Maryland’s Living Shorelines Program

Bhaskaran Subramanian
February 27, 2015
• Erosion & traditional approaches
• Living shorelines- what is it?
• Maryland’s Living Shorelines program
  – LS Law
  – Products
  – Funding- loans, grants, etc
• How are projects in MD performing?
  Lessons learned.
• Strengths of the Program
• Moving forward
Erosion is a natural phenomenon
MARYLAND DEPARTMENT OF NATURAL RESOURCES

Problems Associated with “Structural” Approach
Recognizing the Problem

- MD shorelines approximately 7,000 miles.

- Erosion affects all 16 coastal counties along the Chesapeake Bay and Coastal Bays watersheds.
Excessive ??
<table>
<thead>
<tr>
<th>Rate of change</th>
<th>Shoreline Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Miles</td>
</tr>
<tr>
<td>Accretion</td>
<td>2,006</td>
</tr>
<tr>
<td>No Change</td>
<td>75</td>
</tr>
<tr>
<td><strong>Slight erosion</strong></td>
<td>3,740</td>
</tr>
<tr>
<td>0 to -2 feet/year</td>
<td></td>
</tr>
<tr>
<td><strong>Low erosion</strong></td>
<td>618</td>
</tr>
<tr>
<td>-2 to -4 feet/year</td>
<td></td>
</tr>
<tr>
<td><strong>Moderate erosion</strong></td>
<td>173</td>
</tr>
<tr>
<td>-4 to -8 feet/year</td>
<td></td>
</tr>
<tr>
<td><strong>High erosion</strong></td>
<td>48</td>
</tr>
<tr>
<td>Over -8 feet/year</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,659</td>
</tr>
</tbody>
</table>
Slight Erosion: 0-2 ft/y

Low Erosion: 2-4 ft/y
Moderate Erosion: 4-8 ft/y

High Erosion: 8+ ft/y
Living Shorelines
“…… a suite of techniques which can be used to minimize coastal erosion and maintain coastal process”.

- Techniques may include the use of fibre coir logs, sills, groins, breakwaters or other natural components used in combination with sand, other natural materials and/or marsh plantings.

- These techniques are used to protect, restore, enhance or create natural shoreline habitat.
• Provides shallow water habitat that results in higher abundance and diversity of aquatic species both nearshore and offshore.

• Helps to maintain a link between aquatic and upland habitats, providing shoreline access for wildlife and recreation.

• Maintains natural aesthetic.
• Improve water quality by settling sediments and filtering pollution.

• Absorb wave energy.

• Maintain natural shoreline dynamics and sand movement.

• Costs comparable to “structural” options.
Limitations

- Not effective in all situations.
- Limited number of marine contractors with knowledge/expertise in living shorelines.
- Limited detailed science/literature.
MARYLAND DEPARTMENT OF NATURAL RESOURCES

Biolog Projects
Profile of typical stone groin and cross section used to stabilize eroding banks.

Note: Plants are placed between groins on the sand fill.
Groins
S. *alterniflora* is planted from mid-tide to mean high water

S. *patens* is planted above mean high water
Sills with Marsh Plantings
Sills with Marsh Plantings
Breakwaters
Living Shorelines Protection Act of 2008

- Bill passed into Law October 2008; regulations implemented in February 2013.

- Previously, Living Shorelines were “recommended” but not required.

- The law provides the regulatory agency with a strong foundation to promote alternate shoreline erosion control measures.

