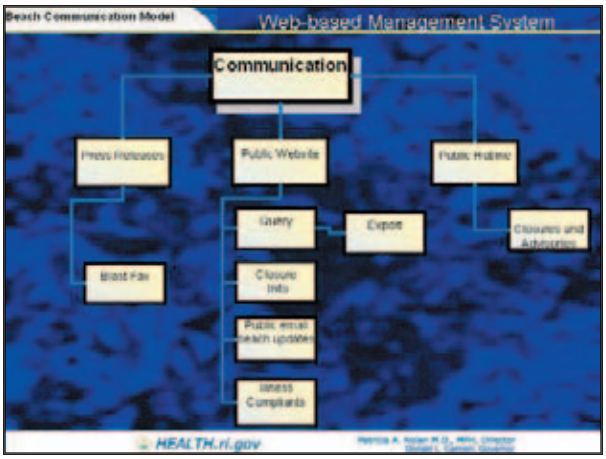
Beach Communication Model
Web-based Management System
Communication
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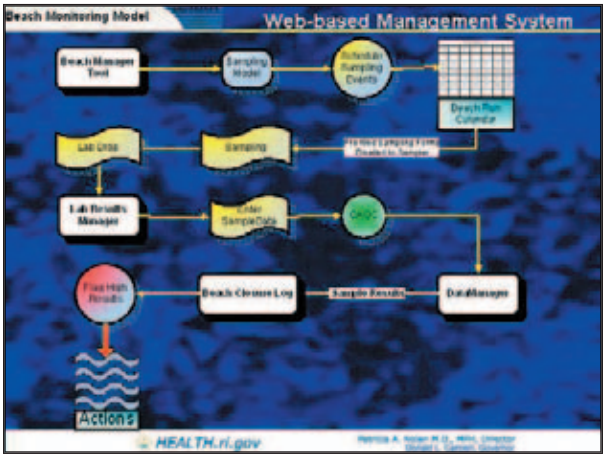
Beach Monitoring Model
Web-based Management System
Actions
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Analytical Tools
Web-based Monitoring Tool
Real time Analysis Tools
Under Development
Complex Query Tools
Charting Capabilities
Custom Reports with Rainfall and Sample Data
Sewage Discharge Manager
Single Sample Reports
Running Geomean Reports
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PROTECTING OUR BEACHES
Web Based Monitoring Tool
Beach Data Capture
Data Storage and Analysis
Planning and Logistic Support
EPA Reporting Support
Web Site
Public Access to data – Real-time
4000 Hits 2001 bathing season
Over 10,000 Hits in 2004
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The Impact of Technology
Rapid Response Time
General Efficiency Improved
Press and Public Has 24/7 Access to INFO
Custom Data Delivery
Searchable Data
Minimizes "Service Calls"
Enables HEALTH to Take Active Approach
With Water Quality Issues
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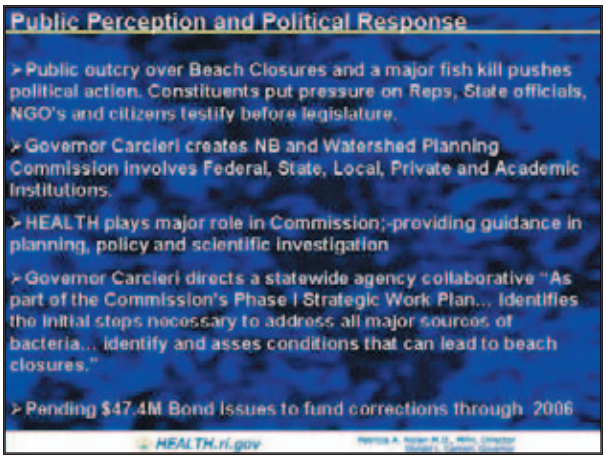
Public Perception and Political Response
➢Public outcry over Beach Closures and a major fish kill pushes political action. Constituents put pressure on Reps, State officials, NGO's and citizens testify before legislature.
➢Governor Carcieri creates NB and Watershed Planning Commission involves Federal, State, Local, Private and Academic Institutions.
➢HEALTH plays major role in Commission;-providing guidance in planning, policy and scientific investigation
➢Governor Carcieri directs a statewide agency collaborative "As part of the Commission's Phase I Strategic Work Plan... identifies the initial steps necessary to address all major sources of bacteria... identify and asses conditions that can lead to beach closures."
➢Pending $47.4M Bond Issues to fund corrections through 2006
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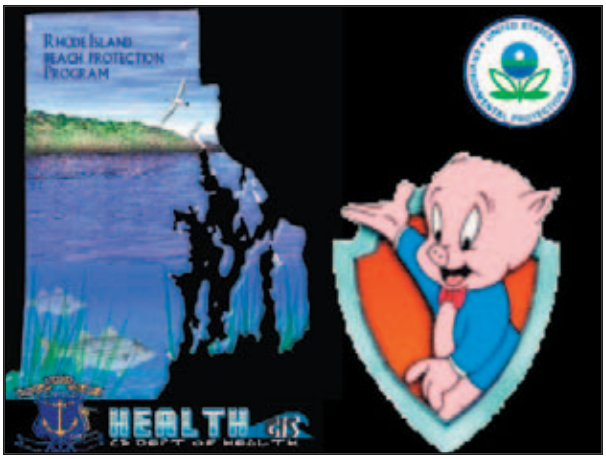
Rhode Island Beach Protection Program
HEALTH


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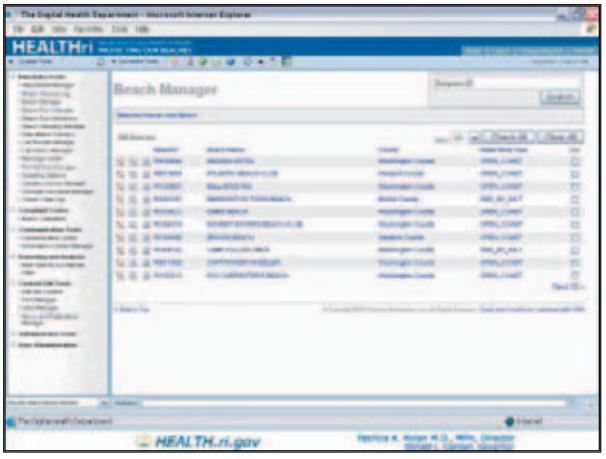
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Beach Manager
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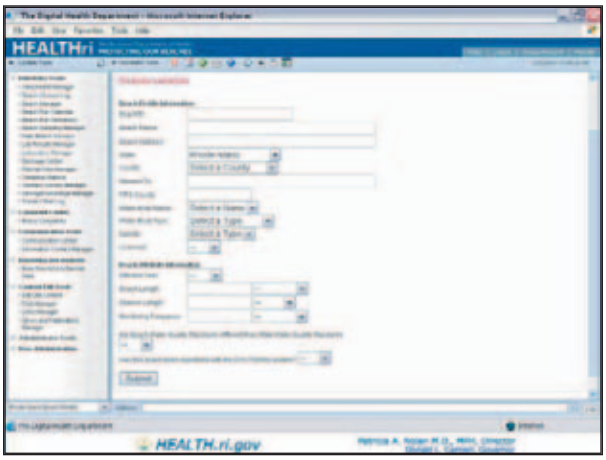
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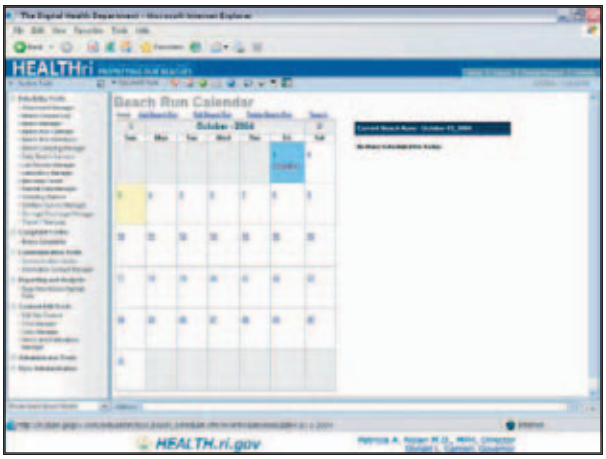
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Beach Run Calendar
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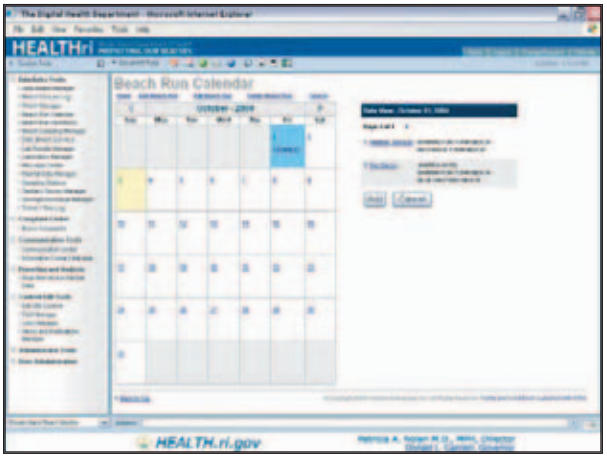
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Beach Run Calendar
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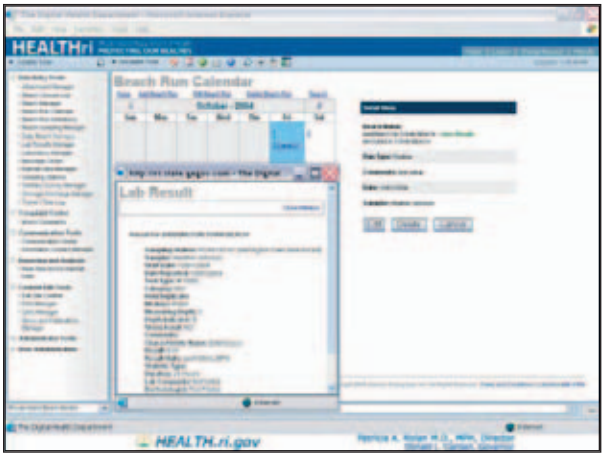
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Beach Run Calendar
Lab Result
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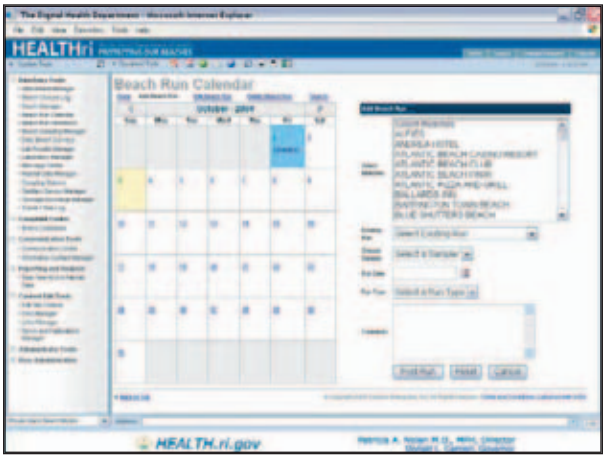
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Beach Run Calendar
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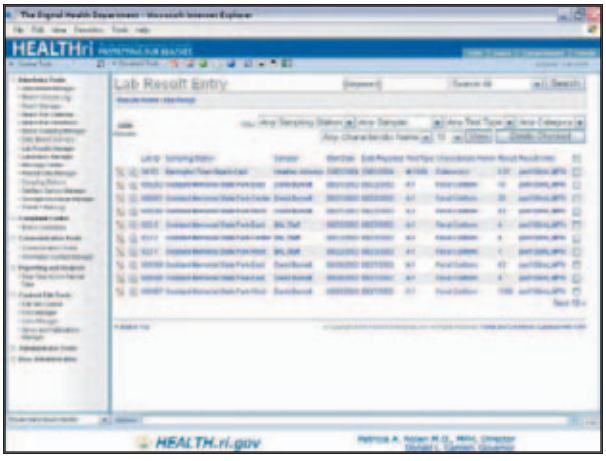
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Lab Result Entry
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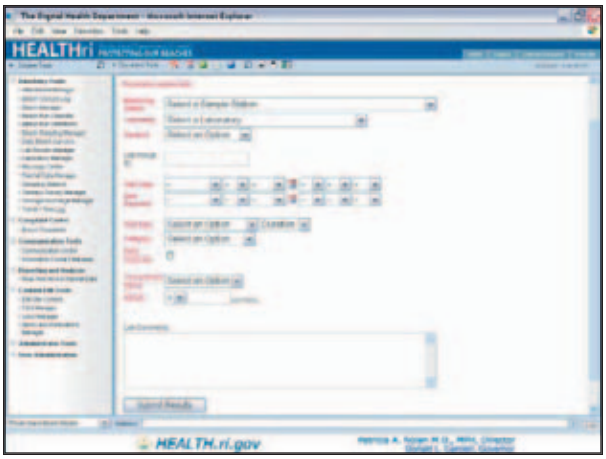
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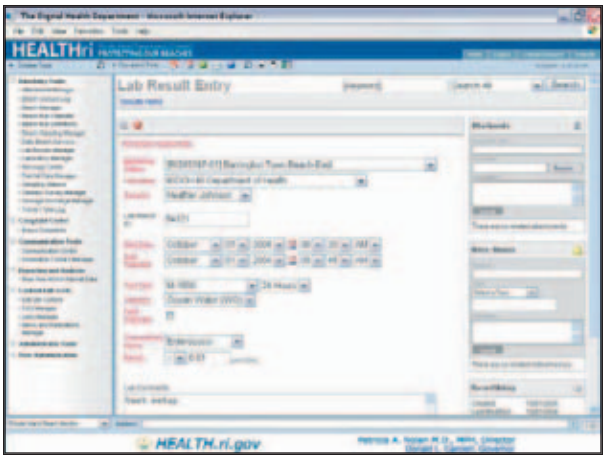
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Lab Result Entry
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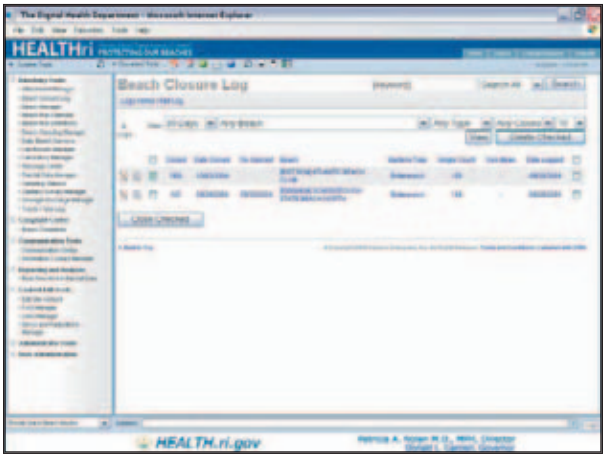
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Beach Closure Log
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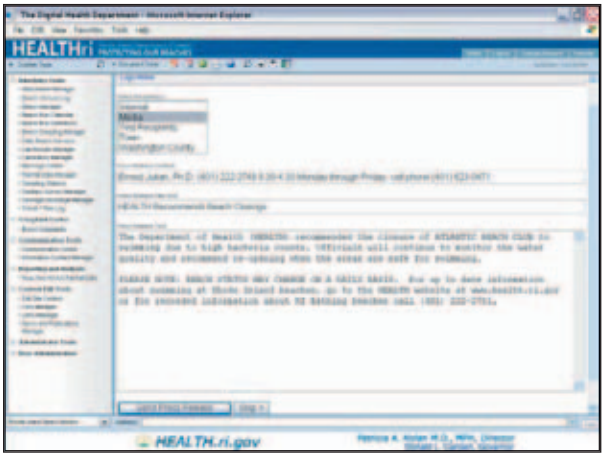
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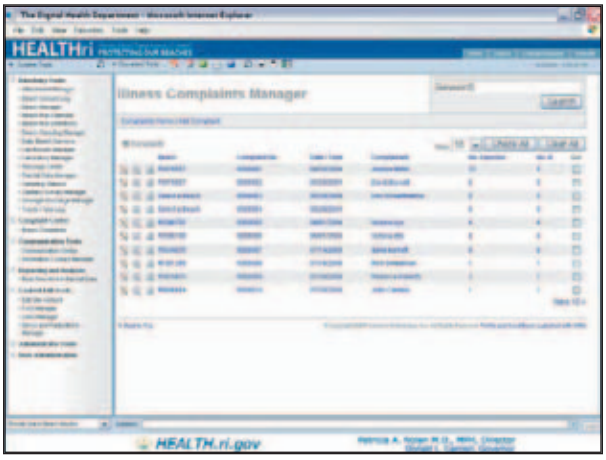
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Illness Complaints Manager
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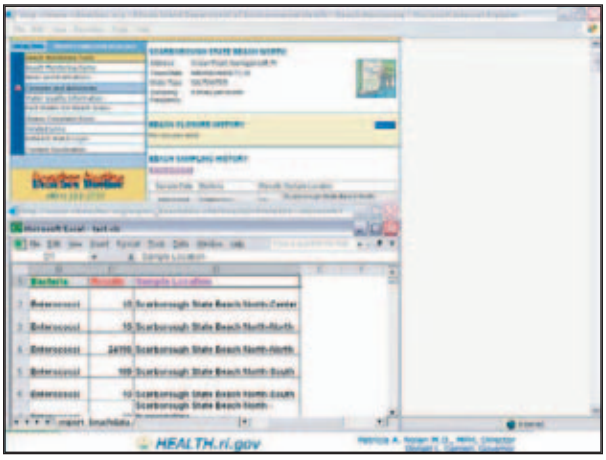
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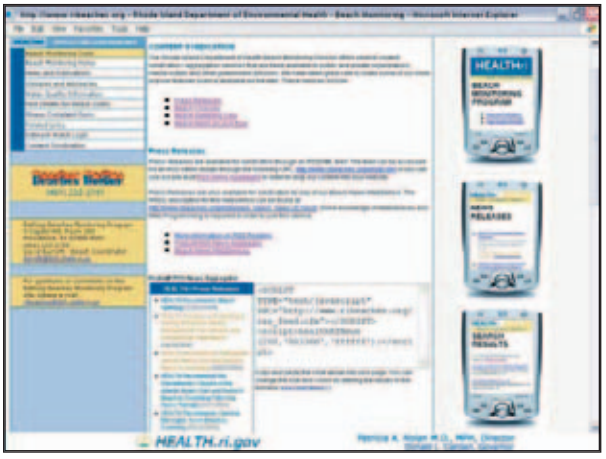
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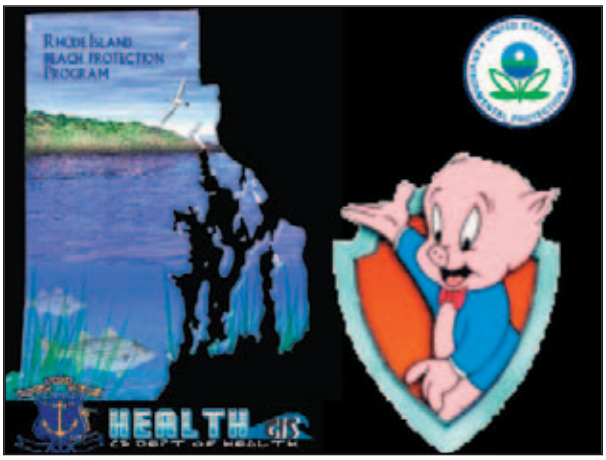

