Wednesday, April 13
10:20 a.m.–11:50 a.m.

Session 2:
Trends in Beach Management

The Broader Context of Beach Monitoring

John Wathen
U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, Standards and Health Protection Division

Abstract

The Beach Monitoring and Advisory Program is a public health protection measure, supported under the Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000, designed to provide information on the risk of illness from recreational water contact. This is accomplished through periodic water quality monitoring, issuing advisories and/or beach closure notices, and communicating the advisories to potential users of recreational waters. In addition to providing time-relevant water quality information about specific beaches, not only is exposure risk reduced by advisories, but states and local jurisdictions also are undertaking measures to address sources and improve water quality based on monitoring information. The scope of the benefits of beach monitoring go well beyond avoiding illness, encompassing a range of beneficial outcomes not readily anticipated from the straightforward act of periodically determining water quality. At beaches where sources are mitigated, water quality is improved, public health is better protected, and local jurisdictions are seeing economic benefits that include increased beach usage. This presentation points to locations around the country where these improvements have occurred and highlights the broader public and economic benefits that can result from improved conditions in waters adjacent to our beaches.

Biosketch

John Wathen is a senior science advisor for fish and beach programs in the Standards and Health Protection Division of the Office of Science and Technology in the U.S. Environmental Protection Agency's (EPA's) Office of Water. He had served as assistant chief and as acting chief of the Fish, Shellfish, Beaches and Outreach Branch since coming to EPA in 2005, until it was combined recently with the National Standards Branch. Mr. Wathen received his bachelor of arts degree in geology from Northeastern University and his master of science degree in earth sciences from the University of New Hampshire. He worked as a consulting hydrogeologist for 15 years, primarily in northern New England; and served as the southern Maine regional director of the Maine Department of Environmental Protection 2000–2005. Mr. Wathen provides technical support to the Beach Environmental Assessment, Communication, and Health (BEACH) Act monitoring and advisory program, National Fish Advisory Program, and Office of Water's fish tissue contaminant studies, focusing on human health implications. He is a Maine-certified geologist and a registered geologist in Kentucky.

The Broader Context of Beach Monitoring:

Considering health benefits, environmental, recreational, and economic value

EPA Recreational Waters Conference
New Orleans, LA
April 15, 2016

John Wathen, U.S. EPA

EPA

Disclaimer

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Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

2 EPA

Beaches are good for us

- Beaches encourage families to be physically active;
- Increase social and family interaction;
- Families engage with nature;
- Beaches are associated with fun and stress relief.

Ashbullby et al., 2013. Health and Place 23, 138-147

3 EPA

Our session is *"Trends in Beach Management"*

- The evolution of the Beach Program describes a clear trend
- From elements described in the Beach Act of 2000- *monitoring and assessment of coastal recreation waters adjacent to beaches or similar points of access that are used by the public for attainment of applicable water quality standards for pathogens and pathogen indicators;* and *"the prompt notification of the public of any exceeding of or likelihood of exceeding applicable water quality standards"*
- To an integral and dynamic element of the Clean Water Act mechanism

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Beach Monitoring and Advisory Program is a public health protection measure

- Provides information on the risk of illness from recreational water contact.
- Provides time-relevant water quality information about specific beaches.
- Allows the recreating public to make informed choices on where, when, and whether to go to the beach.

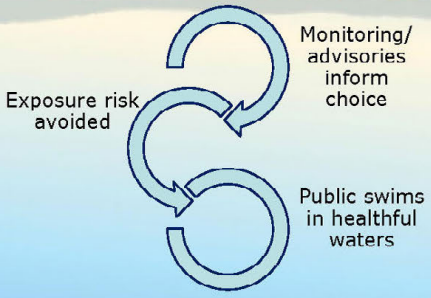
5 EPA

We welcomed the Surgeon General's thoughts on public health protection

Photo thanks to USPHS

6 EPA

We all know the Basic Paradigm



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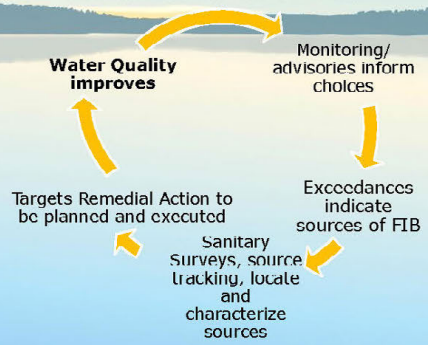
But wait… there's more



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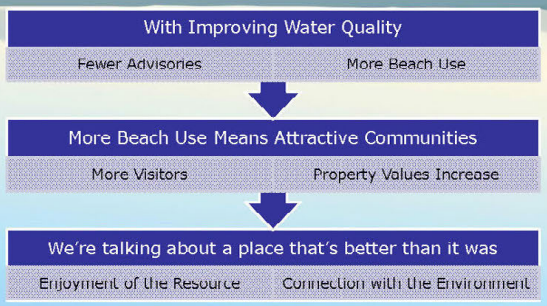
And that's not the end of it…



9 EPA

These outcomes documented

- Beaches that have been mitigated have improved water quality;
- Public health is better protected; and
- The towns/cities are seeing economic benefits from higher beach attendance.
- Monitoring of waters adjacent to beaches was the initiating event for undertaking many measures to improve water quality.

