Adaptation for Marinas and Harbors

Adaptation in the Great Lakes Conference
Session: Adapting Infrastructure to Better Handle the Impacts of Climate Change

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Amy Samples,
Michigan Sea Grant
Overview

Marinas and Harbors in Context

Approach

Infrastructure

Responses
Project: “Helping Marina and Harbor Operators Respond to Climate Change”

2013 Climate Assessment Grant Recipient

Purpose: Assist marina and harbor operators in sector-specific problem identification, decision making, and planning related to climate change adaptation.
Why Focus on Marinas & Harbors?

Both public harbors and private marinas are access points for people to get to the water. Public marinas are especially important in that they oftentimes create a sense of place in coastal communities. {800+ marina and harbors}

Boating is a major recreational activity in Michigan, and boating in the Great Lakes requires harbors and marinas to gain lake access. {$2.4 billion to MI economy}

Clean Marina Program [helps marinas and harbors] improve their practices, but also to educate users about best practices.
General Status of Marina, Harbor and Port Infrastructure

- Infrastructure design life: 40-50 years
- Delayed Observations

- Great Lakes facilities rarely plan now for future events
- Infrastructure, management and operational changes are made only when the facilities are actually being threatened or damaged.
Approach

Deliverables:
- Online training module (within Clean Marina Classroom);
- Workshop series (2014);
- Print resources; and
- White paper.

Outcomes:
- Increased knowledge of climate impacts;
- Identification of sector-specific responses;
- Familiarity with tools and technology;
- Guidance on communicating with decision makers.
Relaying Information

“The challenge, for both the practitioners using climate information, as well as for those who are developing the resources to aid practitioners in the adaptation process, is creating and maintaining cross-sector communication of climate adaptation resource needs, and then disseminating the right resources in the right format to effectively aid the adaptation process.”
MSG Support for Clean Marina Efforts

Clean Marina Classroom (April 2013)

• A regional, online training tool developed in support of existing and developing Clean Marina certification and educational efforts.


• Suggested standard for CMP program cert requirements
• Commitment to annual or biennial review
Great Lakes Clean Marina Programs

Other regional resources:

- New York Marina Environmental Best Practices
- Pennsylvania Smart Boating, Clean Waters Program
Great Lakes Certified Clean Marinas and Harbors
Adapting to What?

Environmental Conditions
- Shorter winters
- Warmer temperatures
- More intense storms
- Reduction in ice cover
- Fluctuating lake levels

Policy and Budget
- Deteriorating infrastructure
- Limited funding for repairs/improvements

Issue Avoidance
- Information overload!
- Controversy, uncertainty
Stakeholder Identified Environmental Changes and Influence on Operation

- Lake level changes
- Structural repairs due to impact from storms
- Increased need for dredging
- Maintenance/operations scheduling due to changes in seasonal weather patterns
Stakeholder Interest in Adaptation-oriented Tools

1. Assistance with small grants for adaptation
2. Collaborative development of BMPs
3. Coordination of dredging efforts
4. Infrastructure/construction recommendations
5. Guidance on how to discuss policy, budget and planning issues with decision-makers
Adaptation Training Themes

- **Assessing Risks & Impacts**
  - Water Levels (historical and predicted)

- **Infrastructure & Dredging**
  - BMPs for stormwater control measures, floating docks;
  - Habitat Restoration;
  - Dredging (Coordination of effort, resources for technical assistance);

- **Planning & Zoning**
  - Design standards, building codes, harbor management plans;
  - Linkage to master plans.