Rhode Island
Beach Protection
Program
HEALTH

Questions and Answers

No questions.

Experience of Delaware

Dennis Murphy
Delaware Department of Natural Resources & Environmental Control

Biosketch

Mr. Dennis Murphy is Application Development Manager for the Delaware Department of Natural Resources and Environmental Control (DNREC) in Dover, Delaware. Mr. Murphy received his B.S. in Geology from the University of Missouri-Columbia and his M.A. in Geology from the University of Texas-Austin. He worked for Exxon as a coal geologist for 12 years before joining DNREC as a Hydrogeologist. Five years ago he became Application Development Manager for DNREC. Since then his main emphasis has been on building an integrated environmental data system for the Department. He also serves on a number of joint state/EPA committees and workgroups focusing on data standards and development of the Environmental Exchange Network.

Abstract

The State of Delaware's Department of Natural Resources and Environmental Control (DNREC) monitors 25 beaches on at least a weekly basis during the swimming season. Advisory information from this monitoring is shared with the public through DNREC's website and with EPA via our Node on the Environmental Exchange Network. DNREC's beach monitoring start page includes an interactive map showing the location of all monitored beaches in the state and a table showing the latest monitoring results. From there the user can click on a beach to see current and past advisories and monitoring information. Beach web pages are automatically updated as data is entered into DNREC's Environmental Information System.

Delaware beach advisories are transmitted to EPA on a near real-time basis via DNREC's Node. DNREC has built a watcher computer program that runs every hour and checks if a new advisory has been entered. If a new advisory is found, the program generates a standard format XML file. This file is then sent using the standard protocol developed for the joint state/EPA Environmental Exchange Network. The file is transmitted from DNREC's Node on the Exchange Network to the CDX Node. The CDX Node is EPA's Central Data Exchange central receiving point for all environmental data. Once CDX receives the message, the XML file is extracted and passed along to the PRAWN database for automatic input.

Delaware Beach Data Dissemination

Getting The Word Out

Dennis Murphy
Delaware DNREC

Prepared For The San Diego National Beaches Conference 10/15/03

DE Beach Monitoring Program

Data Sharing

- Public - via DNREC Beach Web Pages
- EPA - Advisories via Web Services & XML Over the Exchange Network

Computing Environment

- SQL Server 2000 Data Stores
- Clustered DB Server on Intranet
- Transaction Replication To DB Server in DMZ
- ASP.Net For Data Entry & Display
- VB.Net Node For Web Services

DE Beach Data Input

- Advisories

DE Beach Data Input

- Monitoring

DE Beach Summary Page

DE Beach Detail Page

Advisories to EPA - Background

- National Environmental Information Exchange Network (Exchange Network)
- Result of Multiple Joint State/EPA Workgroups Over Past 4 Years
- Each Partner on the Exchange Network has a "Node" server connected to the Internet & to the Partner's Data Store(s)

Node Definition & Function

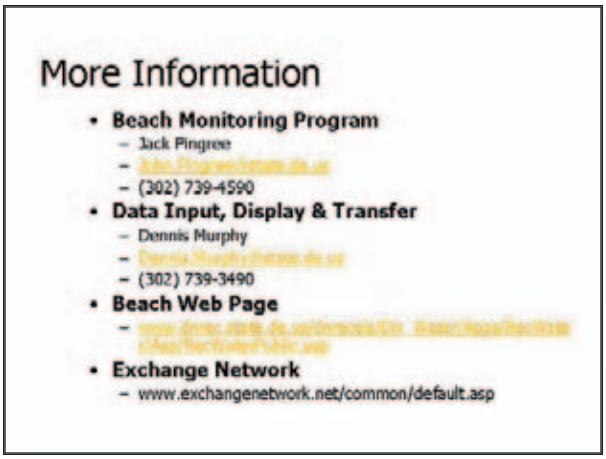
- Machine/Program that listens and transmits standard Exchange Network requests
- Requests are written in the Exchange Network 'flavor' of XML
- Data (beach advisories, monitoring, . . .) is transmitted in a 'flavor' of XML specific to the data flow

Advisories to EPA – Data Flow

1. User Enters Advisory via Web Form
2. Advisory Saved to Intranet SQL Server DB
3. Advisory Data Replicated to DMZ SQL Server DB
4. Watcher Program on DNREC's Node Polls DMZ DB for New Advisories
5. If Found, Advisory Transmitted via DNREC's Nodes to EPA's CDX Node
6. EPA's Node Forwards Advisory To PRAWN

Next Steps

- Automate Analytical Data Flow From Lab to Database
- Flow Analytical Data Through Exchange Network


More Information
Beach Monitoring Program
Jack Pingree
(302) 739-4590
Data Input, Display & Transfer
Dennis Murphy
(302) 739-3490
Beach Web Page
Exchange Network
www.exchangenetwork.net/common/default.asp

Questions and Answers

Q (Carl Berg, Hanalei Watershed Hui): You said that you are trying to move to having your lab analytical results put in but your field results can't always be put in automatically. We find that our temperature and salinity, when measured using a probe, can be automatically downloaded and put into the database very quickly, but as far as the lab results go, how do you get your enterococcus counts automatically put in the database, especially if anyone is using IDEXX? This is something I am trying to do, especially with my school programs. If there is anyone else in the audience who has an automatic IDEXX reader, I'd like to know about it.

Dennis Murphy

I am not familiar with the details of how the lab does its business, but I know that the lab puts its data into the Laboratory Information Management (LIM) system, and we pull from that LIM system. They have instruments set up for it to go quickly into the database. I don't know about enterococcus counts, specifically, though.

Q (Carl Berg): As someone else mentioned, we have a real problem with QA/QC. How do you know how much to trust your instruments putting that data outright, and where along the line should we check on that to make corrections? What if calibrations are possibly wrong?

Dennis Murphy

The results that are seen are reported. These are supposed to be blind samples, so the lab doesn't know where the samples are coming from or what they should be. That's why we don't make automatic advisories or closures based on those readings. Professional judgment is used.

Q (Shannon Briggs, Michigan Department of Environmental Quality): Let's say we have dataflow going into EPA. What happens when incorrect data goes into the database that we have to correct? If its automatically going into EPA database, how to do we get it back to correct it? Is that something you are working on?

Dennis Murphy

That is an issue, and I'll let Charles talk more about that. But, at this point in time, it's pretty much a one-way flow. That is certainly true if it is going into STORET, where you only have the ability to send data but you can't correct it. You can wait to post it until it's correct, but that defeats the purpose of our goal of near real time data.

Comment (Shannon Briggs): Our data is posted immediately. And, one of the things we noticed in another seminar is that the data entry error rate is round 5-8%. It was more than the rate for under- and over-reporting of closed beaches. So there is an innate error rate with data reporting. So that is one of my concerns. When we have a constant flow, and you catch it a little bit later, how do we deal with that?

Charles Kovatch

With beach advisory data, you can edit that data, especially being an authorized user, and you'll have secure access and you can go in and send an updated file that will update the record. With STORET, I thought there was a way you could update the data. You might be able to update with online registration. I'll have to check on that.

Dennis Murphy

We haven't had much of a problem with this, but we will be automating the flow from the lab. We are pulling data straight from our lab's database and printing it out. The lab has a pretty rigorous QA/QC program to check their data. That should eliminate some of those kinds of potential errors. But, the data quality is never going to be 100 percent.

Comment (Blake Traudt, Texas General Land Office): My comment is about the data error problem. We've discussed this internally. How do you catch a data error and account for it? For example, if the value is 20 and someone enters it as 200. There is no way you can account for that. We've been struggling with that, and are basically putting our trust in our contractors or the health departments to enter the data correctly. That is something to think about. Whether you correct it or not, how do you know if you need to correct it?

Q (Lynn Schneider, Washington State Department of Ecology): My question is for the technical people. How have you gotten around the firewall issues with having people do the web?

Dennis Murphy

For ours, we do replication out of DMZ, which is beyond our internal firewall. For those of you who know what a DMZ is, you have your intranet, then your firewall, a DMZ, and then you have another firewall to protect your system from the outside world. We replicate data one way from inside to outside, and then use that and go from there to the rest of the world. We were fortunate in Delaware because we were collecting our own data ourselves, so all of the data went in on the inside of our firewall. But for other people you have a more common situation where you have a number of different agencies, and they are not all inside a network system, so you are going to have to deal with some kind of password protection and encrypted system. Fortunately, I don't think it will be some sort of high profile target for people who are going to try to hack into a system.

Experience of Massachusetts

Tom Hinchliffe
Massachusetts Department of Public Health, Center for Environmental Health, Environmental Toxicology Program

Biosketch

Mr. Thomas Hinchliffe received a B.A. in Environmental Science and an M.A. in Energy and Environmental Analysis with a focus on Environmental Modeling from Boston University. His current position is a Senior Environmental Analyst for the Massachusetts Department of Public Health, Center for Environmental Health, Environmental Toxicology Program. His research interests include modeling health risks posed by environmental contamination and atmospheric modeling.

Abstract

The development of a data processing infrastructure created by the Massachusetts Department of Public Health for the purpose of implementing the reporting requirements of the Massachusetts Beaches Act and the federal BEACH Act required considerable effort. The Massachusetts Beaches Act, passed in 2000, requires an Annual Report be published on all beaches monitoring data as well as timely public notification of results during the beach season. The system facilitates collecting, entering, displaying, and analyzing water quality monitoring data from over 510 marine public and semi-public bathing beaches in 60 coastal communities as well as data management for over 600 freshwater bodies throughout the state. This system utilizes a variety of state and local agencies in a variety of formats, as well as methodologies for integrating and performing quality control on the data. Finally, the methodology and infrastructure used to report locational, monitoring and notification data to EPA in XML format via the EPA CDX website will be discussed.

Friday, October 15

10:20 a.m. – 11:40 a.m.

Session Thirteen: Communicating Beach Condition to the Public

Heal the Bay's Beach Report Card®: Communicating Complex Water Quality Issues and Improving Public Health

James Alamillo
Heal the Bay

Biosketch

Mr. James Alamillo received his bachelor's degree in Environmental Studies and Economics from the University of California at Santa Cruz, and is in the process of completing a master's degree in Urban Planning from the University of California at Los Angeles. Over the past ten-years, Mr. Alamillo has worked on a number of water quality issues related to urban runoff, having contributed to such efforts as the health effects study of swimmers in Santa Monica Bay, Heal the Bay's Beach Pollution Report Card, EPA's BEACHs Program, California's Clean Beach Initiative Program, and the State Water Resources Control Board's Beach Water Quality Work Group. Mr. Alamillo is currently charged with creating and establishing an inland outreach program for Heal the Bay that focuses on water related issues in highly urbanized and under-serviced watersheds.

Abstract

Historically, beach water quality was important to beachgoers and public officials only when there was a substantial sewage spill. Few people were concerned with the potential health effects associated with swimming in ocean waters polluted by contaminated runoff. Only recently has there been extensive research and study on beach water quality issues. It has been challenging for health agencies to effectively convey the plethora of new information about water quality issues associated with swimming at the beach, and therefore difficult to protect the health of the beachgoing public. Most research has focused on increased understanding of microbiology, risk assessment, mechanisms driving nearshore processes, and limitations of conventional bacterial sampling and measurement. For 15 years, Heal the Bay has provided the public with an easy-to-use tool for deciding where to get in the water, based on current bacteriological data and analysis. The Beach Report Card® (BRC) methodology provides the beachgoing public with easily understood water quality information so they can protect themselves when going to the beach. The BRC assigns a letter grade to each monitored beach based on the amount of exceedances of California's beach bathing water standards and the magnitude of each exceedance. The BRC provides health information for 450 beaches throughout California, and is widely available via the Internet, in coastal business establishments such as surf shops, and in local newspapers like the Los Angeles Times. We continue to update and revise the BRC methodology to improve the quality and usability of information produced, and are now conducting our fourth major revision of the program.

Heal the Bay's
BEACH REPORT CARD℠

Moving from this type of information provided to the public...

Date	Total Coliform	Fecal Coliform	Entero	Total:Fecal Ratio
05/01/04	5000	200	68	25
05/08/04	400	50	10	-
05/15/04	2000	400	150	5
05/22/04	10	10	10	-

To this...