- The Law clearly states: “Improvements to protect a person’s property against erosion shall consist of non-structural shoreline stabilization measures (i.e. living shorelines) except where the person can demonstrate such measures are not feasible, or where mapping indicates areas that have been deemed appropriate for structural shoreline stabilization measures”.
• Erosion control measures considered in order of preference
  - No action
  - Nonstructural shoreline stabilization
  - Structural measures to stabilize nonstructural stabilization
  - Revetments
  - Breakwaters
  - Groins
  - Bulkheads

• COMAR 26.24.04.01
• Regulations implemented February 4, 2013
• Order of preference
  – No action
  – Relocation of structures
  – Nonstructural shore erosion control project
  – Structural shore erosion control project with MDE approved
• Waiver
## LS Waiver Request Form

**Living Shoreline Waiver Request**  
*Maryland Department of the Environment Water Management Administration*

The Living Shoreline Protection Act of 2006 requires that improvements to protect a person’s property against shoreline erosion consist of marsh creation or other nonstructural shoreline stabilization measures (i.e., Living Shorelines) that preserve the natural environment unless:

A) The project shoreline is mapped by the Maryland Department of the Environment (MDE) as an area appropriate for structural shoreline stabilization measures, or

B) The applicant can demonstrate to MDE’s satisfaction that nonstructural measures are not feasible due to excessive erosion, severe high energy conditions, or the fact that the waterway is too narrow for effective use of nonstructural shoreline stabilization measures.

A person meeting any of these conditions should provide the information requested below, which will help to demonstrate that nonstructural shoreline stabilization measures are not feasible for the project site and provide the basis for the issuance of a waiver by MDE exempting the property owner from the requirement to construct a living shoreline.

1. Name of Property Owner:
2. Address of Property Owner:
3. Address of Project Site:
4. Previous MDE permit number (if known):

Please refer to the Living Shoreline Waiver Diagram on Page 3 and the Living Shoreline Waiver Flowchart on Page 4 when you answer the questions in the following table.

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>CATEGORY</th>
<th>QUESTION</th>
<th>ANSWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Navigation</td>
<td>Distance in feet from the Mean High Water Line to the edge of the closest mapped or unmapped navigable channel.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Width of Waterway</td>
<td>Distance in feet from edge of worksite shoreline perpendicular across the waterway to the opposite shoreline.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Depth of Toe of Bank</td>
<td>Depth of the water in feet from the Mean Low Water Line to the bottom or toe of the shoreline bank.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>CATEGORY</th>
<th>QUESTION</th>
<th>ANSWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Depth of Waterway</td>
<td>Depth of water in feet relative to the Mean Low Water Line at the channelward extent of the proposed nonstructural shoreline erosion control measure.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Fetch</td>
<td>Distance in feet from the edge of the worksite shoreline across the closest waterway in the direction of prevailing summer/winter winds to the opposite shoreline.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bank Orientation</td>
<td>Provide a compass direction perpendicular to the line of the worksite shoreline. Direction can be given as NE, SW, etc. or as a compass heading (i.e., 45°, 225°).</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bottom Substrate</td>
<td>Fineness of bottom material or substrate? Hard/Soft</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Describe the composition of the bottom material or substrate (i.e., sand, mud, silt, clay, gravel).</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sensitive Species</td>
<td>Will project construction adversely impact fish, plant, or wildlife habitat? If unknown, leave this section blank. MDE will coordinate with the Maryland Department of Natural Resources to determine if there are any potential impacts to sensitive species. Explain:</td>
<td>Yes/No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How will a structural shore erosion control project minimize impacts to fish, plant, and wildlife habitat?</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Site Access</td>
<td>Is access to the worksite via water impractical? Yes/No</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Explain:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>How will the worksite be accessed to facilitate construction of the project? Explain:</td>
<td></td>
</tr>
</tbody>
</table>
Waterway Width

- Less than 100 feet
- 100 – 140 feet
- Greater than 140 feet

Apply for exemption
1 pts
2 pts

Shoreline Orientation

- Shoreline receives <6 hours of sunlight per day
- Shoreline receives adequate sunlight

Apply for exemption
1 pts
2 pts

Tree clearing or Bank Grading will NOT allow for 6 hrs of sunlight

Fetch: Maximum distance wind may travel unimpeded over open water before approaching the worksite shoreline; relates to wave height

- Maximum Fetch greater than 5 miles
- Maximum Fetch greater than 3 miles
- Maximum Fetch less than 3 miles