10 EPA

Case in point: North Beach –Racine, WI

- Initially, BEACH Act monitoring resulted in an average of 32 advisories per season (2000 –2004)
- Sanitary surveys and expanded monitoring identified pollution source and led to remediation
- Advisories were reduced to an average of 5.5 per season 2005 –2015
- First site in USA to use qPCR for BEACH Act closure decisions

11 EPA

Benefit to the Community

- Number of daily beach visitors has
- increased 4-fold (2005 –2015)
- 200,000 beach visits in 2015 (almost 3 times the population of Racine)
- $5,000,000 generated annually based on beach visits, event-based revenue, and improved housing stock
- Source of community pride

12 EPA

See for yourself

Photos and data thanks to Julie Kinzelman

13 EPA

Direct quote from Julie Kinzelman:

Monitoring is like preventative maintenance on your car or routine health screenings. It helps communities identify potential problems before they are out of control, and the impacts to human health and the environment are significant. This important surveillance allows communities to take care of problems before the cost of remediation becomes insurmountable. ***Like the old adage, an ounce of prevention is worth a pound of cure.***

That's the same thing the Surgeon General said !

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There are plenty of other examples of remediation in the Great Lakes

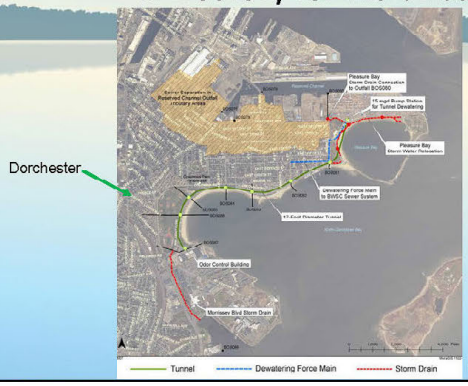
For more:

- See Sarah U'Ren's and Greg Kleinheinz's presentations on Friday Morning!

(Plug)

15 EPA

It's all over the country- in Boston, for instance…



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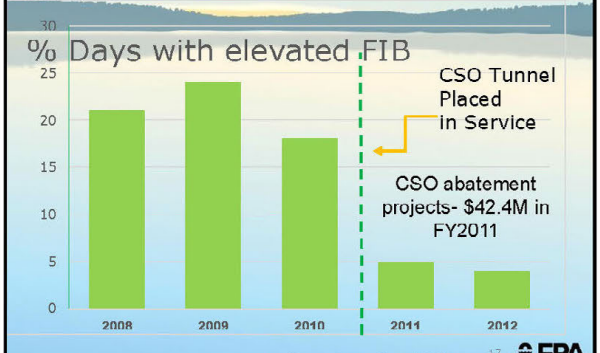
MWRA COMPLETES OVERFLOW TUNNEL IN SOUTH BOSTON

Beaches Will Be Among The Cleanest In The Country



Photos and data from MWRA

17 EPA

Effects of the installation of porous pavement adjacent to beaches in Provincetown, MA with Section 319 grant funds

Bathing Beach Closures[1] - Commercial Street Phases I and II
Town of Provincetown, Massachusetts

Phase	Beach Sampling Point	No. of Beach Closures per Bathing Beach Season								
		2007	2008	2009	2010	2011	2012	2013	2014	2015
Phase I	Johnson Street	1	0	1	3	1	1	0	1	0
	333 Commercial Street	2	1	3	2	1	1	0	0	0
	Ryder Beach (Middle)	0	1	1	2	2	3	0	0	0
	Court Street	1	3	0	3	1	1	0	0	0
Phase II	Atlantic Avenue	1	3	5	2	0	1	1	0	0
	ILW of C.G. Station	3	2	1	1	0	1	1	0	0
	West End Lot	2	3	1	3	2	1	1	2	0

Notes.
(1) Data from Commonwealth of Massachusetts Department of Public Health, Bureau of Environmental Health: http://mass.digitalhealthdepartment.com/public_21beaches.cfm
(2) Closures are based on the exceedance of the MA enterococcus bacterial standard of 104 cfu/100 mL.
(3) Years highlighted in green indicate porous pavement was in place for those bathing seasons.

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Maine Healthy Beaches -Source Tracking and Remediation in Maine

- Beach WQ indicator exceedances from sources in the Goosefare Brook watershed in Saco/Old Orchard Beach;
- Identified Sources, eliminated them with sewer and stormwater upgrades; and implemented an
- **Integrated watershed management plan**
- Many other beaches investigated and remediated
- More about their M.O. in Friday.