For the date ending: 05/22/04	DRY GRADE	WET GRADE
SPONGE BEACH	B	NS

Heal the Bay's Beach Report Card

The first Beach Report Card (BRC) Heal the Bay published in 1990 covered 60-plus monitoring locations in Los Angeles County from Leo Carrillo Beach to Cabrillo Beach.

The BRC was published annually until 1995. From 1995 through 1998, the BRC is published weekly for Los Angeles County.

The implementation of AB 411 in 1999 allowed Heal the Bay to expand the BRC beyond Los Angeles County.

The BRC now covers over 300 locations (400-plus from April to October) from Humboldt County to San Diego County on a weekly basis.

Heal the Bay's Beach Report Card

Goals of the Program:

- Public Awareness about beach water quality issues
- Advocacy Tool to Mitigate or Eliminate Pollution Problems at beaches

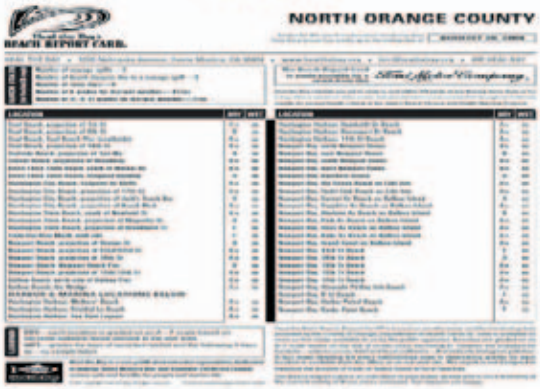
Methods of Dissemination

- Internet
- Surf/Dive Shops
- Marine Aquariums
- Membership
- Media

Internet

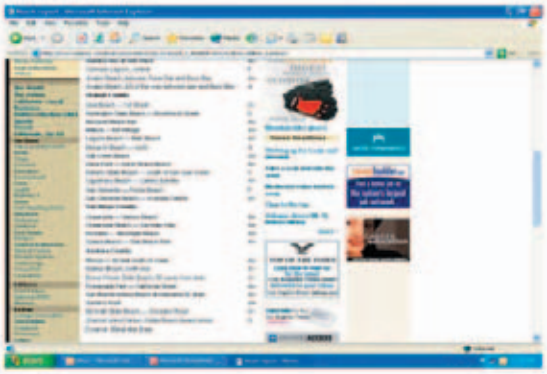
Internet

General Public



Media

Media



What have we learned with the BRC?

Improved understanding of beach water quality:

- Increased monitoring at appr. 300 beaches in California and countless more throughout the U.S.
- Enterococcus exceedances are more frequent
- "Open and unimpacted" beaches clean most of the time.
- Chronic contamination typically at enclosed beaches and storm drain impacted beaches
- Duration and magnitude of storms impacts urbanized beaches differently than rural ones.

Heal the Bay's Beach Report Card

Benefits to the Public

- **General beach water quality information is provided to the general public**
- **Beach conditions throughout the State are provide in one location**
- **Different types analysis are conducted**
  - Dry vs. Wet
  - Temporal Analysis (Annual, Summer, Weekly)
  - Beach Type (open ocean, storm drain, and enclosed)
- **Data trends can be used for advocacy**
- **$72 million appropriated through the Clean Beach Initiative**

An Ideal System for Communicating Water Quality Information

- Moves us (science and policy folks) in a direction to better characterize general beach water quality trends.
- The Beach Report Card is continually evolving that incorporates new information.
- Continues to fill a public education void that historically was ignored.
- An ideal tool that enables the general public to get involved in water quality issues.

Heal the Bay's Beach Report Card

- A - F grades for beach water quality
- Easy-to-understand translation of bacteria indicator data
- Data from monitoring regulatory agencies
- Rolling average

Methodology

Group:	Cat 1	Cat 2	Cat 3	Cat 4
Total Coliform	0-1,711-6,999	10,000-14,999	>14,999	*
Fecal Coliform	200-399	400-599	>599	*
Enterococcus	70-103	104-155	>155	*
Total to Fecal Ratio (when Total > 1,000)	10:1-12	7:1-10	2:1-7	< 2:1

The Beach Report Card
A living document

- Two major modifications to the grading algorithm based on scientific studies
  - Santa Monica Bay Restoration Commission
  - Southern California Coastal Waters Research Project
- Third major modification based on input from the ***State Water Resources Control Board's Beach Water Quality Workgroup***
  - Implementation of a 30-day geometric mean category
  - Heavier weight applied to most recent sample
  - A 100-point scaled grading system

Questions and Answers

Q (Bob Peeples, Earth 911): We're told that we need five pieces of data in a month to get a 30-day geometric mean. How do you get a wet weather grade when there is not enough data to do that?

James Alamillo

They Weather Grades system is based on the California system which basically, we can use total coliform, fecal coliform, and Enterococcus concentrations and the fecal/total ratio. The current algorithm does not take geometric means into account, but based on input from State Water Resources Control Board (SWRCB) Beach Water Quality Workgroup, that is a component that we are adding to the algorithm to deal with. To get enough samples, you either go back until you get enough rainy days to get enough data or grab more samples per wet weather event. Or, from your standpoint, you would have to say there is either insufficient data to calculate a geometric mean. There is not a good answer to your question.

Methods for Assessing Beach Management Policy Effectiveness

Sharyl Rabinovici
U.S. Geological Survey, Western Geographic Science Center

Biosketch

Sharyl Rabinovici has been a Physical Scientist with the USGS Western Geographic Science Center since February 2000. Her research focus is the application of geographic, economic and policy analysis tools to the development of improved environmental and resource management policies. She has published several papers on methods for evaluating policy strategies related to earthquake mitigation and recreational water quality. Mrs. Rabinovici holds a Master of Public Policy degree from the University of Chicago where she was a Harris Fellow and a B.S. with distinction in Geologic and Environmental Science from Stanford University. Prior to her work with the USGS, Mrs. Rabinovici spent four years working for various non-profit organizations related to community development finance and low income housing in the Chicago area.

Abstract

As local, state and federal agencies struggle to understand and remediate recreational water quality problems, practical but realistic methods are needed for assessing the effectiveness of current and proposed beach monitoring and swim closure policies. It is assumed that society desires the greatest possible public health protection with the least possible cost and loss of recreation access. Assessing these trade-offs requires an evaluation framework that integrates epidemiologic, economic, behavioral, ecologic, and water quality data and predictions.

We present an evaluation methodology that comprehensively addresses multiple forces driving near shore swimming health risk, but is simple and flexible enough to be generalized for use in a variety of ecologic settings. The method is based on benefit transfer and combines local water quality data with outputs from an econometric visitor behavior response models to estimate current management policy effectiveness and outcome probabilities under current and hypothetical conditions. In a demonstration of the method at a southern California marine beach, we find that current monitoring strategies perform poorly despite the sensitivity of the evaluation to several input assumptions and areas of uncertainty.

USGS
science for a changing world

Methods for Assessing Beach Management Policy Effectiveness

Sheryl Rabinovici, Richard Whitman (USGS)
Linwood Pendleton (UCLA)
Michael Hanneman (UCBerkeley)
Alexandria Boehm, Deyi Hou (Stanford University)

US EPA National Beaches Conference, October 2004

U.S. Department of the Interior
U.S. Geological Survey

Societal Objectives of Beach Management

- Protect Human Health
- Maximize Recreation Access
- Promote Healthy Environment

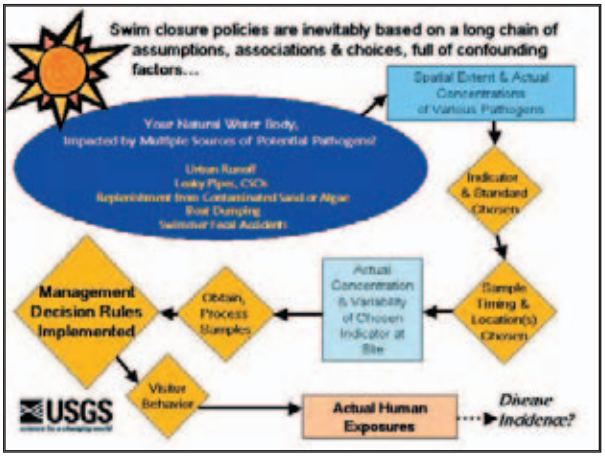
Simple, right?

USGS

Effective Advisories & Closures Depend on…

1. *Right Place at the Right Time*
2. *Clear Communication*
3. *Compliance/Enforcement*

USGS



Management Outcome Matrix

MANAGEMENT STATUS	TRUE COMPLIANCE STATUS: BELOW STANDARD	TRUE COMPLIANCE STATUS: OVER STANDARD
SWIMMING PERMITTED	OUTCOME A: Correctly Identified "Safe" Condition	OUTCOME B: An "Unsafe" Beach is Open (Type II Error)
SWIMMING PROHIBITED	OUTCOME C: A "Safe" Beach is Closed (Type I Error)	OUTCOME D: Correctly Identified "Unsafe" Condition

USGS

Key Management Questions

1. What are the likely economic and health impacts of each outcome on the swimming population?

   RECREATION v. PUBLIC HEALTH

2. How often does each outcome occur given local beach conditions and the management policy in place?
3. Which policies create the highest net benefit for swimmers given local conditions?

USGS

Approach

(Rabinovici et al., 2004)

- Benefit transfer policy analysis
  - Dose-response equations (EC: Dufour, 1984; ENT: Cabelli et al., 1986)
  - Value of swim recreation: $15 – $38
    (Murray et al. 2001; Rosenberger & Loomis, 2000)
  - Value per avoided GI illness: $280 - $1125
    (Mauskopf & French, 1991)
  - Per day net benefit
  - Management outcome probabilities
  - Daily and seasonal policy assessments
- Visitor and WQ data from case study sites:
  - Fresh-water: Indiana Dunes State Park, IN
  - NEW: Marine: Huntington State Beach, CA

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Per Day Net Benefits of a Beach

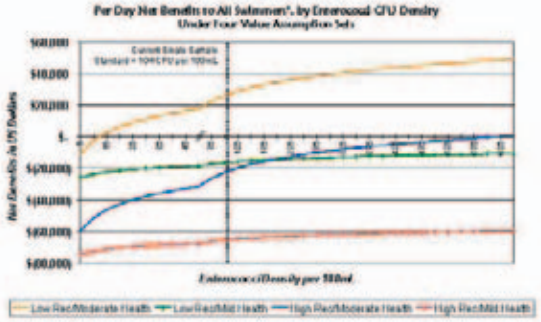
$$NB = SFN\left[V_{recreation} - \frac{R \cdot V_{health}}{1000}\right]$$

- S = 1 if open, -1 if closed
- F = fraction of visitors that swim
- N = # of visitors
- R = GI illness rate per 1000 persons at FIB level
- $V_{recreation}$ = per person value for a swim visit
- V_{health} = per person value* to avoid illness episode

USGS

*Expressed as willingness to pay, which encompasses all perceived costs to an average individual.

How "Dirty" Does It Have to Be for a Closure to "Pay Off" at HSB?



USGS

*Visitation estimate for Station 9N Huntington State Beach, CA courtesy of M. Hanneman, L. Pendleton.

Estimating Daily Outcome Probabilities

	DAY 1	DAY 2
OUTCOME D:	OVER	CLOSED OVER
OUTCOME C:	OVER	CLOSED UNDER
OUTCOME B:	UNDER	OPEN OVER
OUTCOME A:	UNDER	OPEN UNDER

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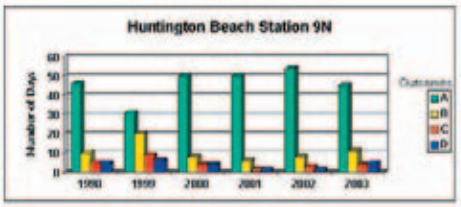
Management Outcome Rates Over Time

- Testing "randomly" five mornings per week June through August
- Overall closure error rate = 23% (71% were missed closures)
- Closure Rate = 22% (43% were unnecessary)



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Is Testing Net Beneficial?

Summer Season Total Under All Value Assumption Sets (in year 2000 US$)

Huntington State Beach Station 9N	Low Rec/Mod Health	Low Rec/Mild Health	High Rec/Mod Health	High Rec/Mild Health
No Testing	-$680k	$1.98 mil	$3.82 mil	$6.47 mil
Testing 5 days/wk	-$220k	$1.42 mil	$2.07 mil	$4.50 mil
Difference	*+68%*	*-28%*	*-26%*	*-31%*

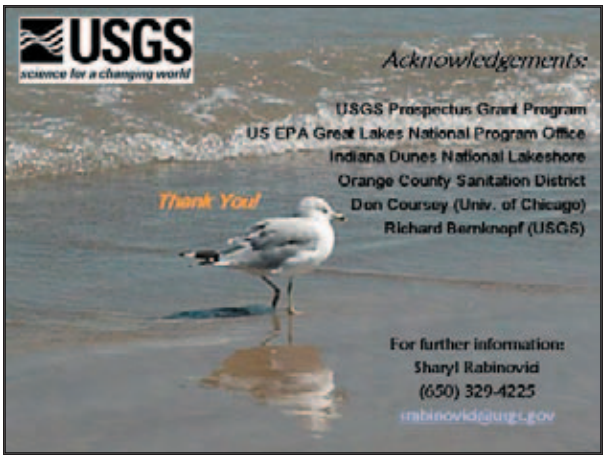
USGS

Recommendations

Compare benefits of new spatially and temporally targeted monitoring strategies:

- daily v. weekly
- adaptive v. regimented sampling schedule
- composite v. single-test sampling
- forecast model v. retrospective
- geometric mean v. daily maximum
- *Others!*

USGS



Questions and Answers

Q (Matt Liebman, US EPA Region 1): Does your model include the idea that people want to go to the beach because they know that it's monitored? I believe I saw a poster or talk at this conference that implied that, and I think that you were missing that.

Sharyl Rabinovici

Economists call that the "assurance value" and it is not explicitly covered in the model. One of the nice things about using equations though, is that if you get a good estimate for something that you would like to consider that isn't factored in, you've got a pretty clear way of being able to include it later. But, those kinds of estimates are pretty rare because "assurance" is not directly traded in any market, so it is difficult to observe that value, but yes, theoretically it could be added.

Natural Resources Defense Council (NRDC)

Mark Dorfman
Environmental Research and Education

Biosketch

(Not submitted)

Abstract

(Not submitted)

1. **Public has a right-to-know:** Public notification of beachwater contamination is critical because:

    - The extent of sewage contaminated beachwaters are widespread (the more we monitor, the more contamination we find),

    - Sewage potentially contains a wide variety of disease causing microorganisms. There are links between exposure to sewage contaminated beachwater and public health, particularly among vulnerable populations.

2. **Ideal public information** would include:

    - Real-time data on contamination levels including viruses and parasites,

    - Clear guidelines on what conditions and activities represent a health risk.

3. **Challenges and surrogate information:** Given the current level of scientific understanding and the status of program funding, these ideal data are not available. While government and academia do the research and development necessary to meet those challenges, the best public health strategy is precaution: prevention and control of sewage contamination. What federal, state, and local government officials need to do is establish or expand programs that:

    - identify contamination sources (sanitary surveys, etc.),

    - track and publicly report the occurrence of sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs),

    - prevent and control SSOs, CSOs, and stormwater runoff.