Apply for exemption
1 pts
2 pts
MDE LIVING SHORELINE WAIVER – Worksheet (Page 2)

**Depth of Waterway**
- Water depth at 40-feet channelward of shoreline worksite MHWL
  - Water depth >4-feet
  - Water depth <4-feet
  - Water depth at 20-feet channelward of MHWL
    - > 2-feet
    - < 2-feet

**Bottom Material**
- Firmness of bottom material in the near shore area
  - Coarse (Hard)
  - Sand/Silt mix (Med)
  - Organic / silt / Clay (Soft)

**Critical Area Buffer**
- Forested Riparian Buffer or fish, wildlife, or plant habitat
  - Would be preserved
  - Not present
  - Would be affected equally by structural or nonstructural measures

**Scores**
- 2 to 5: Apply for exemption
- 6 to 8: Contact MDE for evaluation
- 9 to 13: Living Shoreline is recommended

**TOTAL**
Width of waterway: measured between MHW line at the worksite shoreline and average distance to the approximate centerline of waterway channel

Fetch: Provide four (4) measurements of maximum fetch for each quadrant (e.g., NE, SE, SW, NW) centered on the worksite shoreline

Shoreline orientation: compass direction perpendicular to average worksite shoreline

Navigation: Distance from MHW to edge of Navigation Channel
Approximate Channel Location (Grey Area); represents deepest portion of WATERWAY

Centerline of Channel (Black Dash Line); represents deepest portion of CHANNEL

Mean LOW Water Line (MLWL); location of the average “low tide” line of worksite shoreline

Mean HIGH Water Line (MHWL); location of the average “high tide” line of worksite shoreline

Bottom Material (Substrate); determine “softness” or “hardness” of bottom; determine composition (i.e., sand, clay, sticks and leaves)

MHW
Mean High Water

MLW
Mean Low Water; referenced to 0.0 ft.

1

40-feet

20-feet

3

Depth of Water at toe or bottom of bank

4

Measure water depth during low tide at approximately 20-feet channelward of the MLWL and at approximately 40-feet channelward of the MLWL
• Maryland's Environmental Resources & Land Information Network

• [http://www.mdmerlin.net/index.html](http://www.mdmerlin.net/index.html)
• Online mapping and planning tool
• Partners: DNR, MES, Univ. of MD, TNC and NOAA
• Visualize, query, map, and analyze available data to better manage our marine and estuarine resources.

http://gisapps.dnr.state.md.us/coastalatlas/iMap-master/basicviewer/index.html
Historic Erosion Rate

Average Rate: 1.51 feet/year.

<table>
<thead>
<tr>
<th>Functions</th>
<th>OBJECTID</th>
<th>RECENT_RATE</th>
<th>RECENT_TIME_PERD</th>
<th>LINEAR_REGRESSION</th>
<th>END_POINT_RATE</th>
<th>WATERSHED</th>
<th>COUNTY</th>
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<tbody>
<tr>
<td>zoom</td>
<td>72817</td>
<td>1.51</td>
<td>07/1960-07/1993</td>
<td>-1.443569556</td>
<td>-1.25</td>
<td>02139998</td>
<td>CALVERT</td>
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</tbody>
</table>

Legend
- Transects
- Baseline
- Shoreline Change Rates
- Slight Change: +2 to -2 ft/yr.
- Low Change: -2 to -4 ft/yr.
- Moderate Change: -4 to -8 ft/yr.
- High Change: less than -8 ft/yr.
- Stabilized

All Historical Shorelines
- 1841 to 1961
- 1862 to 1982
- 1883 to 1903
- 1904 to 1924
- 1925 to 1946
- 1946 to 1977
- 1998 to 1995

Road Names
- Detailed Roads
- Interstate Highways
- Major County Roads
- Major Municipal Roads
- State Secondary Highways
# Project Selection Criteria