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CA CLEAN BEACHES INITIATIVE GRANT PROGRAM

- CBI Grant Program has provided about $100 million from voter-approved bonds
- Includes ~100 projects since it was started under the 2001 Budget Act
- Arroyo Burro Beach, Colwell Beach, Doheny Beach, Lovers Point Beach, Topanga Beach MST studies
- Numerous implementation projects underway

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Great Lakes Shoreline Cities Green Infrastructure Grants-2016

- Great Lakes Restoration Initiative grants of up to $175K available for Green Infrastructure Projects that will improve water quality at beaches
- Plans based on needs from sanitary surveys or WQ monitoring results
- No cost-share required for smaller communities

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Economics Studies: Water Quality Conditions under Future Scenarios

- **Scenario 1: Improvement at 10% of Lakes with Poor or Fair Clarity**
- **Scenario 2: Decline at 10% of Lakes with Good Clarity.**
- **Scenario 3: Decline at 10% of Lakes with Good and Fair Clarity.**

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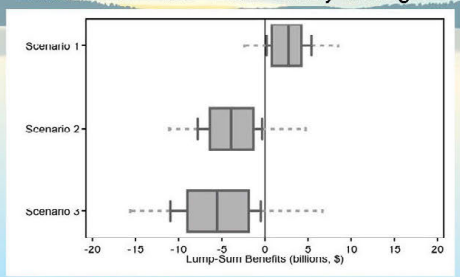
Potential Range of National Benefits to Property Values from Lake Water Clarity Changes



Notes: The figure shows the range of U.S. total discounted benefits estimated under each scenario. The dashed gray lines represent a 95% confidence interval for estimated national benefits. The solid lines represent a 90% confidence interval. The shaded bar area represents a 50% confidence interval. The single heavy solid line in the middle of the shaded bar area represents the average benefit estimate

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Wrap-up: What does Beach Monitoring REALLY do?

- Monitoring/advisories inform choice.
- Exceedances indicate sources of FIB.
- Remedial actions target sources.
- Water quality then improves.
- There is more beach use.
- Communities are enhanced.
- Property values increase.
- More beach use increases our connection with the Environment and makes us healthier.

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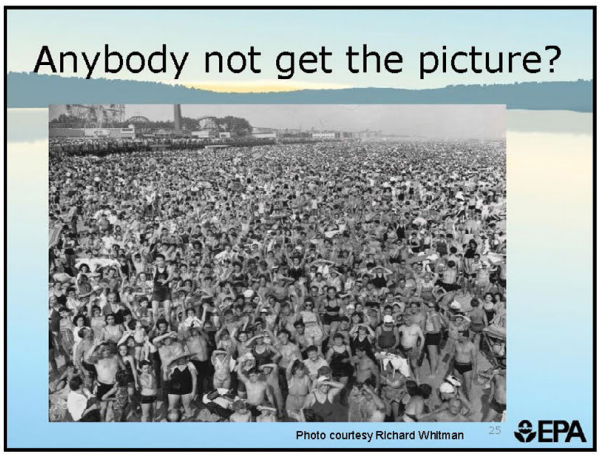
Anybody not get the picture?
Photo courtesy Richard Whitman
25
EPA

Thanks for your attention and for coming to our EPA Recreational Waters/Beaches Conference.
Any Questions?
Photo: Keri Kaczor MHB
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Providing and Promoting Recreational Water Quality Information through Mobile and Social Technology

Trevor McProud
New York City Department of Health and Mental Hygiene

Abstract

In an effort to understand and improve the way New York City beachgoers receive and react to water quality notifications, the Department of Health and Mental Hygiene Beach Program undertook a research effort in 2013 that included intercept surveys and focus group testing. Interviews were conducted with more than 575 members of the public. The research found that most beachgoers receive their information via television and Internet, and that those methods, along with email, text notification, and smartphone applications, were the preferred alternatives for future communication. Those findings are similar to national evaluations of U.S. Environmental Protection Agency BEACH Act programs, highlighting a gap of information delivery between the public highly valuing text message and smartphone applications and the department's current reliance on signage and browser-based retrieval. In response, the program developed a text-for-information service that provides current beach water quality conditions and, for subscribers, active notification of beach-related announcements. Through well-designed print and social media campaigns, the Know Before You Go text service now has over 5,000 active subscribers. From the results of its research, the department was able to identify ways in which it could improve the Beach Program by more effectively communicating the current status of recreational water quality along with the potential health impacts of recreating in those conditions.

Biosketch

Mr. Trevor McProud is a research scientist with the Bureau of Environmental Sciences and Engineering of the New York City Department of Health and Mental Hygiene. He has worked with the bureau's Recreational Waters and Beach Program for more than 6 years. He also is highly involved in the bureau's other efforts to manage public health risks from the built and natural environments, including the Drinking Water Supply Oversight and Surveillance Program. Mr. McProud received his master's degree in environmental science and engineering with a specialization in water resources management from the Bren School of Environmental Science and Management at the University of California, Santa Barbara.