4. **Policies** that would help protect public health form sewage-contaminated beachwater:

    - Fully fund and implement the BEACH Act, including full funding for the BEACH Act grants program of $30 million annually, updating water quality criteria for the full range of pathogens, requiring new recreational water quality standards to be used to make beach closure andadvisory decisions and to set effluent limits for dischargers of pathogens (e.g. sewage treatment plants),

    - Encourage the development of faster and more accurate beachwater monitoring procedures,

    - Increase funding to the Clean Water State Revolving Fund, which is the principal source of funding for reducing the sources of beachwater pollution,

- Promulgate the January 2001 Sanitary Sewer Overflow Proposed Rule, which would require operators to implement a plan to reduce sewer overflows and notify the public when they occur,
- Pass the Raw Sewage Overflow Community Right-to-Know Act (HR 2215), which would require monitoring and public notification of sewer overflows,
- Create a national public database of sewage overflow occurrence, and fund for epidemiological studies to create a health effects database,
- Drop the EPA "blending" proposal to allow routine bypasses of critical sewage treatment processes during rain events, which significantly increases the public's risk of contracting a waterborne illness,
- Update sewage treatment standards to require use of emerging technologies that provide effective treatment for the full range of pollutants that pose risks to public health and the environment.

Questions and Answers

Q (Bob Peeples, Earth 911): Do you send out a complete draft to all of those states before you publish to give them a chance to comment? We have watched North Carolina show some of the advances they have made over the year. I think if they volunteered that information to you, then maybe they would have been like Encinitas rather than being beach bums.

Mark Dorfman

No, we don't send out the report before it is published. But, before the next year's report, since this is an annually updated report, we contact the states with the reports from the previous year and give them an opportunity to make any changes or corrections. We base the reports essentially on the data that was compiled since the last year by EPA. Because of EPA's new system, they didn't have the data for multiple states, so we had to go directly to the states for the data.

Q: Are the closure records and such error free?

Mark Dorfman

We receive the data from states and EPA and do the best we can with it. Whatever the errors are in those databases before it is sent to us. We can't take a national report and verify all the data that we get. The data that comes to us goes through a data quality process, and if some of the data does not make sense, we can send it back to the state or contact the state to check. For example, sometimes we see closures reported in Southern California due to monitoring, but we know that Southern California only closes beaches when there is a known sewage spill. That is something that we would check.

Comment (James Alamillo, Heal the Bay): You bring up a good point. In California, we meet quarterly with our water quality workgroup. It's a forum that allows us to touch base with people and it enables me to better write my annual report. It gives me the ability to talk to the specific people who are intimately involved with this program and share information with them ahead of time. Then, I can get feedback so that when my report comes out, we are all on the same page and have a better understanding of things. And we air our differences, as opposed to airing our dirty laundry, in the media. If I were you I would be calling NRDC and asking them to give you the courtesy of letting you see your state's write-up prior to their report being published. The more that you reach out, both from an environmental organization to the contigancy that involves county representatives or the public, and vice versa, I think the better off everybody is when a final product comes out.

Comment (Clay Clifton, County of San Diego Department of Environmental Health): With regard to NGOs like NRDC giving a heads up to agencies about reports, an area that has been identified as a buddy can help the NGOs in consideration of how to list that area in the report (buddy or non-buddy, for example).

So Many Report Cards, So Little Information

Steve Aceti
California Coastal Commission

Biosketch

Mr. Steve Aceti has been an attorney and lobbyist for twenty years. He helped create, and is now the Executive Director of, the California Coastal Coalition (known as "CalCoast"), headquartered in Encinitas, CA. CalCoast is an advocacy group comprised of 35 coastal cities, 7 counties, regional planning agencies and interest groups committed to beach restoration, wetlands recovery and improved water quality. CalCoast is a participant in a unique state/federal collaboration known as the "Coastal Sediment Management Workgroup" and it is also a member of the Public Advisory Committee of the Southern California Wetlands Recovery Project and the Public Advisory Committee of California Sea Grant. Mr. Aceti is a director of the American Shore and Beach Preservation Association and he chairs that organization's legislative committee.

Abstract

Every year, American beaches get several report cards offering passing and failing grades on criteria including water quality, safety, services, education and outreach, habitat conservation and how the beach is dealing with erosion. But some of the report cards themselves deserve failing grades.

Some of the grade-givers are well-known, reputable organizations whose evaluations are unbiased and based on good science. Unfortunately, they are not in the majority. Some organizations distort the data to reach false , but dramatic, conclusions. Some do no independent testing at all, but charge a fee to be listed as a "clean beach." Cities that do not participate in this "pay to play" campaign are maligned on websites and in press releases that infer non-members have unhealthy beaches.

For example, a "clean beaches list" disseminated earlier this year by an organization called the Clean Beaches Council (CBC) did not contain any California beaches. The reason for that is that cities and counties in the state have declined solicitations to join its certification program. In the national media, however the group suggested that more stringent "criteria" used by the CBC and heavy usage at California's beaches was the reason the state's beaches didn't make the cut.

Discrepancies in the criteria, methods and dissemination of beach "report cards" make it difficult for the public to properly evaluate the health an unfair assessment can be devastating to the economy of a coastal community. There is a need for clear guidelines and standards, and, possibly, federal regulation through the EPA to bring truth and integrity to the process.

Questions and Answers

Comment (Jack Gregg, Cal Coastal Commission): I have to sit in San Francisco and look at projects up and down the coast, and try to advise our planners on how to regulate based on our coastal water quality resource. We have two really good resources-California Coastal Records Project, where a private entrepreneur went out and took photos of 1100 miles of the coast, put them on a web site, and now they have recent photos as well as past photos, so you can see changes in the coastline. The other really good resource is Heal the Bay's report card. I would encourage you all to take a look at it online. Its such a great resource, and it is now expanded along the entire coast. If I want to see what is going on with the water quality at a certain beach, I can quickly get to those maps, and not only will it show me how the beach is doing in graphic form, but it also has links that will give you as much data as they have. It has been an invaluable tool for the state of California coastal regulators.

Friday, October 15
11:40 a.m. – 12:00 p.m.

Session Fourteen: Conference Wrap-Up

Denise Keehner
U.S. Environmental Protection Agency
Office of Science and Technology

Conference Wrap-Up

Summary and Future Directions for EPA Beach Program

Key Take-Home Messages

- 4 years after Beach Act, State/local governments have made good progress in developing and implementing beach monitoring and notification programs
  - Have learned important things about day-to-day variability, variability based on time of day, variability in results based on where in water column sample is taken, what factors correlate best with higher levels of indicators, and economic impacts of advisories and closures
    - Refinements in monitoring strategies are occurring, more pressure on research to develop rapid, inexpensive, accurate methods, more advisories now than 4 years ago and press for EPA to modify sampling/monitoring guidance to reflect "lessons learned" and to increase consistency where important and retain flexibility where desirable

Key Take-Home Messages (con)

- Increased advisories are leading to more pressure on the science of source identification and more need for technical guidance on microbial source tracking methods
  - Some communities are seeking to remedy/address sources even in face of uncertain science and sometimes in advance of TMDLs: we have some good case studies of this

Key Take-Home Messages (con)

- Need additional epi studies and better understanding of linkages between different indicator levels and pathogen levels and health outcomes/risk levels
  - These linkages are needed in order to ensure beach monitoring and notification programs provide public health protection AND to press for source control

Key Take-Home Messages (con)

- Need to improve data availability and communication on an on-going basis among "partners": more "states helping states" and "locals helping locals"
  - EPA needs to play a greater role in making this happen through sponsoring information clearinghouses, list serves, data bases, and workshops

Key Take-Home Messages (con)

- Need to reach out more and include other possible partners in efforts to get important questions answered in a more timely manner
  - EPA needs to show more leadership in increasing coordination and collaboration with CDC, NOAA, EU/WHO and other federal agencies
  - State and local governments and universities are key partners as well---need to ensure coordination

Key Take-Home Messages (con)

- Need to prepare for upcoming reauthorization of BEACH Act and ensure that Report to Congress well represents what we have accomplished
  - EPA needs to begin discussions and involve States and local government reps
    - State/local examples of good case studies needed

Key Take-Home Messages (con)

- National monitoring and notification data needs to be readily available and easily accessible in 2005
  - EPA needs to stay committed to fixing the problems with eBeaches

Key Take-Home Messages (con)

- Comparisons of beach monitoring and notification programs need to be fair and well represent relative "quality"
  - EPA needs to show leadership in helping to develop standardized criteria and process to ensure fair and accurate assessments of relative Program quality

Key Take-Home Messages (con)

- Analytical methods work needs more focus
  - Effluent methods need to be published/approved for indicators
  - Suggested improvements to currently approved ambient methods to make them work faster needs EPA attention and endorsement if appropriate

Poster Presenters

The Recreational Beach Program at Lake Powell

Mark Anderson
National Park Service, Glen Canyon NRA

Biosketch

Mark Anderson is an Aquatic Ecologist with the National Park Service at Glen Canyon National Recreation Area. Mr. Anderson received his B.S. in Biology and M.S. in Environmental Science from the University of North Texas. He has been the Director of the Lake Powell Beach Monitoring Program and Executive Secretary of the Lake Powell Technical Advisory Committee since 1999. As Beach Monitoring Director, Mr. Anderson oversees the monitoring effort focused on 2000 miles of Lake Powell shoreline, operates two environmental laboratories, and maintains laboratory certification through the Utah Department of Health. His primary interests are aquatic natural resource protection and recreation management.

Abstract

Glen Canyon National Recreation Area (NRA) began beach monitoring throughout Lake Powell in 1988. Two National Park Service laboratories process samples from the immense reservoir. Class II Environmental Laboratory Certification is maintained through the Utah Department of Health. In 1992, eight beaches were closed, some for extended periods. A dozen beaches were closed in 1995. In response, Glen Canyon NRA, Utah Department of Environmental Quality (DEQ), and Arizona DEQ developed a strategic plan to restore the water quality in Lake Powell. The strategic plan focuses on visitor education, legal authority for enforcement, facility improvement, and beach monitoring. The education program uses many approaches to help visitors understand the regulations and need for proper waste disposal. Legal authority and jurisdiction were carefully defined for cooperation between enforcement agencies active on the lake. A No Discharge Designation for Lake Powell was obtained from the US EPA. Facility improvement involved upgrading pump-out docks, adding shore based toilets, and deploying floating pump-outs in remote locations. A Technical Advisory Committee (TAC) was formed in 1996 to guide the Beach Monitoring Program. Protocols were established for location, frequency, and replication of sampling. Compromises were reached on indicators and standards. A rational approach to beach closures was developed. The Beach Monitoring Program at Lake Powell today is the result of eight years of progressive development under guidance of the TAC. The Beach Monitoring Program confirms that the strategic plan has been a great success. Now there are few high bacterial counts detected and beach closures are rare.

Washington State's BEACH Program: Results from 2003 and 2004

Jessica Archer
Washington State Department of Ecology

Biosketch

Ms. Jessica Archer is the Database Coordinator for the Washington State BEACH Program. Ms. Archer received her B.S. in Marine and Molecular Biology in 2002 from The Evergreen State College in Olympia, Washington. She then began work for the Washington State Department of Natural Resources on their statewide eelgrass monitoring program. Intermittently, she has taught GIS to environmental professionals. In 2003, she joined the BEACH Program at the Washington State Department of Ecology and helped to implement the first statewide monitoring and notification program for Washington State. She is an avid surfer and has a strong interest in monitoring and improving marine water quality and providing rapid notification to protect those who play in the saltwater.

Abstract

The Washington State BEACH Program used 2003 as a pilot sampling season to determine an optimal sampling plan for the full implementation in 2004. Five counties participated in the pilot project. Three counties sampled for enterococci and *E. coli* at one location per beach. One county sampled for enterococci and fecal coliform at one location per beach. The last county sampled for enterococci at three locations across the beach and averaged the samples. The pilot project confirmed that background levels for bacteria indicators in Washington's marine recreational beaches are generally less than 10 colonies per 100 milliliters. However, in ~10% of the samples, entercocci were observed in excess of 104 colonies per 100 milliliters. Frequently these exceedences were correlated with rain events. Environmental health officials were uncomfortable making advisory decisions based on the one sample result. The additional information gained from taking three samples across the beach gave better information and confidence for decision-making. The lessons learned from the pilot project were incorporated into the 2004 sample plans. In 2004, three samples are being taken across the beach with weekly results averaged and compared to single sample threshold limits. Geometric means are calculated using all the sample results from the five previous weeks. Data from the 2004 Washington State BEACH Program sample season will be presented, including trends and exceedences.

Beaches in Enclosed Harbor – Are They Worth IT?

Russell Boudreau
Moffatt & Nichol

Biosketch

Mr. Russell Boudreau has 23 years of experience in coastal and ocean engineering. He is currently an Associate and Supervisory Coastal Engineer with Moffatt & Nichol in Long Beach, California. His responsibilities have included planning, engineering and management for a broad range of coastal processes, small craft harbor and commercial port development, beach nourishment, wetland restoration, water quality and navigation improvement projects in the U.S. and throughout the world. Mr. Boudreau is a registered Civil Engineer in the State of California. He has a Master of Engineering degree from the University of California at Berkeley. His involvement in professional organizations includes serving on the board of directors of the American Shore and Beach Preservation Association.

Abstract

Problems of water quality in enclosed harbor beaches in California deal almost exclusively with studies and investigation of remedial measures to solve an existing problem, since nearly all of these beaches have been in use prior to the State's water quality monitoring programs. However, a unique opportunity arose in which new swimming beaches were proposed as part of a new development within an existing harbor. The issue the developer, engineers and scientists, resource agencies, and public had to deal with, was it worth the effort?

Concern was raised during the environmental review process regarding the potential for poor water quality within the newly created swimming beaches, since the harbor presently includes a public beach exhibiting chronic poor water quality for swimming. However, extensive modeling and monitoring supported the contention that the beach waters would be of sufficient quality for swimming based on current State guidelines. After much effort and debate, it was ultimately decided that the risk of poor water quality was too great, and the area was re-designated for non-body contact recreational use. Regardless, the process offers a very interesting and informative case study.

The presentation will include a review of water quality modeling and monitoring, a general assessment of overal enclosed harbor beach water quality in California, and discussion of BMPs and monitoring that were to be required should be beaches have been maintained as part of the development.

Louisiana Beaches Program: Milestones in Development

Bruce Champion
Louisiana Department of Health and Hospitals

Biosketch

Bruce Champion is the Administrator of the Louisiana Department of Health and Hospitals Molluscan Shellfish Program and Recreational Beach Monitoring Program. Mr. Champion received his Bachelor of Science Degree in 1973 from Northwestern State University, Natchitoches, Louisiana. He is a Registered Sanitarian and has been involved in protecting Louisiana's Public Health as regulator of environmental health programs for the past twenty years. For the past two and one-half years, he has been responsible for the development and implementation of the Recreational Beach Monitoring Program.

Abstract

The Louisiana Beach Monitoring Program, administered by the Louisiana Department of Health and Hospitals, Office of Public Health (OPH), is an ongoing success story featuring clever technological applications and interagency cooperation.

- Aerial photography of potential program sites was performed on Memorial Day, 2002 to assess populations of beach-goers.
- Geographic information system and global positioning system applications were employed to give precise locations of these sites, and later to mark sampling and signage points.

Partnership among OPH, the non-profit Lake Pontchartrain Basin Foundation, and the Louisiana Department of Culture, Recreation and Tourism, Office of State Parks (OSP) has resulted in OSP furnishing all current program pilot sites, located at coastal state parks. Ongoing discussions with parish (county) governments will increase program involvement among other agencies as OPH seeks to increase the number of beach sites incorporated into the monitoring and notification activities of the program.

BEACH Monitoring Program's Goals

BEACH Monitoring Program purposes and goals:

- Monitor coastal water conditions during the swim season, March through October, to establish predictive models of water quality at certain Louisiana beach segments that are highly used.
- Comply with the Beaches Environmental Assessment and Coastal Health Act (BEACH Act) signed into law on October 10, 2000, to reduce the risk of diseases to users of the coastal marine recreational waters.
- Adopt performance criteria for monitoring and assessing coastal recreation water and for promptly notifying the public when those waters exceed applicable water quality standards

Services provided by the BEACH Monitoring Program

The BEACH Monitoring Program has been established to provide the following services to the general public:

- Notify the public through posting of beach signs and press releases when conditions at Louisiana's coastal recreational waters indicate high levels of harmful bacteria and when the conditions are safe.
- Post advisory signs at beaches when there is a high risk associated with swimming.
- Produce and distribute informational brochures to inform public of personal health risk associated with swimming in waters contaminated with harmful microorganisms.
- Produce and maintain a website that contains information on the monitored beaches and informs the public of health risks (at www.ophbeachmonitoring.com)
- Provide the United States Environmental Protection Agency with Louisiana beach water quality data that is stored in a national database.