## DNR-SCMS

<table>
<thead>
<tr>
<th>Creek, Cove</th>
<th>Minor River</th>
<th>Major Tributary</th>
<th>Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Depth</td>
<td>-1.0 to -2.0</td>
<td>-2.0 to -4.0</td>
<td>-4.0 to -15.0</td>
</tr>
<tr>
<td>Fetch</td>
<td>1.0 to 1.5 mile</td>
<td>2.0 or more</td>
<td>2.0 or more</td>
</tr>
<tr>
<td>Erosion</td>
<td>2 to 4 ft/yr</td>
<td>4 to 8 ft/yr</td>
<td>8 to 20 ft/yr</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low wave energy</th>
<th>Medium wave energy</th>
<th>High wave energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Structural</td>
<td>Hybrid</td>
<td>Structural</td>
</tr>
</tbody>
</table>

### Type I
- Beach replenishment
- Fringe marsh creation
- Marshy islands
- Coir logs edging and groins

### Type II
- Marsh fringe w/stone groins
- Marsh fringe with stone sills
- Marsh fringe with stone breakwaters
- Marsh edging with stone
- Stabilization of streambanks with vegetation and stone

### Type III
- Stone breakwaters with beach replenishment and appropriate vegetation

### Least expensive | Medium priced | High priced | Expensive
|$100 - $200/L.F. | $250 - $400/L.F. | $450 - $600/L.F. | $500 - $1,500/L.F.
Outreach & Education
Maryland’s Coastal Atlas
Maryland’s Chesapeake & Coastal Program

The Coastal Atlas is an online mapping and planning tool that allows state and local decision makers to visually analyze and explore data for coastal and ocean planning activities.

Maryland’s Blue Infrastructure
Our oceans and estuarine environments today face an era of unprecedented activity. Wind farms and other energy facilities, commercial fishing, diverse recreational users, and shipping highways are all competing for use and space. To ensure the protection of Maryland’s critical ocean and estuarine resources, our Blue Infrastructure, and the coastal economies that depend on them, the Coastal Atlas has been developed to provide direct access to available data needed for coastal and ocean planning efforts. From finding the best locations for renewable energy projects to locating and resources needed for beach replenishment to helping local communities identify areas vulnerable to sea level rise and erosion—the Coastal Atlas will assist users in identifying potential conflicts so that they can then be avoided early in the planning process.

Better Decision-Making
The Coastal Atlas is the result of a collaborative effort among the Maryland Department of Natural Resources, the Maryland Energy Administration, Towson University, the University of Maryland, The Nature Conservancy, and the National Oceanic and Atmospheric Administration.

The data available through the Coastal Atlas includes physical characteristics, human uses and ecological resources. Through the Coastal Atlas, users will be able to visualize, query, map, and analyze available data to better manage our marine and estuarine resources.

The tools currently available, and those that will be continually developed for the Coastal Atlas, are designed to support better decision-making by transforming available data into information tailored for specific users.

“By having a real understanding of where resources are located and what they provide to us, the Coastal Atlas will help us better protect ocean resources and balance the many commercial and recreational demands they face.”
—Governor Martin O’Malley

Factsheets

Balancing human demands with conservation of the resources that make Maryland such a unique place to live, work and play.

Maryland’s Coastal Atlas
Maryland’s Chesapeake & Coastal Program

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Factsheets
Interpretive Panels

Living Shorelines, Naturally

Who can resist the lure of the water? Shorefronts draw us—
as launches for our work or play on river or bay, as quiet zones of beauty and tranquility.

Interpretive panels add another dimension to our coastal wetlands.

First Person

Kevin Smith
Chief, Shorelines, Maryland Department of Natural Resources

The Living Shoreline at Great Otter Point is a form of coastal infrastructure that not only adds beauty to the environment but also helps maintain the natural health of the shoreline.

Dave Wilson
Coastal Zone Management

Living Shorelines, or shoreline stabilization projects, are a growing trend. They are intended to help prevent erosion and provide habitat for wildlife.

George E. “Happy” Mayer Jr.