2016 EPA Recreational Waters Conference Trends in Beach Management

Providing and Promoting
Recreational Water Quality Information
Through Mobile and Social Technology

Trevor McProud, MESM, New York City Department of Health

Overview – New York City Beaches

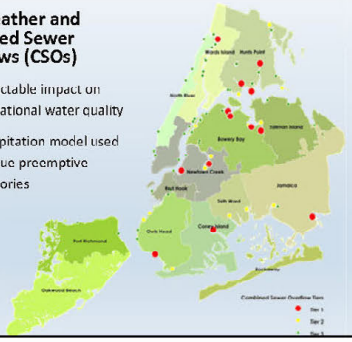
- 23 permitted beaches in NYC
  - 15 privately owned
  - 8 run by the NYC Department of Parks and Recreation (DPR)
- Average of 15 million visitors to DPR beaches

Overview – NYC Beach Management

- **NYC Department of Health and Mental Hygiene (DOHMH)**
  - Primary implementation of EPA BEACH Act and NY State Sanitary Code
  - New York City Health Code for Bathing Beaches
- **Routine Beach Water Quality Monitoring (DOHMH)**
  - Bathing Season from Memorial Weekend to Labor Day
  - Weekly sampling from April to September, 24 hr. turn around
  - Approximately 1,500 samples are collected during a typical season
  - Weekly sampling for Tiers I and II beaches, Bi-Weekly for Tier III beaches and resampling as needed

Overview – NYC Wastewater Treatment and CSOs

- **Wet Weather and Combined Sewer Overflows (CSOs)**
  - Predictable impact on recreational water quality
  - Precipitation model used to issue preemptive advisories



Overview – NYC Beach Notifications

- **Historical Number of Annual Notifications**
  - An average of 378 total Closure and Advisory days across all beaches over the last two years (303 private, 15 public)
  - Out of a total of approximately 2360 total beach days
- **Historical Notifications: On-site Signs, Call Service, Web Post:**

NYC Beach Program Assessment Objectives

- **Protect public health**
- **Improve the Beach Management Program**
- **Provide useful, actionable information for beachgoers**
- **Evaluate the effectiveness of different water quality notification methods**
- **Assess the public's current understanding and awareness of water quality issues**

NYC Beach Program Assessment – Methods

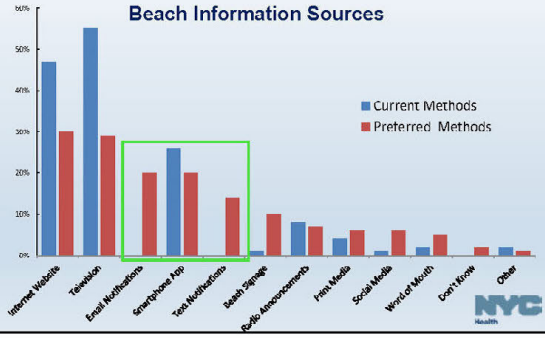
- **Beachgoer Intercept Survey (N=557, Refusal Rate 57%)**
  - Systematic cluster sampling of beachgoers, ≥ 18 years old
  - 5 NYC public beaches from July 3rd to August 25th 2013
  - 26 Open-ended questions, 8 topical sections

- **Beachgoer Focus Group (N=21)**
  - 2 sessions conducted by specialized firm
  - Participants selected to be demographically representative + visited a NYC beach within last 2 years

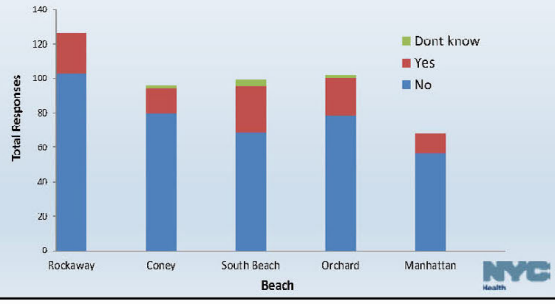
NYC Beach Program Assessment – Results

- **Demographics**
  - Age and Gender
    - 65% female
    - 18 - 65+ years old, average of 46-64 years old
  - Education Level
    - 5% Some or No High School,21% High School, 18% Some College, 33% Undergraduate, 15% Graduate School
- **Beach Behavior & Notifications**
  - 56% did not check for any beach related information before going to the beach
  - 70% have never seen notifications or any other signage posted at NYC public beaches.
  - 69% did not feel that that they had enough information to know if the water at New York City public beaches was safe for swimming

NYC Beach Program Assessment – Results



NYC Beach Program Assessment – Results



NYC Beach Program Assessment – Results

Signage Locations:

NYC Beach Program Assessment – Results

- **Lack of information leads to misperceptions of what causes risk from recreational water.** Question: what causes water pollution?
  - *"If it looks dirty, like a lot of seaweed", "sometimes people throw garbage in the water", "Only when there's a storm"*
- **Signage did not provide information regarding the cause or risks of poor water quality**
  - *"I don't think its clear enough"*
  - *"... If there was an explanation, like there [are] bacteria in the water"*
  - *"Bathing is like laying on the beach and bathing in the sun", "Bathing could mean cleaning"*
  - *"[Advisory is] a soft word", "Instead of Advisory, the words 'warning' or 'danger'"*

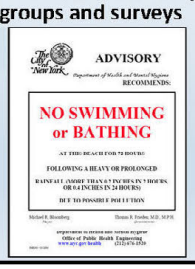
NYC Beach Program Assessment – Results

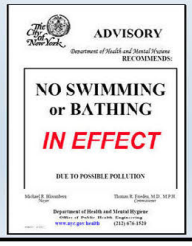
- A gap between current methods of providing information and the public preferences/needs
- A need to develop program materials that incorporated current, standardized designs
- A need to develop useful, relevant methods of providing information (mobile phones, digital formats)
- Conduct outreach through "non-traditional" methods