The accomplishments of the BEACH Monitoring Program

- Developed a risk-based beach evaluation and classification plan that identified Louisiana's marine beaches.
- Developed a tiered monitoring plan to evaluate the need for beach monitoring at high use beaches.
- Developed a public notification and risk communication plan to inform Louisiana's public when there are high levels of harmful bacteria in the water.

Guam Beach Monitoring: Past, Present and Future - An Island Perspective

Veronica Cummings-Gutierrez
Guam Environmental Protection Agency

Biosketch

Veronica Cummings Gutierrez is a biologist for the Monitoring Program of the Guam Environmental Protection Agency. Ms. Cummings Gutierrez received her B.S. in Biology and Environmental Studies from Baylor University in Waco, Texas and is working on her M.S. in Biology/Environmental Science at the University of Guam. She worked as a fisheries biologist for 5 years at the Division of Aquatic and Wildlife Resources in Guam, heading the Sea Turtle Recovery Program and various other projects. For the past 2 1/2 years, she has been the program leader for the Guam Recreational Beach Monitoring Program.

Abstract

The Guam Environmental Protection Agency's Recreational Beach Monitoring Program has collected bacteriological data of Guam's waters since the late 1970s. The goal of the program has always been to monitor and assess Guam's recreational waters for microbiological contamination and advise the public against swimming in contaminated waters. With increasing support from the federal government by way of the BEACH Act and the Clean Beaches Plan, Guam is able to support and maintain our beach monitoring program. This poster offers a historical perspective of beach monitoring on Guam and how it has evolved. It will also highlight the importance of reporting to media and consistency in monitoring using USEPA approved indicators.

Interlaboratory Validation of Method 1603 (Modified mTEC) for *E. coli* in Wastewater Effluent

Yildiz Chambers
CSC Biology Studies Group

Biosketch

Yildiz Chambers is a senior microbiologist with CSC in the biology studies group. Ms Chambers received her B.S. in Microbiology and MSPH in Environmental Health from San Diego State University. Ms. Chambers manages microbiological analytical method development, optimization, and validation projects for EPA's Office of Water, including laboratory methods for determination of *E. coli* and enterococci in wastewater, and fecal coliforms and *Salmonella* in biosolids. Ms. Chambers has 13 years of bench experience as an environmental microbiologist, including 7 years of direct experience with cell culture assays and has designed and conducted more than a dozen studies on method performance and pathogen occurrence in wastewater influent and effluent, reclaimed water, biosolids, drinking water, ground water, marine water, tissue, soil, and plant matter.

Abstract

U.S. EPA recently conducted a validation study of Method 1603 (modified mTEC) for *E. coli* in wastewater effluent in an effort to respond to NPDES permit holders' requests for approved methods. Eight volunteer participant laboratories, a verification laboratory, and a research laboratory participated in the study. Samples spiked with laboratory-prepared spikes were used to assess method performance and for the development of QC acceptance criteria to support future assessments of method and laboratory performance for disinfected wastewater matrices.

Method 1603 recovery of *E. coli* was found to be acceptable for use in wastewater, and was characterized by pooled within-laboratory standard deviation of 6.86 for unspiked disinfected wastewater samples. Disinfected wastewater samples spiked with laboratory-prepared spikes had an overall mean recovery of 80.7%. Laboratory-specific relative standard deviations (RSDs) from disinfected wastewater samples spiked with laboratory-prepared spikes ranged from 6.1% to 51.4%, with an overall pooled, within-laboratory RSD of 25.9%.

False positive confirmation rates were also acceptable, with laboratory-specific rates for unspiked disinfected/secondary results combined, ranging from 0%–22.2%. Laboratory-specific false negative confirmation rates for unspiked disinfected/secondary results combined, ranged from 0%–6.7%, which was considered acceptable.

Based on the results of this study, Method 1603 is considered valid for use in determining the concentration of *E. coli* in disinfected wastewater.

Fixed and Random Factors Affecting *E. coli* Occurrence at Southern Lake Michigan Beaches

Meredith Nevers
U.S. Geological Survey, Great Lakes Science Center

Biosketch

Ms. Meredith Nevers is an aquatic biologist with the U.S. Geological Survey, Great Lakes Science Center, stationed in Porter, Indiana. Ms. Nevers received her B.A. in Biology from Wittenberg University in Ohio and her M.S. in Marine Biology from the University of North Carolina at Wilmington. She worked in North Carolina tidal creeks studying nutrient loading and eutrophication and their effects on benthic microalgae. She then became a biologist with the United States Geological Survey and has been working at the Lake Michigan Ecological Research Station in Porter, Indiana for the past 8 years. Her research interests include water quality, biological monitoring and assessment, and the improvement of beach monitoring effectiveness.

Abstract

The southern Lake Michigan shoreline beaches are recreationally and therefore economically important to the region, so managers depend on the reliability of their *E. coli* monitoring programs to ensure healthy recreational opportunities. Studies undertaken at Indiana and Illinois beaches have revealed numerous random and fixed factors that influence the outcome of *E. coli* results taken as part of routine beach monitoring. Abundant *E. coli* in the nearshore sand, often as high as 4 log/100 ml at 63rd Street Beach in Chicago, strongly influenced its counts in the beach water. Further, wind speed and direction and subsequent high waves likely moved *E. coli* from the sand to the water; counts are typically higher during a direct onshore wind. In addition to the sand acting as a source of *E. coli* to the water, amassed Cladophora algae and number of shoreline birds present may influence *E. coli* counts in water. Fixed factors including time of sampling also directly influenced *E. coli* results, with lower *E. coli* densities in afternoon samples than in morning samples ($p<0.01$). Also, the number and location of replicate samples greatly influences the outcome of *E. coli* monitoring; at the subject Chicago beach, replicates collected across the entire beach were far more variable than replicates collected intensively in one location. Ongoing research along southern Lake Michigan focuses on developments and calibration of predictive models to minimize error and increase reliability.

City of Encinitas Perspective on Beach Postings

Katherine Weldon
City of Encinitas, Clean Water Program

Biosketch

Katherine Weldon has over 12 years of experience in Water Quality Management Programs. Most of her experience has been in role of program manager for the Recreational Ocean Water Quality Coordinator for the County of San Diego and most recently as the Stormwater Program Manager for the City of Encinitas. Ms. Weldon has been active in the field of stormwater monitoring since 1993 when the County first began testing storm drains. Kathy developed a voluntary ocean-monitoring program with the POTWs, which became a routine monitoring program for the County of San Diego. She has been involved with the implementation of AB411, which mandated a routine coastal monitoring program for the State of California.

Throughout Ms. Weldon's career she has worked for the public sector. She has developed the City of Encinitas' Stormwater Program from the beginning, which is considered the model by the Baykeepers and the local Regional Water Board. Kathy has created numerous presentations for City Council as well as the local media. She works with each department from public works, engineering, construction and planning. Ms. Weldon's most recent accomplishment is the completion of the Moonlight Beach Urban Runoff Treatment Facility, which cleans the creek of bacteria and viruses prior to being discharged back into the creek.

Abstract

The City of Encinitas, a coastal town located 25 miles north of San Diego with 6.2 miles of beaches, generates an estimated $44,000,000 of revenue annually. Moonlight Beach, the crown jewel, supports 4000 beach users on a summer day, with facilities including volleyball courts, fire rings, snack/rental shops, and lifeguards. Water quality at Moonlight has been historically poor due to Cottonwood Creek, conveying bacteria in urban runoff directly to the beach. Understanding the value of the resource, the City installed an ultraviolet treatment facility on Cottonwood Creek to compliment persistent upstream investigations, killing 99.9% of the bacteria. Nearly $11,000 are spent annually monitoring water quality at Moonlight, above and beyond the required AB411 program. With these Best Management Practices, postings due to sewage and urban runoff have been nearly eliminated.

Yet, Moonlight continues to have postings, often a result of misguided policy not protective of public health. Guidelines such as sampling before 11 am or the inability of weekend staff to un-post beaches has kept Moonlight posted when bacteria samples indicate acceptable water quality. Three cases of postings not protective of public health and their fiscal impacts will be discussed.

Samples of seagull feces have been analyzed for bacteria indicators, data will be presented. Understanding contributions from this source of bacteria leads the City to question how often beaches are posted due to natural sources. Is the enterococcus standard often exceeded because of natural sources, resulting in incorrect perceptions of water quality? A study supporting this hypothesis will be presented.

Enumeration and Characterization of Enterococci Found in Marine and Intertidal Sediments and Coastal Water in Southern California

Donna Ferguson
Orange County Public Health Laboratory

Biosketch

Donna Ferguson is a Supervising Microbiologist for the Water Quality Department of the Orange County Public Health Laboratory. Ms. Ferguson received her B. S. in microbiology from California State University Long Beach and M.S. in Epidemiology from the UCLA School of Public Health. She has worked as a public health microbiologist for 10 years, specializing in parasitology. She also worked as research microbiologist for Metropolitan Water District of Southern California's water quality laboratory for 7 years working on *Cryptosporidium*, *Giardia* and Microsporidium detection and culture methods and watershed investigation studies. She is currently involved with fecal indicator source tracking studies.

Abstract

Storm drains, rivers and estuaries are major sources of bacterial and nutrient pollutants to beaches located near these coastal outlet areas. Regulatory failures due to high levels of enterococci have been a common occurrence during summer dry weather periods at two beaches that differ in beach morphology and types of coastal outlets. Baby Beach, in Dana Point Harbor, is a small, enclosed beach with limited circulation. In contrast, Huntington Beach is a large, open beach bordering a marsh and river. High levels of enterococci were found in intertidal sediments adjacent to storm drains at Baby Beach. At Huntington Beach, the highest levels of enterococci were found in intertidal sediments from the river as compared to the surfzone sand and marine sediments at 10 m depths off shore near a sewage outfall and power plant. High levels of enterococci in sediment (1,000 - 10,000 CFU/10g) suggest the occurrence of bacterial regrowth.

To better understand the ecology of enterococci in the environment, isolates were characterized to species and strain level. *E. faecalis*, *E. faecium* and *Streptococcus bovis* were the predominant species isolated from water and sediments using mEI media (EPA Method 1600). *E. faecalis* isolates were subjected to pulsed-field gel electrophoresis (PFGE) molecular typing. Clonal populations were found in water, sediments and gull stools. We hypothesize that coastal outlets discharge enterococci and nutrients that are associated with sediments. Nutrients allow persistence and regrowth of bacteria in sediments. Thus, sediments may be an important source of these organisms to overlying water when resuspended or transported by tidal currents.

Sediments as a Reservoir of Indicator Bacteria in a Coastal Embayment – Mission Bay, California

Steve Gruber
MEC-Weston Solutions, Inc.

Biosketch

Steve Gruber received his B.S. in Aquatic Biology from the College of Charleston, South Carolina and his M.S. in Biology from California State University, Fullerton. After graduate school, he worked for the U.S. Geological Survey National Water Quality Assessment Program as a research biologist assessing contaminant impacts on agricultural watersheds in eastern Washington State. He then worked as a research biologist for the Colorado Department of Public Health and Environment establishing state water quality criteria for biota and nutrients in lotic environments

and writing TMDLs. For the past two years, Mr. Gruber has been a Senior Scientist with MEC-Weston Solutions, Inc. in Carlsbad, CA, working on watershed research projects such as source investigations, assessments of coastal embayments, and TMDL issues.

Abstract

Mission Bay is a large, heavily used coastal embayment within the City of San Diego that includes over 27 miles of recreational shoreline. Historically, exceedences of state water quality standards for indicator bacteria (total coliform, fecal coliform, and enterococcus) have been a persistent problem at some beaches in Mission Bay. A two-year, comprehensive study was conducted to investigate and identify the numerous potential sources of bacterial contamination in the Bay receiving waters and surrounding watershed. As part of the investigation, intertidal sediments were assessed at some sites to determine the extent to which the beach sands act as a reservoir for indicator bacteria. The results suggested that bacterial densities in upper intertidal beach sands were significantly greater than those in lower intertidal beach sands. In addition, when the sediments in the upper intertidal zone were resuspended during simulated swimming activity, bacterial densities in the water column were an order of magnitude greater than those in samples collected when sediments were not disturbed. This pattern was not observed when the experiment was conducted in the lower intertidal zone. This phenomenon suggests that swimming activity may lead to greater bacterial densities in the water column and helps explain the pattern of bacterial contamination observed at some sites in Mission Bay. The study also has potentially important implications for other recreational beaches in southern California.

Amplification of Indicator Bacteria in Organic Debris on Southern California Beaches

Andrew Martin
MEC-Weston Solutions, Inc.

Biosketch

Mr. Andrew Martin is a Senior Scientist with MEC Analytical Systems – Weston Solutions (MEC-Weston) in Carlsbad, California. He received his B.S. in Geological Oceanography from the University of Washington. Mr. Martin's 9 years of experience as an environmental consultant spans a range of disciplines, providing expertise for emergency response to ecological incidents (oil spills, chemical spills and ship groundings), coastal oceanographic surveys, geophysical surveys, scientific dive surveys, storm water sampling, bacterial source identification studies and watershed management plans. He is skilled in designing and conducting sampling and analysis programs, modeling for NPDES permits requirements, performing Natural Resource Damage Assessments (NRDA) and using CAD/GIS.

Abstract

Certain recreational beaches in southern California frequently exceed state water quality standards for indicator bacteria (total coliform, fecal coliform, and enterococcus). In San Diego County, two sites have been particularly problematic: Mission Bay, a large coastal embayment; and Dog Beach at the mouth of the San Diego River. Recent studies designed to investigate sources of indicator bacteria at these sites suggested that densities of indicator bacteria can be amplified through extended survival and reproduction in organic debris deposited on area beaches. This process was most prevalent in two common features of recreational beaches: organic debris deposited on the beach in the form of a wrack line and tidally influenced storm drains where organic debris frequently accumulates. Field investigations showed that the wrack line acts as a bacterial reservoir that can impact receiving waters. Indicator bacteria were concentrated in the organic debris deposited on the beach during spring tides, maintained in the wrack above the water line during neap tides, and then released back to the receiving waters during subsequent spring tides. At some locations, this

process was considered to be a significant cause of bacterial water quality standard exceedances. In laboratory experiments that simulated tidally influenced storm drains, bacterial amplification was even more dramatic. Fecal coliform and enterococcus bacteria were shown to reproduce rapidly under conditions typical of coastal storm drains, with densities increasing three to four logs in 48 hours. The results have potential implications for managing recreational beach water quality in southern California.

CICEET: Developing New Technologies for Detecting and Source-Tracking Coastal Contamination

Kalle Matso
University of New Hampshire, Cooperative Institute for Coastal and Estuarine Environmental Technology

Biosketch

Kalle Matso is the program manager for the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), where his primary responsibilities include managing the competitive grants process and developing/implementing new approaches to connecting coastal managers with innovative researchers (a process often referred to as "technology transfer"). Mr. Matso received his B.A. in English from the Colorado College and enjoyed eight years in the field of journalism before attending the University of New Hampshire (UNH) and receiving his M.S. in Natural Resources, studying sampling methods for fauna and vegetation in eelgrass beds under Dr. Fred Short. Mr. Matso has been with CICEET since the year 2000.