“It’s a good idea to stabilize the shore and reduce erosion.”

In the long run, we get a more beautiful, healthier shoreline.

SHORE TO LOSE

In the long run, we get a more beautiful, healthier shoreline.

Interpretive panels tell a story of change and development.
Living Shorelines in Bluff Situations: Calvert County

You're invited!!!

Saturday September 27th, 2008
9 am to 3 pm

Living Shorelines in Somerset County

You're invited!!!

Saturday August 16th, 2008
9 am to 3 pm

Bringing living shorelines home to you
LS Professionals’ Workshops

LIVING SHORELINES PROFESSIONALS’ TRAINING SESSION
SEPTEMBER 24, 2009
CALVARY UNITED METHODIST CHURCH
311 ROWE BLVD
ANNAPOLIS, MD 21401

Dear Marine Contractors/Engineers/Consultants,

The State of Maryland passed the new Living Shorelines Protection Act of 2008 into law in October 2008. With this Law, “Living Shorelines” are now the preferred method of shoreline erosion control.

In order to increase awareness about shoreline restoration and provide information to professionals who are entering into these projects, a FREE training session will be held in Annapolis at the Calvary Church on September 24, 2009 (Monday, 10:00 a.m. – 5:00 p.m.). We cordially invite you to be a part of this event and help to move the science forward.

Though it is a FREE event, space is limited. So please reserve your spot soon! To register contact Diana Dall, MD, Chesapeake & Coastal Program, Ph: 410-260-6753 or dndall@md.gov.

The topics that will be covered at the event include:
- What are living shoreline projects and why are they needed?
- Surveying shorelines
- Design options and choosing the appropriate practice
- Past projects: What worked and what didn’t?
- Projects in different coastal systems (low, medium, and high)
- Permit and regulatory guidelines
- Technical tools and Shorelines Online
- Quality control of projects
- Optimizing survival of vegetation and aquatic species.

Sincerely,
Diana Dall, Chesapeake & Coastal Program

Financial assistance provided by the Coastal Zone Management Act of 2002 as amended, Title 10, Subtitle C, Section 10-502, Maryland Code Annotated, the Chesapeake Bay Program, and the U.S. Army Corps of Engineers. This publication is a product of the Maryland State Office of the Coastal Resources Management Program, Department of Natural Resources, and the USACE. Visit www.coastalmaryland.org for more information.
Erosion Rate Study Grant

Design Grant

Design Grant
- Identify areas vulnerable to effects from shoreline erosion over 50 years.

- Provide information using GIS to screen and evaluate potential impacts from shoreline erosion.

- Present data and studies to support shoreline erosion project formulation.
Living Shoreline Suitability Model
Calvert County, Maryland

Hybrid design option

Final Report Submitted to
Coastal Zone Management Program
Maryland Department of Natural Resources
Annapolis, Maryland

Submitted By
Center for Coastal Resources Management
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia

funded through grant number NA07NOS4190161/14-09-1233 CZM 161

Soft stabilization

Living Shoreline Suitability Model
Somerset County, Maryland

Hybrid design option

Final Report Submitted to
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Soft stabilization
<table>
<thead>
<tr>
<th>Program</th>
<th>Organization</th>
<th>Contact Information</th>
</tr>
</thead>
</table>
| Shoreline Conservation Services | Maryland Department of Natural Resources (DNR) | Shore Erosion Control Program  
Phone: (410) 260-87986  
Website: www.dnr.state.md.us/grantsandloans/sec.html |
| Maryland Linked Deposit        | Maryland Department of the Environment (MDE) | Water Management Administration  
Phone: (410) 537-3119  
Website: http://www.mde.state.md.us/AboutMDE/grants/index.asp |
| Small Creeks and Estuaries    | Maryland Department of the Environment (MDE) | Water Management Administration  
Phone: (410) 537-3908  
Website: http://www.mde.state.md.us/AboutMDE/grants/index.asp |
| Living Shoreline Initiative   | Chesapeake Bay Trust (CBT)            | Phone: (410) 974-2941  
Website: www.cbtrust.org |
| CBT/FAF Partnership            | Fish America                          | Website: http://www.fishamerica.org/grants |
| Small Watershed Grants        | NFWF                                  | Grant Programs; Website: www.nfwf.org |
# Shoreline Conservation Services Loan Program