NYC Beach Program Improvement – Signs

- Visibility and clarity of notification signs through universal colors and symbols
- Preference and comprehension confirmed by focus groups and surveys

Previous Signs





NYC Beach Program Improvement – Signs

- Clear Information about cause and risk of water quality:

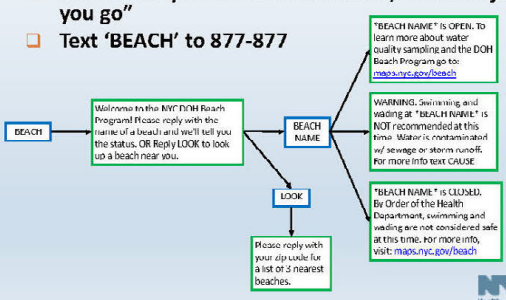
Water is contaminated with sewage or storm runoff, which may cause vomiting, diarrhea, respiratory illness or infections. Children, pregnant women, the elderly and the chronically ill are at higher risk.

- "Call to action" guidance for beachgoers:

For beach status updates: Text BEACH to 877-877 or call 311

NYC Beach Program Improvement – Mobile

- Provide easy access to information, "know *before* you go"
- Text 'BEACH' to 877-877



NYC Beach Program Improvement – Outreach

- **Social Media Promotion** – Based on demographics of likely beachgoers
- **Traditional advertising** – Strategically Located near beaches

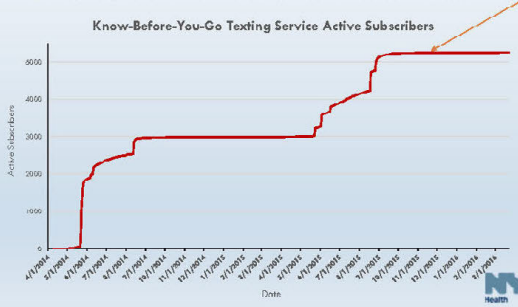
Facebook:

Twitter:

Staten Island Ferry Terminal:

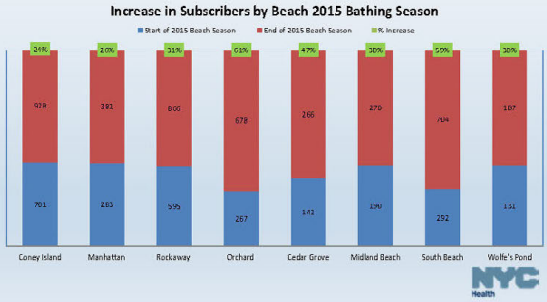
NYC Beach Program Improvement – Success

- Sustained rate of text service subscribers, over 5,250



NYC Beach Program Improvement – Success

- Subscription to all NYC beaches served



NYC Beach Program Improvement – Future

- Encourage texting service enrollment and utilization
- Engage beach going public with safety messages and promotion of City resources
- Develop and plan texting service as at-the-ready tool to reach localized/specified communities in urgent water quality situations

NYC Beach Program Improvement

- Thank you
- Acknowledgments
  - Christopher Boyd
  - Li Huang, P.E
  - Amanda Levy, MS,MPH
  - Davida Judelson, MPH

Office of Public Health Engineering
Bureau of Environmental Science and Engineering
NYC Department of Health

Monitoring, Detection, and Management of Hazardous Algal Blooms in Freshwater Lakes East of San Francisco Bay

Matthew Graul
East Bay Regional Park District

Abstract

The East Bay Regional Park District maintains a diverse system of regional open space parks and trails in Alameda and Contra Costa counties east of San Francisco Bay. The park system comprises 120,000 acres in 65 parks. The district operates and manages five freshwater lakes to provide recreational swimming, boating, and fishing opportunities. Park resource managers had never before seen hazardous algal blooms (HABs) in their lakes, but in 2014 they recorded three. The blooms in Lake Temescal in Oakland resulted in closure for approximately 9 weeks over the summer and fall of 2014. During 2015, the district experienced HABs in four of its lakes. Each of those lakes was closed to recreational swimming for approximately 2½ months due to the presence of algal toxins.

In response to the recurring HABs, the district has developed a comprehensive monitoring, assessment, and notification plan in cooperation with San Francisco Bay Regional Water Quality Control Board and U.S. Environmental Protection Agency Region 9 staff. Additionally, water quality managers from the park district have partnered with local agencies and universities to conduct nutrient source analysis studies and develop nutrient control strategies to reduce bloom formation and persistence. The focus of this presentation will be to discuss the recreational impacts of HABs and the district's water quality monitoring program to provide early detection and public notification when hazardous conditions exist. Additionally, updates on the results of ongoing nutrient source analysis studies will be presented and progress on the development and implementation of nutrient management programs will be discussed.