Abstract

CICEET (Cooperative Institute for Coastal and Estuarine Environmental Technology) is a research institute, funded by the National Atmospheric Administration (NOAA) and headquartered at the University of New Hampshire (UNH). The Institute funds the development of technological solutions to pressing needs of coastal and estuarine resource managers around the country. A critical partner in this effort is the National Estuarine Research Reserve program within NOAA. CICEET uses the 26 reserves in the United States as platforms for research and vehicles for outreach and education.

CICEET's sphere of interest encompasses all the activities and habitats that affect the health of estuaries and coasts. Specific to beaches, relevant CICEET projects include:

- Microbial Source Tracking
  CICEET has or is funding work on viral indicators of pathogens; targeted sampling techniques for using Enterococcus faecalis as an indicator of microbial contamination; ribotyping
- Rapid Detection of Pathogens
  Using fiber-optic and other technologies for near real-time, remote sensing of microbial contaminants.

Sentient results for these research projects are presented.

CICEET's main vehicle for developing new technologies is its three competitive grants programs (Proof of Concept; Environmental Technology Development; Technology Transfer). Please visit our web site (http://ciceet.unh.edu) for information on the current call for proposals, due November, 2004.

Combining Targeted Sampling and Bacterial Source Tracking During Calm Versus Windy or Stormy Beach Conditions

Jennifer McDonald
University of Georgia, Marine Extension Service

Biosketch

Jennifer McDonald is a Water Quality Microbiologist at the University of Georgia Marine Extension Service in Brunswick, GA. She received her B.S. in Biology from North Georgia College and State University. Her primary research focuses on bacterial source tracking (BST) and monitoring water quality in coastal Georgia.

Abstract

Recently, high numbers of fecal enterococci triggered beach advisories on Georgia's Jekyll and Sea Islands. Targeted sampling, which finds fecal contamination much like the children's game of hot and cold, preceded bacterial source tracking (BST) methods of Enterococcus speciation, fluorometry, and the presence or absence of a human virulence factor in *E. faecium* isolates. No fecal contamination was observed at Jekyll Island beach during calm conditions, but fecal contamination was observed during windy conditions. Windy conditions doubled the water turbidity compared with calm conditions. A test for human virulence factor was negative. The likely contamination source was wild bird feces in sediments from the beach and a nearby creek. For the Sea Island beach during calm conditions, the likely contamination sources were wildlife feces, and leaking sewer lines or malfunctioning septic systems. Fluorometry quickly identified malfunctioning sewer lines or septic systems. A test for human virulence factor was positive. During stormflow conditions, the likely contamination sources were wildlife feces and effluent from two pipes. A test for human virulence factor was negative. Because the percentage of *E. faecalis* from the pipes was high (30%), fecal contamination from wild birds was likely. This is the first report of targeted sampling during both windy and stormy conditions, and the first time fluorometry has been combined with targeted sampling. Because fluorometry was less time-consuming than the other two BST methods, it may be the method of choice for identifying human fecal contamination where high counts of fecal enterococci are observed.

Carbon Source Utilization by enterococci as a Method to Distinguish Sources of Fecal Contamination for Texas Beach Waters

Joanna Mott
Texas A&M University at Corpus Christi

Biosketch

Dr. Joanna Mott is an Associate Professor of Biology at Texas A&M University-Corpus Christi. Dr. Mott received her B.S. in Biological Sciences from the University of Aston in Birmingham, U.K., her M.S. in Biology from the University of Waterloo, Canada and her Ph.D. from Texas A&M University. She worked as a Research Associate at the Texas A&M University Research and Extension Center for two years and then as an adjunct at Texas A&M University-Corpus Christi. For the last ten years she has been a full-time faculty member at Texas A&M University-Corpus Christi in the Physical and Life Sciences Department and a Research Faculty Scientist at the Center for Coastal Studies, and is the Undergraduate Biology Program Coordinator. Her main research interests are coastal microbiology, recreational water quality and bacterial source tracking.

Abstract

A comprehensive beach water monitoring program has recently been implemented in Texas; however, the monitoring does not identify sources of contamination. Bacterial source tracking can provide information for remediation or risk assessment of contaminated beaches. In this study, carbon source utilization by enterococci from four potential sources of beach fecal contamination was compared to determine effectiveness of this technique for source identification. Fecal samples from humans, birds, cows, and dogs were collected in the South Texas coastal region. Isolates were grown on mEnterococcus agar and analyzed using the MicroLogTM Microbial Identification System (Biolog, Inc.). Specific Enterococcus species were identified for 75% of the isolates. *E. faecalis* was the most common species isolated from both humans (62.5%) and nonhumans (44.5%). *E. mundtii* was the second most common species in nonhuman sources. Intensity and positive/negative well data was analyzed using SPSS version 11.0 for Windows for discriminant analysis. The average rate of correct classification (ARCC) for a two-way analysis (human vs. nonhuman) was 90.7% and for a four-way analysis (human vs. bird vs. cow vs. dog) was 80.3%. In the two-way analysis, an ARCC of 96.8% of nonhuman isolates was achieved. Stepwise methods were used to evaluate contributions by individual carbon sources. The highest rates of correct classification were achieved using all the wells. The use of enterococci, isolated using EPA Method 1600 during routine monitoring, to discriminate between sources, makes this an attractive, relatively inexpensive and rapid technique for source tracking of fecal contamination of marine beach waters in Texas.

The Influence of Climate, Land Use and Tidal Mixing on Water Quality in Newport Bay, Southern California

Abhishek Pednekar
University of Southern California at Irvine

Biosketch

Abhishek Pednekar is a graduate student of Chemical engineering, with a research specialization in Environmental Engineering at the University of California, Irvine. Mr. Pednekar received his B.S. in Chemical Engineering from the University of Mumbai, India and MS in Chemical Engineering from University of California, Irvine. He is currently working as a graduate student researcher at the Environmental Biotechnology lab at the University of California, Irvine. For the past two years he has pursued his graduate studies focusing on coastal water quality issues with respect to fecal indicator bacteria impairments and is specifically looking at Newport bay in Southern California for his thesis. He has also managed and worked on various water quality studies at Newport Bay, Mission Bay San Diego and Carpinteria marsh, Santa Barbara.

Abstract

There is growing concern about a possible link between global climate change and the spread of infectious diseases. Previous reports suggest that coastal water quality--and by implication human health risk--are influenced by global climate variability. However, relatively little is known, either qualitatively or quantitatively, about how coastal water quality is impacted by the combined influence of local-scale changes (e.g., land-use changes) and global climate variability. To fill this knowledge gap, we compiled and analyzed a 32 year long time series of water quality measurements (n~60,100) in Newport Bay, a regionally important embayment in southern California. To identify dominant spatial and temporal trends in the time series, we utilized a mathematical technique widely employed in the atmospheric and ocean sciences—called Empirical Orthogonal Function (EOF) analysis. The results show that 69% of the temporal water quality variability is associated with rainfall, implying that a very large fraction of the water quality signal can be attributed to storm water runoff. Moreover, trend analysis on the time series demonstrate that water quality is negatively impacted by long-period processes

that generate more local rainfall, including El Nino Southern Oscillations (ENSO) events and Pacific Decadal Oscillations (PDOs). Indeed, we demonstrate that the water quality signal measured in Newport Bay can be reproduced by a simple box model that takes, as input, daily estimates for the load of fecal pollution flowing into the Bay from the watershed, solar radiation, and tidal mixing residence times. Analytical and modeling tools developed for this study should be readily generalizable to other field sites. The results presented here should be useful for both policy makers interested in developing Fecal Coliform TMDLs for the Bay, and scientists interested in understanding how climate changes influence the spread of infectious diseases.

Survival and Regrowth of Fecal Enterococci in Moist and Desiccated Sediments

Karen Rodgers
University of Georgia

Biosketch

Ms. Karen Rodgers holds a B.A. in communications (1991) from the State University of New York in Cortland and a Master's degree in communications (1994) from the University of Georgia. She received her B.S. in environmental health science (2003) from the University of Georgia. Currently, she is Research Coordinator II in the Soil Microbiology Laboratory in the Department of Crop & Soil Sciences at the University of Georgia, where she has been conducting bacterial source tracking research with Dr. Peter Hartel.

Abstract

Moist and desiccated beach sediments may serve as reservoirs of fecal indicator bacteria. Desiccated saltwater beach sediments occur after extreme high tides; desiccated freshwater beach sediments occur when water levels drop. Bacterial regrowth may occur when sediments are rewetted and survivors dine on the deceased. We determined the ability of fecal enterococci to survive and regrow in moist and desiccated sediments. Fecal enterococci were enumerated in nonsterile sediments from Alabama, Georgia, New Hampshire, and Puerto Rico with the IDEXX Enterolert system. Counts were corrected because the sediments falsely inflated them. Numbers of fecal enterococci in the sediment were variable (0.95 to 4.78 log10 colony-forming units g-1 dry weight). Survival in moist sediment was determined with sentinel chambers containing known Enterococcus species. None of the three Enterococcus species, *E. faecalis*, *E. faecium*, and *E. gallinarum*, or seven *E. faecalis* subspecies survived >14 days in moist sediment. Some sediments were air-dried at room temperature and rewetted after 2, 30, and 60 days, then sampled immediately (survival) and after one day (regrowth). Fecal enterococci survived 2, 30, and 60 days of desiccation in all sediments and regrew in most. Survival ranged from 16 to >100%; regrowth ranged from 0 to >3000%. Because sediments are reservoirs of fecal enterococci, beach monitoring needs to include sediment sampling. Also, regulators need to reconsider the rule that assumes fecal indicator bacteria do not survive and regrow in the environment. Finally, these results affect bacterial source tracking because desiccated bacteria may represent a source of past fecal contamination.

Indicator Bacterial Populations in the Las Vegas valley – Part I: Source Identification

Angela Rosenblatt
City of Henderson

Biosketch

Ms. Angela Rosenblatt has been working in the field of water quality for over ten years. She is currently employed as a Chemist for the City of Henderson. She is completing her Master's Degree in Environmental Microbiology and is presenting research from her thesis project. She is a member of several professional organizations including American Society for Microbiology, Water Environment Federation and American Water Works Association and has made many presentations including those for the ASM, Nevada Water Environment Association and the WateReuse Association.

Abstract

The Las Vegas Wash (LVW), a tributary to Lake Mead, is the only drainage point for the entire hydrographic basin. Contributing sources include groundwater, stormwater, urban runoff and 160 million gallons per day of tertiary-treated wastewater. High levels of fecal contamination are observed in the LVW. This is of concern as Lake Mead is the major source of drinking water for Las Vegas. We have conducted several studies to determine the sources of this microbial signal.

Comprehensive phenotypic speciation (500 isolates) of enterococcal populations from three LVW associated matrices was conducted at two time points. API strips were used to determine that human signals (*Enterococcus faecium* and *Enterococcus faecalis*) accounted for 18% of the isolates, while the environmental signal (*Enterococcus avium* and *Enterococcus gallinarum*) was 81%.

These results correlate with studies on growth and survivability of enterococcal and streptococcal species in natural LVW water, which were estimated by inoculating sterile LVW water with ATCC enterococcal and streptococcal species and conducting heterotrophic plate counts at specified intervals. The species most commonly found in the LVW survived for > 63 days.

Studies sought to determine if significant levels of indicator bacteria isolated from tertiary-treated wastewater were able to regrow or resuscitate in the LVW. Wastewater disinfected by chlorination, chloramination and UV was assessed. No significant fecal coliform recovery from the chlorinated or chloraminated effluent was observed, however the UV treated effluent demonstrated a 10-20 fold increase. These studies provide important information for wastewater treatment and for proper watershed management.

Indicator Bacterial Populations in the Las Vegas valley – Part II: Survivability and Resuscitation

Kameron Entrekin
University of Nevada at Las Vegas

Biosketch

(Not submitted)

Abstract

The Las Vegas Wash (LVW), a tributary to Lake Mead, is the only drainage point for the entire hydrographic basin. Contributing sources include groundwater, stormwater, urban runoff and 160 million gallons per day of tertiary-treated wastewater. High levels of fecal contamination are observed in the LVW. This is of concern as Lake Mead is the major source of drinking water for Las Vegas. We have conducted several studies to determine the sources of this microbial signal.

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Novel Sediment Traps Reveal Role of Suspended Sediment in *E. coli* Transport

Pamela Struffolino
University of Toledo, Lake Erie Center

Biosketch

Ms. Struffolino graduated in 1999 with a B.S. in Classical and Environmental Geology. She is currently a graduate student with the University of Toledo, where she will receive a M.S in Geology and a PhD in Microbial Ecology. For the last two years Ms. Struffolino has been working in partnership with US Geological Survey tracking bacterial pollution in the western basin of Lake Erie. Her primary focus has been on suspended and resuspended sediment and their role in bacterial pollution. In addition, she is working on identifying Escherichia coli in suspended sediments using genetic methods to determine the structure of *E. coli* populations.

Abstract

Beach closings or warnings due to bacterial pollution are common during the recreational season. Although bottom sediments have been shown to facilitate fecal coliform survival, the role of suspended sediments in facilitating fecal bacteria transport and high density is unknown. To determine the impact of suspended sediments on *E. coli* densities, sediment traps consisting of five sets of vertical cylinders attached to a stable base were deployed throughout Maumee Bay to collect suspended sediments from the water column. At approximately two-week intervals, trapped sediments, bottom sediments, and water were collected and analyzed for *E. coli* densities. *E. coli* densities in trapped sediments were significantly higher than those of bottom sediments and water ($p < 0.01$), indicating the potential for sediment-mediated *E. coli* transport and accumulation. To investigate the potential for sediment-mediated *E. coli* transport, the *E. coli* population structure in trapped- and bottom sediments from three trap locations was compared following DNA extraction and denaturing gradient gel electrophoresis (DGGE). The results showed that populations in trapped sediment were structurally distinct from those of the bottom sediment, confirming sediment-mediated transport of discrete *E. coli* populations throughout the Bay. Overall, our results suggest that while suspended sediments harbor differing densities of *E. coli* compared to bottom sediments and water, the populations associated with these sediments are composed of novel *E. coli* populations that are likely transported continuously throughout the Bay.

Advanced Source Identification Tool for Pathogen Pollution through Integrated Monitoring and Modeling

Craig Swanson
Applied Science Associates

Biosketch

Dr. Craig Swanson is a founder of and principal at Applied Science Associates, Inc., Narragansett, RI. He received his Ph.D. from the University of Rhode Island in Ocean Engineering. During the last 25 years he has been actively involved in the development and application of hydrodynamic, pollutant transport and fate, water quality and sediment transport models for rivers, lakes, estuarine, coastal and shelf use. Model application areas and associated field programs have included sites in both marine and freshwater environments.

Abstract

Recreational beaches and shellfish beds are often closed due to exceedances of pathogen water quality criteria indicative of potential human health risks. One such example is the closure of shellfish beds in the Southport Beach area of Southport Harbor on Long Island Sound that are impacted by elevated levels of fecal coliform bacteria. However, the location and relative contribution of bacteria sources that result in elevated levels of bacteria over the shellfish beds have not yet been characterized and quantified. Although new bacterial source tracking technologies such as DNA fingerprinting provide a promising solution their use is often limited due to cost and required expertise. An alternative and complementary approach is the use of advanced computer models combining well-designed monitoring programs that hindcast the likely source locations that would affect a specified resource area such as a beach or shellfish bed.

WQMAP, a GIS-based hydrodynamic and water quality mapping and modeling framework, can be used to identify the location of bacteria sources responsible for closure. The pollutant transport model uses particles that represent a specified mass of decaying bacteria, which can be run both forward and backward in time. In the forward mode, the model forecasts the evolution of pollutant plumes from specified source locations. In the backward mode, the model hindcasts the likely source strengths and source locations. Model output shows the spatial contours of the probability where bacteria originate that affect a given resource area. As an advanced source identification tool to support estuary restoration, the use of integrated monitoring and modeling facilitates identification of pathogen sources and prioritization of corrective efforts at those locations where the greatest positive impact on water quality improvement can be realized.