- **Policy & Financing**
  - Communicating with decision-makers
  - Assistance with grants for adaptation
Adapting Marina and Harbor Infrastructure to Better Handle the Impacts of Climate Change
Climate impacts most directly impacting ports, harbors and marinas:

- Fluctuating water levels,
- Increased storm frequency and intensity,
- Precipitation and temperature changes.
Fluctuating Water Levels

Both rising and falling water levels can impact infrastructure stability and strength and require additional dredging of harbor navigation channels and interior facility slips

- Clark, 2012
Lower Water Levels

- **Undermine the existing structure**
- **Dockage at fixed height?**
  - potential safety concerns if vertical distance between dock and vessel increases
- **Need for additional dredging**
  - Site characterization and dredging are both costly endeavors and the process often takes years to complete
- **Channel access**
  - failure can cut off a facility from the GL
Higher Water Levels

- Impact port, harbor and marina infrastructure stability and overall strength
- Create a greater potential for flooding of critical land areas and operational structures

Credit: Gene Clark/ UW Sea Grant
Increased Storm Frequency & Intensity

- Larger waves, higher seiches and greater storm surges can damage port and harbor infrastructure
- Need rock scour protection at the base of the dock wall
- Damage to dockage and boats while moored
- Increased channel sedimentation or resuspension
  - ...Contamination issues?
Precipitation and Temperature Changes

- Increased rainfall amounts and storm intensities
Specific Impacts & Adaptation Responses

A variety of complex physical processes are exerted upon Great Lakes shorelines.

Marina and harbor operators cannot stop these processes, but do have options to combat adverse impacts.

(Jeff Kiessel / Ludington Daily News / AP)
Failing Wood Infrastructure

- **75%+ navigation infrastructure over 60 y.o.** - becoming even more vulnerable due to low water levels, which expose – and further deteriorate – weakened timber crib core sections.
  
  – GL Commission, 2010

- Underwater timber structures can last indefinitely; when exposed to air, the timber begins to rot
Typical USACE breakwater section
- Timber crib, filled with rock
- Timber pilings

(Gene Clark/UW Sea Grant Institute)
Timber “soldier pile” wall

(Gene Clark, UW Sea Grant Institute)
Timber Crib Failure

(Gene Clark/UW Sea Grant Institute)
Timber crib with interior rock loss

(Bill Brose–SmithGroupJJR)
Settlement failure
Accelerated Freshwater Harbor Steel Corrosion

- Steel pins used to connect them have been corroding...

...See WI Sea Grant for more info

(Gene Clark/UW Sea Grant Institute)
Repairs for Wood Infrastructure

- New Concrete wall constructed on top of a failed timber crib

Source: Gene Clark, WI SG; *Failing Coastal Wood Infrastructure on the Great Lakes*
Repairs for Wood Infrastructure

(Chad Scott–AMI Consulting Engineers)
Repairs for Pilings

(Gene Clark/UW Sea Grant Institute)
Floating Docks

Floating dock and gangway at Straits State Harbor; Mackinaw City, Michigan
Enlarged Breakwater

- Contact your state agency for Design Guidelines and Standards
- Work with coastal engineer to understand repercussions (water circulation, sedimentation, etc.)

Credit: Bill Brose/Smith Group JJR
Assess Stormwater Infrastructure

- Source Control
  - Practice low impact development
  - Plant and maintain vegetated areas
  - Minimize impervious areas
  - Capture and reuse roof water
  - Minimize pollution in runoff
  - Control sediment from construction sites
  - Stencil storm drains
Assess Stormwater Infrastructure

- Stormwater Treatment
  - Use site analysis to inform BMP selection
  - Use structural controls as necessary
Additional Adaptation Approaches

- Dredging
- Policy options
- Planning
- Zoning
- Financing

MDNR Emergency Dredging Toolkit; Apollo Bay Harbour
Find Us

Online

In Person

- **July 15**
  - MacRay Harbor, Harrison Twp.

- **August 5**
  - Bil-Mar Restaurant, Grand Haven, MI

- **November (TBD)**
  - Veterans Park, Bay City

- **December 10-11**
  - Lansing, Recreational Boating and Educational Conference

Adaptation content Available July 2014

MICHIGAN SEA GRANT
Thank You.

QUESTIONS, COMMENTS OR REMARKS?

Mark Breederland
breederl@msu.edu
(231) 922-4628

Amy Samples
asamples@umich.edu
(734) 647-0766

www.miseagrant.umich.edu