Biosketch

Mr. Matthew Graul is the chief of stewardship for the East Bay Regional Park District, which is headquartered in Oakland, California. The district operates 120,000 acres of open space parks in Alameda and Contra Costa counties. Mr. Graul holds a bachelor of science degree in environmental engineering and has completed graduate course work in geography, environmental management, and fluvial geomorphology. He has worked in the fields of natural resource management, water quality protection, and wetland and creek restoration for almost 20 years. He was employed by the San Francisco Bay Regional Water Quality Control Board for 5 years in the Watershed Division reviewing creek and wetland restoration plans, issuing Clean Water Act permits, and developing and implementing National Pollutant Discharge Elimination System stormwater regulations. Mr. Graul's professional experience has been focused on creek and wetland restoration, beach water quality, stormwater management, drinking water treatment, and environmental and regulatory compliance. In his current position, he is responsible for overseeing the natural resource management programs for the East Bay Regional Park District and manages the Wildlife, Wildland Vegetation, Water Management, Fisheries Management, and Integrated Pest Management departments.

Digging in: Understanding the Causes, Impacts, and How Best to Address Excessive Seaweed Accumulation on Maine's Coastal Beaches

Keri Kaczor
University of Maine Cooperative Extension, Maine Sea Grant

Abstract

Over the past 2 years, there's been a rise in reports of increased amounts of cast seaweed on Maine's coastal beaches. When mounds of seaweed cover valued beaches during the state's short summer season, important factors must be considered when mapping the best course of action: water quality, public health, aesthetics, tourist economies, ecosystem health, and laws that are meant to preserve the integrity of these environments. Physical and biological factors are causing the apparent increase, yet the phenomenon is not well documented or understood. Municipalities have been challenged by the aesthetics, impacts on water quality, and how best to manage the mounds. The public is generally outraged by the negative impacts on their beach experience and is overwhelming municipalities with complaints. Detached seaweed cast onto the beach warms in the sun, allowing bacteria to persist and even multiply in seaweed mats and neighboring sand. Water quality can be impaired when the cast seaweed/sand is resuspended in the water column. Management often requires a multifaceted approach as simply raking or waiting for the tides to wash the seaweed away can be ineffective as it can return on the next tidal cycle. There also are important site-specific management considerations, for example, if the area falls within a coastal sand dune system, communities can move but not remove the seaweed from the system. The seaweed issue has prompted research, legislation, and adaptive beach management plans to better understand and address the impacts of cast seaweed on coastal beaches.

Biosketch

Ms. Keri Kaczor is the coordinator of the Maine Healthy Beaches Program, an effort to monitor water quality and protect public health on Maine's coastal beaches. She received her bachelor of science degree in zoology and an environmental studies certificate from the University of Wisconsin-Madison, and her master of science degree in marine policy from the University of Maine (UMaine). Ms. Kaczor is a member of the Marine Extension Team, a collaboration between UMaine's Sea Grant College Program and Cooperative Extension that provides educational and applied research programs in coastal community development, ecosystem health, fisheries, aquaculture, and tourism. For the past 13 years, Ms. Kaczor has worked on environmental monitoring, science literacy, and stewardship projects in Maine.

Digging in: understanding the causes, impacts, and how best to address excessive seaweed accumulation on Maine's coastal beaches

U.S. EPA Recreational Waters Conference

Keri Kaczor
UMaine Coop. Extension
/Maine Sea Grant

April 13, 2016

Funding provided by: U.S. EPA/Maine DEP

Healthy beaches are valuable

- Coastal tourism/recreation- $2.5 billion to Maine's gross domestic product [1]
- York County- 11.5 million+ visitors, contributing > $ 1.6 billion to local economies.[2]

Gary Curtis

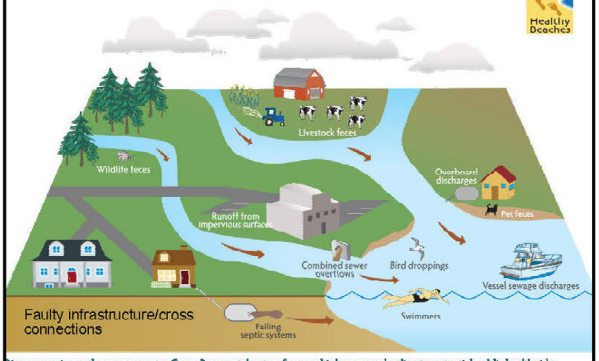
[1] http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp

[2] 2015 Regional Tourism Impact Estimate; Maine Office of Tourism Visitor Tracking Research 2014 Calendar Year Annual Report

Healthy beaches are valuable

Bell et. al. 2016 2016 MHB Survey Report. School of Economics. University of Maine

Coastal beaches are complex systems



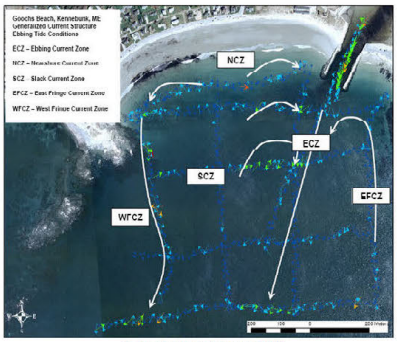
Disease-causing pathogens can enter Casco Bay coastal waters from multiple sources, leading to potential public health risks.

Fecal indicator bacteria are limited

- Relationship to pathogens/human health risk?
- Can persist and regrow
- Extreme variability
- Next day results

Keri Kaczor

Impact of seaweed on water quality



Maine Geological Survey 2008

MAINE Healthy Beaches

Seacoastonline.com

Seaweed invasion poses challenges

By Deborah McDermott
dmcdermott@seacoastonline.com

Posted Aug. 4, 2015 at 10:12 PM

YORK – Seaweed. In the middle of sun
York's beaches. Almost nothing else ca
the phone to ring off the hook more of
office of Parks and Recreation Departm
director Mike Sullivan.