Treatment of Santa Ana River Water using Free-Water Surface and Subsurface-Flow Constructed Wetlands

Stephen Lyon
Orange County Water District

Biosketch

Stephen Lyon, Ph.D. is a senior scientist with the Orange County Water District (OCWD) in Fountain Valley, CA.

Dr. Lyon completed his undergraduate studies in Oceanography and Limnology at Humboldt State University in California and Uppsala University in Sweden. While working as a staff scientist with San Diego Region Water Reclamation Agency he completed his M.S. in Biology at San Diego State University. His doctoral studies were in the Department of Environmental Analysis and Design at the University of California, Irvine in the field of Microbial Ecology. He has worked in a variety of research positions dealing with domestic and agricultural wastewater, surface and ground-

water and the bioremediation of contaminated subsurface water. He has been with the OCWD since 1998 and runs the Field Research Laboratory in Anaheim, CA. His projects there include monitoring the 465 acre Prado Wetlands, the 1000 acre OCWD groundwater recharge system, subsurface flow constructed wetlands and various processes for improving the quality and quantity of water used in recharging the Orange County aquifer.

Abstract

The Orange County Water District (OCWD) in Fountain Valley, CA manages the groundwater basin that provides drinking water for approximately two million people. The basin is continuously recharged by water from the Santa Ana River (SAR). For three quarters of the year, the main source of water in the SAR is tertiary effluent from San Bernardino and Riverside Counties. OCWD maintains the 465-acre Prado Wetland to treat approximately half the flow of the SAR (60MGD). The Prado Wetland is a free-water-surface constructed wetland (FWS) characterized by open water, a variety of submerged and emergent aquatic plants and varying degrees of depth. There is a daily loading rate of approximately 12cm/day and a residence time of five to seven days. At the Field Research Laboratory in Anaheim, CA a series of experimental subsurface-flow constructed wetlands (SSF) is also treating SAR water. The gravel-based wetlands provides an approximate thousand-fold increase in surface area over FWS wetlands for the growth of bacterial biofilms which increases the rate of contaminant removal. Within the gravel matrix there are distinct oxygen rich (aerobic) and oxygen free (anaerobic) zones where specific microbial processes take place. The loading rates range from 16–130 cm/day with residence times of 0.2–1.7 days. The information gathered on both wetlands will include general water chemistry, pore water chemistry, sediment analysis, plant composition (C,N,P) and plant enzymes. The microbial analysis will include qualitative and quantitative molecular methods for total community analysis and the fate of specific pathogens.

Microbial Monitoring and Epidemiologic Study at Two Beach Sites

Samir Elmir
Miami Dade County Department of Health

Biosketch

Mr. Samir Elmir received his B.S. in Civil Engineering from Beirut University, his M.S. in Civil Engineering from the University of Miami and he is currently a PhD candidate in the School of Civil and Environmental Engineering at the University of Miami. Mr. Elmir is a licensed professional engineer in the State of Florida, a diplomat with the American Academy of Environmental Engineers and he is an active member on many environmental health and engineering groups. Mr. Elmir has been the director of environmental health and engineering division with the Miami-Dade County Health Department since 1993. During this period Mr. Elmir administered and implemented many regulatory environmental programs including the Florida beach Monitoring and Public Notification Program and the, Florida Safe Drinking Water Program.

Abstract

The use of microbial water quality indicators was evaluated in a pilot study at two beaches in Miami Dade County, Florida. These beaches were chosen due to their location within a sub-tropical environment, their close proximity to one another, and historical records which indicated significantly different water qualities. The pilot study consisted of the following: 1) an intensive water and sand quality sampling and testing effort, 2) a sanitary survey, and 3) a prospective cohort epidemiological study.

Human health was evaluated through an epidemiologic questionnaire administered to beach goers. 208 participants who swam at the beaches were interviewed by telephone 8-10 days after exposure, and asked about various gastro-intestinal, upper respiratory and skin ailments. The epidemiologic portion of the study did not support a strong

difference in health effects between the 2 study beaches. There was some indication that persons with multiple exposures to beaches might be at greater risk for reporting symptoms, suggesting a possible dose-response relationship. Contrary to what was expected, the number of reported symptoms and the microbial indicators did not positively correlate with one another, probably due to the lack of individual microbial exposure assessment and relatively small sample size.

Data collected during the spatially intense water sampling efforts indicated that the source of indicator microbes came from the shoreline with a hotspot in an area that was characterized by elevated indicator microbe concentrations in the sand. This hotspot was likely associated with limited flushing and tidal currents. The sanitary survey indicated that there is no point source of microbe contamination impacting the beach. Pets mainly dogs and birds, urban runoff, natural sources such as sand and weeds and people are the principle non-point source of microbe contamination documented at the site.

A future expanded study has been recently funded and initiated which will include: 1) a hydrodynamic modeling effort aimed at predicting indicator microbe concentrations to the water column due to transport and regrowth and 2) a randomized epidemiologic study with a larger number of participants and individual exposure measurement. Data from intensive field and controlled laboratory water and sand quality studies and a site sanitary survey update will be utilized to support this future study.

Health-Risks Associated with Fecal Contamination at a Great Lakes Beach

Tracie Jenkins
Michigan State University

Biosketch

Ms. Tracie Jenkins is a graduate assistant of crop and soil sciences in the College of Natural Resources at the Michigan State University. Ms. Jenkins received her B.S. in Environmental Biology from the University of Dayton in Ohio. She is currently completing her Master's Degree at MSU. Her research interests include developing novel microbial source tracking (MST) techniques using the bacterium Enterococcus faecalis.

Abstract

Human activities are primarily responsible for the degradation of water quality in the Great Lakes leading to both ecosystem and human health risks. In order to better understand the human health risks involved during recreational activities, the United States Environmental Protection Agency (EPA) is conducting epidemiological surveys at beaches across the United States. As part of the epidemiological beach survey, the EPA is examining enterococci levels and conducting surveys. In August 2003, the EPA surveyed Huntington Beach (Cleveland, Ohio) located on Lake Erie for six consecutive weeks. In order to enhance the water quality portion of the epidemiological study, this study evaluated the use of enterococci using source-tracking methodology and tested for the presence of enteric viruses. PCR primers designed to detect the enterococcal surface protein (esp) of *Enterococcus faecium* in only humans was used to determine whether the microorganisms were originating in sewage. Viral analysis was conducted using integrated cell culture and polymerase chain reaction (ICC-PCR). The viral portion of the study was conducted during four of the consecutive weekends, including Labor Day Weekend, while the source-tracking portion was conducted during the entire six weeks. The results of this study show that the presence of the human enterococci marker indicates that the risk of acquiring gastrointestinal illness at this beach is related to the presence of enterococci as a water quality indicator.

Preliminary Economic Analysis for Epidemiologic Recreational Water Studies

Elizabeth Sams
U.S. Environmental Protection Agency

Biosketch

Elizabeth Sams is an epidemiologist with the US Environmental Protection Agency, Epidemiology and Biomarkers Branch of the Human Studies Division. Ms. Sams received her B.S. in Business Management from West Virginia University and M.S. in Health Care Administration from California State University. She completed her internship at Community Health Systems, Inc. where she developed administrative financial and scientific research reports concerning local government public health problems. She has coordinated field research efforts for the NEEAR (National Epidemiological and Environmental Assessment of Recreational) Water Study for the last three years. Her main interests in research are epidemiologic studies and waterborne disease.

Abstract

Introduction

The National Epidemiological and Environmental Assessment of Recreational Water Study (NEEAR) offers a rare opportunity for researchers. The study's design involves the collection of health data before and after visiting the beach in conjunction with water quality data at the same beach. An additional component of health burden outcomes as a result of illness provides us with information about the social burden on individuals and the community in which they reside.

Methods

Participants were recruited in the beach area to enroll in the NEEAR Water Study. The enrollment portion of the survey tool asks for general information such as demographics, current illness, and other risk factors. A second portion of the survey was conducted as the household left the beach area for the day. Questions asked in this part included activities in the beach area and exposure factors.

The follow-up phone questionnaire (10-12 days later), questioned the household participant about specific health conditions encountered by the family after their visit to the beach. Symptoms of illness, diagnosis, impact of symptoms or illness on activities of daily living, and financial impact of treatment.

Results

Health burden analysis of beach goer health will be presented. Results for these basic study questions will include:

1. Can health burden impact be mathematically correlated with illness in a given beach goer population?
2. Is household disposable income and activities of daily living significantly reduced?
3. Does health burden differ by age, race, gender and other demographic variables?
4. How does illness from beach exposure impact work productivity?

Discussion

The recreational water health burden analysis and symptom-related expenses can enhance our knowledge of the true cost of recreational water pollution and play a role in setting public health policy. Because current tests for recreational water quality require at least 24 hours, real-time tests could reduce any health burden associated illness resulting from recreational water exposure.

This is an abstract of a proposed poster presentation and does not necessarily reflect the views or policy of the US EPA.

A Follow-up to the Santa Monica Bay Epidemiological Study: A Decade of Progress

Guangyu Wang
Santa Monica Bay Restoration Commission

Biosketch

Dr. Guangyu Wang is the staff scientist working for the Santa Monica Bay Restoration Commission. Dr. Wang received his Ph.D. in Biology from the University of California, Los Angeles. He worked for the Bay Commission for over 10 years and has extensive experience in environmental policy and planning addressing water quality issues, especially issues related to watershed management, storm water, and nonpoint source pollution control. Dr. Wang was the project manager for, and an author of the report on the land-mark Santa Monica Bay epidemiological study that establishes linkage between pollutant runoff and increase in swimmer's illness. He is currently a member of the State of California Clean Beach Task Force.

Abstract

In 1995, the Santa Monica Bay Restoration Commission successfully completed the landmark Santa Monica Bay Epidemiological Study. The study for the first time demonstrated the linkage between increased illnesses in swimmers and proximity to areas with contaminated runoff. Anticipating the demand for change that would occur following the release of the study findings, the Bay Commission seized upon the momentum and brought together key agencies and organizations to develop a post-study action agenda. The agenda included recommended steps to:

- Educate and advise the public about the health risk of swimming and surfing near flowing storm drains
- Identifying and eliminating pathogen sources
- Financing and implementing source control measures, and
- Incorporating the study findings into standards and monitoring programs.

The post-study action agenda were publicized in 1995, simultaneously with the finding of the epi-study. Since then, significant progress has been made in achieving the action agenda including construction of runoff diversion projects, revised beach warning and closure protocol, new state legislation, and earmarked state funding, etc. These achievements and lessons leaned will be discussed during the presentation.

Source-Tracking Tools for Understanding Fecal Contamination and Predicting Water Quality at a Lake Erie Beach

Donna Francy
U.S. Geological Survey, Water Resources Discipline

Biosketch

Ms. Donna Francy is a hydrologist with the U.S. Geological Survey, Water Resources Discipline, Ohio District Office. She received a bachelor's degree in Biology from Indiana University and a Master's degree in Environmental Science from Rice University, Houston, Texas. She has 15 years experience in environmental microbiology and prior to that worked as a clinical microbiologist. At the U.S. Geological Survey, Ms. Francy has served as project chief on several projects that involve methods and process affecting microbiological indicators and pathogens in the environment. These included studies that addressed recreational water quality in rivers and lakes, virus contamination in drinking-water supplies, or methods for monitoring protozoan and viral pathogens in streams. Recently, her main research focus has been on improving and developing monitoring methods and identifying sources of fecal contamination at Lake Erie beaches.

Abstract

Multiple lines of evidence and source-tracking methods were used to help identify sources of fecal contamination at Edgewater Beach, in Cleveland, Ohio. In several field studies, investigators determined the spatial distribution of *E. coli* in nearshore surveys and in lake-water samples collected within the bathing area. Temporary shallow piezometers were installed to determine the direction of ground-water flow and *E. coli* concentrations in foreshore sands. Two microbiological source-tracking methods were tested: determining the genotype of F-specific coliphage and the multiple antibiotic resistance (MAR) patterns of *E. coli* isolates.

The results from near shore surveys and lake-water sampling at Edgewater indicate that fecal contamination is most likely of local origin. Shallow ground-water flow directions were toward the lake during two piezometer studies. The lack of *E. coli* in shallow ground water >50 ft inland and *E. coli* spikes at seemingly random locations further supports a local source; this local source may be a surface source, such as bird excrement. Because coliphage were not found in six samples of fecally contaminated water, this method may not be a suitable source-tracking tool at Edgewater. More promising is the use MAR patterns to distinguish between contamination from humans and water fowl. In a small sampling at another Lake Erie beach, MAR indexes were able to distinguish gull fecal samples from sewage samples, and the MAR index for a bathing-water sample was similar to that of the gull fecal samples.

Rapid Determination of *E. coli* and Enterococci in Recreational Water using Defined Substrate Technology™

Gil Dichter
Idexx Laboratories

Biosketch

Mr. Gil Dichter is the World Wide Technical Support Manager, environmental for IDEXX laboratories. Mr. Dichter received his B.A. in Chemistry from Brooklyn College in New York and his MBA in Management from Marist College in New York. He has over 15 years experienced in the Pharmaceutical and Clinical Industry and for the past17 years experience in Microbiological Methods in the Water Industry. He is the Chair of ASTM D19-24 Methods for Water Microbiology and is a member of the sub-committee for Enzymatic Methods, HPC and Enterococci for Standard methods in Water and Waste Water. He is a member of AWWA, ASM, SFAM, ACS, ASTM, WEF and ASM

Abstract

Under the recently promulgated rule, "Guidelines Establishing Test Procedures for the Analysis of Pollutants: Analytical Methods for the Biological Pollutants in Ambient Water" (FR July 21st, 2003), Colilert®, Colilert-18® are approved for the testing of E.coli in fresh recreational waters and Enterolert™ is approved for testing enterococci in marine and fresh waters. Colilert, Colilert-18 and Enterolert are the only methods that are based upon DST.

E. coli species are a subset of coliform bacteria that is part of the normal intestinal flora of humans and animals. Enterococci is an enteric bacteria used to detect fecal contamination as well. These two bacteria show a direct correlation with swimming associated gastrointestinal illness, while fecal coliforms do not; this holds true for enterococci for marine waters and both *E. coli* and enterococci for fresh waters.

An analytical method should be based on criteria such as sensitivity, specificity and accuracy as well as being a rapid and easy method to perform. Data will be presented from a number of peer review papers as well as presentations made at scientific meeting to support these criteria

Immobilized DNA Probes to Rapidly Detect Toxic Dinoflagellates and Sewage-Indicating Bacteria

Kelly Goodwin, Ph.D.
National Oceanic and Atmospheric Administration (NOAA), Atlantic Oceanographic & Meteorological, Laboratories, Ocean Chemistry Division

Biosketch

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Abstract

A DNA hybridization assay in microtiter plate format was adapted to detect toxic dinoflagellates and fecal bacteria in coastal waters. The assay provided species-specific identification and simultaneous detection of multiple targets. The assay detected *K. brevis* in coastal waters collected from the Rookery Bay National Estuarine Research Reserve (NERR). Results were verified by species-specific PCR and sequence analysis. The presence/absence of *K. brevis* was consistent with microscopic observation. The assay yielded quick colorimetric results, employed a single hybridization temperature, and conserved the amount of genomic DNA utilized by using one set of PCR primers. The microplate assay provides a useful tool to quickly screen large sample sets for multiple target organisms.