"The first lecture I get is how importan
are to our economy," said Sullivan. "I l
them. Some people who call me are he
a week, and it ends up to be a week w
seaweed on Long Sands Beach. What I

Zoom

MAINE Healthy Beaches

Courier (Biddeford-Saco-OOB) — Mainely Media

Seaweed situation plaguee beach

By Duke Harrington and Molly Lovell Keeley

BIDDEFORD POOL — The surge of seaweed that washed ashore last week on the beach in Biddeford Pool may not be uncommon, but by volume, it was unusual.

"I've been here 35 years and I've never seen anything like it," said the city's public works director, Guy Casavant, on Monday.

Enlarge Map

A storm Sunday, June 28, brought in loads of seaweed to the Bath House in Biddeford Pool. Residents have been in touch with city officials about what can be done to remove it, but officials have said it would take a permit from the state. As of Monday, July 6, the tides were doing their job removing the seaweed. (Molly Lovell Keely photo)

"The amount of seaweed that got deposited with that storm a week ago Sunday (June 28) was fairly significant — I've never seen that much seaweed left over after a storm — but it's not all that unprecedented. We get some wash-up after just about any storm."

Unprecedented or not, the deluge certainly catered to the attention of locals.

Normand Morin of Biddeford treats Biddeford Pool's Bath House as its own community within the city. He greets newcomers and helps people carry coolers onto the beach. He even pushes strollers for those whose arms are full. His daughter, Jessica Aberle, who often accompanies him to the beach, refers to him as "the mayor."

Aberle said she posted on the Facebook page of Mayor Alan Casavant to

"I've been here 35 years and I've never seen anything like it"

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http://www.seagrant.umaine.edu/node/855

Maine Sea Grant
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Seaweed Accumulation on Maine's Coastal Beaches

Wed, 08/19/2015 - 13.38 — Keri Kaczor

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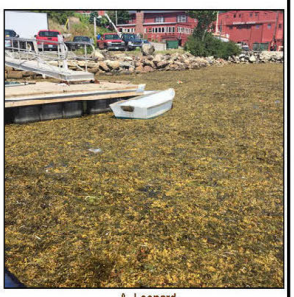
What's likely causing it?

Physical oceanographic factors:

- Wind direction
- Spring tides
- Neap tides
- Surf



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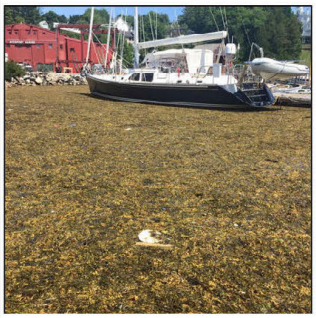
What's likely causing it?



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Biological factors:

- Warmer waters
- Introduced species
- Excess nutrients (pollution)

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Management

- System ecology
- Protective rules
- Legislation
- Beach cleaning

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Management

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Management

Barber Surf Rake "Chicago Style" www.hbarber.com/

Applied research opportunities

- The process of being cast and warmed matters
- Inside mounds temp. and bacteria levels are high.
- Re-suspension- temporary issue
- Regrowth only or health risk?

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QUESTIONS?

The Changing Geographic Distribution of Climate-Sensitive Pathogens in Recreational Water

Jonathan Yoder
Centers for Disease Control and Prevention

Abstract

The U.S. Centers for Disease Control and Prevention (CDC) partners with state public health agencies to monitor the occurrence and geographic distribution of individual cases and outbreaks of disease associated with coastal and inland recreational water exposures, including illnesses caused by pathogens that might be affected by temperature increases or other factors related to climate change. Historically, cases of primary amebic meningoencephalitis (PAM) caused by Naegleria fowleri were limited to fresh water exposures in southern-tier states; however, recent data suggest that there is an increasing northward geographic distribution. Since 2010, a total of five PAM cases have been reported from three northern states (Kansas [2011, 2014], Indiana [2012], and Minnesota [2010, 2012]). Health data from CDC's Vibrio surveillance system, as well as environmental data sources, confirm that pathogenic Vibrio species have become established further north than historically observed, extending up to the west coast of Alaska and the east coast of the Chesapeake Bay in Virginia. Successful public health surveillance, prevention, and control of diseases and outbreaks caused by climate-sensitive waterborne pathogens will require additional expertise, resources, and partnerships among beach management, epidemiology, environmental health and health communication professionals. CDC is collaborating with state and federal partners to support this work, expanding its suite of online resources to include pathogen-specific content (e.g., Naegleria website), and building overall waterborne disease and prevention capacity in the United States.

Biosketch

Jonathan S. Yoder, MSW, MPH is an epidemiologist and the acting branch chief for the Waterborne Disease Prevention Branch in the National Center for Emerging Zoonotic and Infectious Diseases (NCEZID) at the Centers for Disease Control and Prevention (CDC). Mr. Yoder received his graduate degrees from the University of South Florida. He joined CDC as a Public Health Prevention Service fellow in 2003, and in 2004, was assigned to the Illinois Department of Public Health to assist state and local health departments with disease surveillance and outbreak investigations. In 2006, Mr. Yoder began coordinating CDC's Waterborne Disease and Outbreak Surveillance System. He has more than a decade of experience in responding to waterborne disease outbreaks and emergencies, including investigations and response at local, state, and federal public health agencies. He has participated in or led investigations of waterborne disease and outbreaks associated with drinking water and recreational water, including *Cryptosporidium* in pools, *Naegleria fowleri* in tap water, and multistate outbreaks of Acanthamoeba keratitis associated with contact lens wear. Previous work includes summarizing epidemiologic data on waterborne disease outbreaks and pathogens such as *Cryptosporidium*, *Giardia*, and the free-living amebae *Acanthamoeba*, *Balamuthia*, and *Naegleria fowleri*. Currently, Mr. Yoder is the water preparedness and response coordinator for CDC/NCEZID, working to develop and coordinate waterborne disease outbreak and response activities (e.g., developing resources and guidance for state and local health departments).

Question & Answer Session

Question 1
Phil Scanlan: For Jonathan [Yoder]. People talk about a canary in a coalmine. I was looking at mass marine kill-offs in the U.S. and it seems it would be useful to analyze those deaths to get ahead of human deaths. Is CDC [Centers for Disease Control and Prevention] or anyone looking at that? The number of deaths seem high.

Answer 1
Jonathan Yoder: Yes, that is a good question; those are the species most impacted by that. We should be investing and getting data from fish and wildlife services and from veterinarians, and doing more testing. I welcome feedback from others on how to address these climate change impacts.

Comment 1
Phil Scanlan: The first chapter of my book covers this.

Question 2
Sara Hisel-McCoy: For Trevor [McProud]. Do you have plans or have you done follow up on what's the most effective, the most bang for the buck for communities, for their resources?

Answer 2
Trevor McProud: It is challenging to do it on top of our beach program, but we plan to do more surveys. As far as what is the most effective—the texting platform is the cheapest out of what we did. There is an online service that is cheap or free. Getting that service working is easy in terms of resources. Signs were helped by others, and they are shown in EPA's National Beach Guidance document. We are willing to provide those or give help to others for developing their signs.

Question 3
Suzanne Young: I am curious about the extended scope of secondary contact recreation throughout the city where we know there are CSOs [combined sewer overflows], and working with others for protection and outreach.

Answer 3
Trevor McProud: We work with others in the city, and there will be a consent decree, which is a long process, but the outcome will be more warnings and better outreach to the public. Another outcome will be secondary recreation notification in the long term. We look at the waters for events and such, but don't actively monitor them.

Question 4
(Unknown): Jonathan [Yoder], do you have restrictions on the boats or their movement in the lakes?

Answer 4
Jonathan Yoder: We have them for zebra mussels. If you have been in the lake already you can come back without inspection of your boat, but if you are going into another lake you have to get inspected.

Question 5
Michael Bott: HABs [harmful algal blooms] are an increasing issue for states. Why isn't this a focus for monitoring?

Answer 5

John Wathen: We (EPA) have our eyes on HABs to some extent, but we are restricted some by the BEACH [Beaches Environmental Assessment and Coastal Health] Act which focuses on beach pollution. But as you can see at this conference, we are looking some at HABs and we appreciate and agree with the need for more monitoring.

Question 6

Jiyoung Lee: We have HAB issues from agricultural sources. Spring precipitation brings it into the lakes. Usually the toxic bloom is linked to nitrogen and not phosphorus. Where do you think the blooms or sources come from in your waterbody?

Answer 6

Matthew Graul: We mostly think it's from the watersheds, like fertilizer. Also, some lakes have not been dredged in 30 years and there are large nutrient loads in the bottom sediments. For us, it's mostly from phosphorus—typically in the fall season we see a spike in phosphorus in the reservoirs. We also see a spike in nitrogen in rainy periods in October and November. We have seen blooms that last all year, and that is confusing our thoughts on what is driving it. We are looking at it. It's not directly correlated to flow anymore.

Question 7

(Unknown): Have you thought about remote sensing?

Answer 7

Matthew Graul: Yes, on a statewide level, but only applies to one of our lakes. We are also looking at using drones on a small scale.

Question 8

Mark Sobsey: One of the re-emerging concerns from a public health standpoint is microbial resistant bacteria. To what extent will we be able to look at exposure to those resistant type of bacteria?

Answer 8

Jonathan Yoder: We'll learn a lot more in the next few years. CDC has looked at microbial resistant bacteria, but there are a lot of drivers to look at, other factors, such as what is the impact to the community for antibiotic resistance? A lot of impact in terms of food and other things.

Question 9

Lisa Larimer: For Trevor [McProud]. With your texting service, does it go out to all your subscribers when a beach is closed?

Answer 9

Trevor McProud: We did not broadcast advisories the first year. It was an inquiry-based service. But, the next year, we thought more about it, like the public health need or impact, and how to best handle it. We have partnered with the parks department with high surf advisories. We don't think that sending out an advisory every single time is the right way to do it, but there can be a balance.