Hybridization Based Detection of Fecal Bacteria

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Abstract

Traditional water quality assays have drawbacks in terms of accuracy and rapidity of detection of organisms. To better protect human health and economic interests, improved assays must be developed. We are testing the feasibility of the Luminex 100, a novel flow cytometer based DNA hybridization system, to detect fecal bacterial contaminants in recreational waters. This method consists of combinations of fluorescent beads covalently bound to capture probes. Target DNA is amplified and labeled with biotin. Upon hybridization, beads bearing target amplicons are classified by their spectral addresses. Detection of the amplicon is based on streptavidin coupled phycoerythrin fluorescence. We designed probes targeting the bacterial species and groups: *Escherichia coli*, *Enterococci faecalis*, *Bacteroides distasonis*, the *Bacteroides fragilis* group and the total coliform group. The assay is specific for the targeted organisms and can be completed in less than an hour following target DNA amplification. The Luminex technology provides a simple, accurate and rapid means of detection of targeted organisms. This high-throughput system allows detection of multiple organisms from a single sample through multiplexing of bead sets with different spectral addresses.

Using a Denaturing High Performance Liquid Chromatography System to Analyze Environmental Communities and their Constituents

Menu Leddy
Orange County Water District

Biosketch

Ms. Menu Leddy is a Senior Scientist at the Orange County Water District in the Research and Development Department. Ms. earned her Bachelor of Science degree in Biological Sciences from State University of New York at Stony Brook and her M.S. in Molecular Biology from California State University, Long Beach. She developed methods to enhance biodegradation of petroleum hydrocarbons and was able to characterize the genetic instability of hydrocarbon-degrading bacteria and how it influences bioreactor performance. For the past 5 years, she has been working on developing rapid molecular-based methods for detection and identification of microorganisms and pathogens present in groundwater and wastewater using the 16s ribosomal RNA (16s rRNA) gene. In addition, she has written software to mine 16s rRNA sequences from public databases. Her main research interests are focused on developing specific 16s rRNA primers and probes for the identification of pathogens in groundwater and wastewater.

Abstract

Analysis of environmental microbial populations using PCR often results in numerous similarly sized amplicons. These amplicons are then separated either by denaturing gradient gel electrophoresis (DGGE) or temperature gradient gel electrophoresis (TGGE), both of which rely on the differences in GC content of the DNA sequence. Alternatively, one can use Denaturing High Performance Liquid Chromatography (DHPLC), which uses both temperature and chemical denaturation to separate DNA fragments of similar size but polymorphic sequence. Due to its combination of methods, we propose that this technology can be used to rapidly and reproducibly analyze environmental microbial communities and their constituents. Total genomic DNA from environmental samples was extracted; a hypervariable region of the 16S rDNA was amplified, resulting in amplicons of approximately 400 bp in length, then separated using a DHPLC system (WAVE). We present the process of DHPLC analysis of unknown communities, describing the optimum temperature and gradient design. Our

results indicate that separation using this system has a number of advantages over DGGE, TGGE, and cloning. These include the direct application of PCR products onto the system without sample manipulation, and separation of individual amplicons within minutes. We demonstrate that DH-PLC analysis can be used to reproducibly analyze complex environmental microbial communities to identify specific organisms or pathogens for source tracking.

Prototype Testing of a Submersible Instrument to Detect Indicator Bacteria and Monitoring Rhode Island Coastal Waters

Heather Saffert
University of Rhode Island, Graduate School of Oceans

Biosketch

Ms. Heather Saffert is a doctoral candidate at the University of Rhode Island's Graduate School of Oceanography. Ms. Saffert received her B.A. in Biology from Wesleyan University in Middletown, Connecticut. As an undergraduate, she did research on salt marsh foraminifera with Dr. Ellen Thomas. Ms. Saffert then worked at Science Applications International Corporation for 4 years in Newport, RI as a marine scientist. In 2000, she identified an interdisciplinary research project with Dr. David Smith and Dr. Al Hanson and enrolled at URI in the oceanography program. Ms. Saffert was awarded a 2-year National Sea Grant Industrial Fellowship, and has worked with SubChem Systems, Inc., a small RI company, to develop and test a new submersible water quality instrument that will detect and quantify bacteria indicators.

Abstract

Health risks posed by fecal contamination at beaches are determined a day too late. With support from EPA Region I and others, we have begun testing prototypes of a new detector, the SubBio Analyzer. This instrument will be remotely deployed and directed to sample autonomously, perform analyses rapidly, and report results via the internet to managers. For the methodology, we are adapting commercially available, USEPA-approved enzyme-based media used to quantify bacteria easily by visual inspection. A bench-top detection system with novel electro-fluidics and miniaturized, sensitive electro-optics has significantly decreased the time to detection. LabVIEWTM software has been designed to control the instrument remotely with both automated and customized settings. A disinfection procedure between samples is being assessed. A submersible instrument capable of rapidly analyzing multiple bacterial indicators could serve as a warning system to water quality managers, so that beaches would be appropriately closed when a health risk is present and open when the water is safe. In preparation for deployment of the SubBio Analyzer and future comparative testing, we analyzed samples using standard laboratory methods during monitoring efforts in summer of 2004. Results from Greenwich Bay, Newport Navy Base, and the Providence River in Rhode Island show overall moderate to minimal levels of indicator bacteria during the sampling periods. Elevated numbers were observed in the northern section of the Providence River estuary and in Warwick and Apponaug Coves. Consistent with the 2001 EMPACT report, we noted some discrepancies among the indicators and tests used for determining alert/action rates.

Polymerase Chain Reaction (PCR) Technology in Visual Beach

Marirosa Molina
U.S. Environmental Protection Agency

Biosketch

Dr. Marirosa Molina is a Microbiologist with the U.S. Environmental Protection Agency in Athens, Georgia. She works in the Ecosystems Research Division, National Research Laboratory of the Office of Research and Development. Dr. Molina received her B.S. in Biology from the University of Puerto Rico, Mayaguez campus. She received a M.S. in Microbiology and a Ph.D. in Ecology from the University of Georgia. She has studied microbial communities in soils and sediments to determine the relationship between microbial community structure and the dynamics of carbon transformation. She is currently working on the evaluation of DNA-based molecular techniques in the area of microbial source tracking to determine sources of fecal contamination in aquatic ecosystems.

Abstract

In 2000, the US Congress passed the Beaches Environmental Assessment and Coastal Health Act under which the EPA has the mandate to manage all significant public beaches by 2008. As a result, EPA, USGS and NOAA are developing the Visual Beach program which consists of software equipped with descriptive, diagnostic, and prognostic tools and models to help health officials and the public understand, address, and ultimately prevent beach closures. One goal of the program is to provide end users, public health officials, environmental monitoring organizations, and other interested individuals with the information to understand, utilize, and benefit from new Real Time (RT)-PCR technology. This methodology allows identification and quantification of specific fecal indicator bacteria, such as enterococcus species and Escherichia coli, in two to three hours compared to 24 to 48 hours with conventional membrane filtration methods. In Visual Beach, the software component dedicated to RT-PCR input provides tools for compiling data and for accessing the latest advances in the methodology including quality control parameters, with the aim to achieve technological standardization across users. The PCR component also offers links designed to acquire information for conducting water monitoring programs, as well as guidance on the application of the results into other compartments of the program to obtain predictive information. Results show how a variety of simulated scenarios representing changes in environmental conditions alter the bacterial concentration and the distance that the plume travels on recreational beaches. The ultimate goal will be to use PCR results to reset initial and boundary conditions for the empirical and numerical bacterial decay and transport models planned for Visual Beach.

Disclaimer: Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

Visual Beach: Software for Achieving Beach Aesthetic and Public Health Protection

Walter Frick
U.S. Environmental Protection Agency

Biosketch

(Not submitted)

Abstract

The Beaches Environmental Assessment and Coastal Health Act of 2000 directs the EPA to assure that 100% of significant public beaches are managed by 2008. Under the Act EPA is devel-

oping a program to monitor beach water quality and strategies for timely notification of the public when bacterial contamination poses danger to bathers. EPA and other institutions, including USGS and NOAA, are developing the Visual Beach program, software to include descriptive, diagnostic, and prognostic tools and models to help health officials and the public to better understand, address, and ultimately prevent beach closures. Work on a prototype began in Spring, 2004. Seeking to support small and large communities alike, the prototype is organized into topical areas, tabs and sub-tabs, of increasing data and resource requirements. Its entry-level descriptive component helps users acquire maps and satellite or camcorder images and identify issues likely to be relevant to the local area, thus customizing Visual Beach to local constraints and conditions. It provides access to some public health data bases and recites procedures for communicating with the public. Diagnostic tools include data links for acquiring information on contaminant sources known to affect specific beaches. It is designed to display current conditions, including sunlight intensity, stream flows, and weather, and includes calculators for estimating bacterial mortality. A subtab is dedicated to emerging PCR technology. Finally, it includes prognostic tools: adaptable empirical models will be designed to be accessible to most communities while sophisticated hydrodynamic models will provide detailed beach condition forecasts for large urban areas.

A Comparison of Beach Visitor Preferences for Natural and Managerial Attributes Across Different Beach Types

Chris Ellis
East Carolina University

Biosketch

Chris Ellis is a Ph.D. candidate in the Coastal Resources Management Program at East Carolina University. Mr. Ellis received his B.S. and M.S. in Recreation and Leisure Studies from East Carolina University in Greenville, NC, where he is currently pursuing a Ph.D. in Coastal Resources Management. He has participated in numerous social science-related coastal research projects over the past several years. Such projects include an economic assessment of ecotourism sites along the Albemarle/Pamlico region of North Carolina, visitor use assessment at Cape Hatteras National Seashore, and estimating the non-commercial harvest of the North Carolina Blue Crab fishery. He is currently a graduate intern for the National Park Service, Social Science Program in Washington, DC.

Abstract

Introduction

Experience diversity is an important factor in people's coastal recreation and leisure pursuits. It is plausible that coastal management agencies are largely responsible for determining the recreational composition of a beach visitor's experience through site-specific rules and regulations that govern these areas. It is also likely that the same natural attributes such as wave size and beach width could entice some individuals while at the same time deter others from visiting. Considering the abundance and diversity of North Carolina beach areas, why do beach visitors go where they go? More specifically, do agency policies and regulations influence the beaches visited by coastal tourists?

Methods

Data was collected for this project from July 2, 2003 to November 2, 2003. A total of 672 visitor surveys were successfully conducted based on the desired initial sample size of 700 by means of a modified systematic sampling strategy. Seven North Carolina beaches were utilized as interview sites based on several site-specific natural, social, and managerial attributes. These areas represent the various jurisdictions that manage the North Carolina coast. Agencies include federal, state, and municipal (city/county) government agencies.

Questions were designed to demonstrate the full diversity of potential beach experiences. The questions included variables of perceptions of environmental quality, and perceived management value and efficiency. Beach visitors were asked to rate how important a series of individual beach attributes are to them when visiting a coastal recreation area. Secondly, the respondent rates the same variables based on how well they feel the site in question measures up. Gap scores between these measures were then analyzed for incongruities between importance preferences and actual performance attributes. Negative scores indicate that the performance of a particular attribute outweighs the importance level, where positive gap scores indicate a lower satisfaction rating among the sample population.

Results

Managerial attributes of adequate parking and water quality/environmental notifications were among the highest levels of importance to visitors across all sites. Natural attributes possessing high importance to visitors included the absence of litter, integrity of historical structures (lighthouses, etc.), wide beaches, and scenic beauty. Significant differences between beach sites were found in six of the nine natural attributes under observation. Those not possessing significance at the 0.05 level were natural beauty, minimal waves, and absence of litter. Significant differences were found in all managerial attributes across beach sites. This research suggests that while certain universal recreational beach preferences exist, different beaches offer significantly different physical and managerial environments which in turn lead to significantly different recreational experiences.

Massachusetts Beach Mapping Project – Technical and Practical Aspects

Tom Hinchliffe
Massachusetts Department of Public Health, Center for Environmental Health, Environmental Toxicology Program

Biosketch

Thomas Hinchliffe received a B.A. in Environmental Science and an M.A. in Energy and Environmental Analysis with a focus on Environmental Modeling from Boston University. His current position is a Senior Environmental Analyst for the Massachusetts Department of Public Health, Center for Environmental Health, Environmental Toxicology Program. His research interests include modeling health risks posed by environmental contamination and atmospheric modeling.

Abstract

A detailed Geographic Information System (GIS) layer for Massachusetts marine bathing beaches was developed by MDPH in collaboration with a consultant with experience in GIS, and with considerable assistance from local health officials in 60 coastal communities. No comprehensive GIS coverage for Massachusetts beaches existed before this effort. Color aerial photo maps, which highlighted sandy coastline, were prepared and were mailed to local health officials. Local health officials were asked to mark on the maps the specific boundaries of each known beach, the designations of each beach public or semi-public (and private if known), water sampling locations, posting locations, and the locations of access points. The marked up maps were returned to MDPH, and were used in the field for quality assurance/quality control by MDPH beach inspectors as they visited each beach to verify the locations marked on the maps and collect latitude and longitude points of those locations using a Global Positioning System (GPS) unit. The completed GIS layers contained detailed geographic information for over 500 marine bathing beaches in 60 coastal communities. Final maps were shared with environmental agencies as well as emergency management officials. Practical aspects of accomplishing this marine beach mapping project will be described.

Communicating Water Quality Hazards: Public Outreach and Education

Ellen Szarleta
Indiana University Northwest - SPEA

Biosketch

Ellen Szarleta is an assistant professor in the Division of Public and Environmental Affairs at Indiana University Northwest. Dr. Szarleta received her B.A. in Political Science from the State University of New York – Fredonia, a Ph.D. in Agricultural Economics from the University of Wisconsin – Madison and a J.D. from the University of Iowa. She has worked on environmental policy issues for 15 years in a variety of capacities including research scientist at Oak Ridge National Laboratory for two years, and many years in academia. For the last four years she has held the position of Magistrate, and most recently returned to Division of Public and Environmental Affairs. Her main research interests include risk communication, public participation, and the role of law in defining environmental alternatives.

Abstract

This paper examines the state of public knowledge regarding water quality hazards and the communication of water quality risks via signage. As a part of the state of Indiana's public notification program under the BEACH Act, a survey of beach users is being conducted on Lake Michigan beaches and a phone survey is being conducted of residents in the northwest Indiana region. This poster will present and discuss the surveys administered and the preliminary results. The objective of the research is to provide policy planners with insight on the most important factors influencing the public's perception of water quality hazards, and thus useful ways to improve communication with the public to encourage safe beach recreational activities will be explored.

Surfrider Foundation's Blue Water Task Force Program

Rick Wilson
Surfrider Foundation

Biosketch

Rick Wilson is Coastal Management Coordinator for Surfrider Foundation. Mr. Wilson has a B.S. degree in Chemical Engineering from Stanford University and a Masters degree in Business Administration from California State University, Long Beach. He is a Professional Chemical Engineer in California. He is also the chairman of the Laguna Beach Chapter of Surfrider Foundation. Rick joined the staff at Surfrider in October 2002 and his primary responsibilities are researching and writing Surfrider's annual State of the Beach Report and managing the Blue Water Task Force, Surfrider's citizen water quality monitoring network.

Abstract

The Blue Water Task Force (BWTF) is the Surfrider Foundation's water quality monitoring, education and advocacy program. It is utilized by our Chapters and members to alert citizens and officials in their communities about water quality problems and to work toward solutions. BWTF has demonstrated success by raising public awareness of coastal water pollution levels and precipitating the establishment of state and local government water quality monitoring programs in many communities where the program has been implemented.

BWTF was established with the following objectives:

- to provide concerned citizens with the opportunity for hands-on involvement with an environmental problem solving effort;
- to gather coastal water samples on a regular basis to determine pollution patterns in the near shore environment;
- to raise public awareness regarding the extent and severity of coastal water pollution;
- to use the data collected to bring polluters into compliance; and
- to develop a model program that could influence national legislation and enforcement.

Approximately 20 of Surfrider's 60 chapters along the West, East and Gulf coasts currently participate in the program. Our chapters implement the program in various ways; using chapter activists, community volunteers and school groups. Testing is typically done using EPA-approved methods developed by IDEXX for enterococci or *E. coli*, although some of our chapters are also testing water for additional water quality parameters.

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