**FINANCIAL ASSISTANCE FOR SHORE EROSION CONTROL PROJECTS**

<table>
<thead>
<tr>
<th>TYPE OF PROJECT</th>
<th>TYPE I</th>
<th>TYPE II</th>
<th>TYPE III</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF FUNDS USED</td>
<td>STATE</td>
<td>STATE</td>
<td>STATE</td>
</tr>
<tr>
<td>TYPE OF ASSISTANCE**</td>
<td>LOAN</td>
<td>LOAN</td>
<td>LOAN</td>
</tr>
<tr>
<td>LOAN INTEREST</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>LOAN TERM</td>
<td>5 YEARS</td>
<td>15 YEARS</td>
<td>20 YEARS</td>
</tr>
</tbody>
</table>

**Type I Projects:** Marsh creation/protection using natural/living materials

**Type II Projects:** Marsh creation/protection with stone edging, stone sills and/or stone groins, with sand fill and marsh plantings

**Type III Projects:** Marsh creation/protection with stone breakwaters, with sand fill & marsh plantings

**APPLICANT**

<table>
<thead>
<tr>
<th>COMMUNITY ASSOCIATIONS/NON-PROFIT ORGANIZATIONS/SERVICE ORGANIZATIONS</th>
<th>EXTENT OF ASSISTANCE****</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT COST $0 to $50,000</td>
<td>75% NTE $20,000</td>
</tr>
<tr>
<td>MUNICIPALITY - PUBLIC LANDS</td>
<td>75% NTE $20,000</td>
</tr>
<tr>
<td>MUNICIPALITY - SPONSORING PRIVATE OWNERS/BUSINESSES</td>
<td>75% NTE $20,000</td>
</tr>
<tr>
<td>COUNTY - PUBLIC LANDS</td>
<td>75% NTE $20,000</td>
</tr>
<tr>
<td>COUNTY - SPONSORING PRIVATE OWNERS/BUSINESSES</td>
<td>75% NTE $20,000</td>
</tr>
<tr>
<td>COUNTY - SPONSORING COMMUNITIES/NON-PROFIT ORGANIZATIONS/SERVICE ORGANIZATIONS</td>
<td>75% NTE $20,000</td>
</tr>
</tbody>
</table>

*** Financial Assistance provided based on project priority and availability of funds

** Matching grants are not available

*** Loan Formula as established in Natural Resources Article, Section 8-1005 of the Annotated Code of Maryland

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**Loan Formula:**
- Project cost $0 to $50,000: 100% loan
- Next $20,000: 50% loan
- Next $20,000: 25% loan
- Above $100,000: 10% loan

$0 Property owner’s cash

$10,000

$15,000

**No financial assistance provided for structural/barrier type projects**
Assessment study analyzed:

- Marsh erosion
- Structure condition
- Non-planted vegetation
No erosion  > 50% erosion

Maryland Department of Natural Resources

Marsh Erosion
Non-Planted Vegetation

Excellent

Poor
Results

• Out of 177 projects, 131 of them were good or better.

• Maintenance- Crucial for the success of a project.
Probable Causes of Decreased Performance

- Poor engineering and/or construction.
- Poor execution of Plans.
- "Incorrect" planting.
- Choice of marsh grasses.
- Boat wake.
- Lack of maintenance.
Strengths of the Program

- Increased collaboration between agencies
- Coastal Atlas- huge asset to make more informed decisions and recommendations
- Workshops- effective in getting contractors and agencies to talk to each other instead of “at each other”
• More buy-in needed from marine contractors, engineers, etc

• Information such as littoral drift map, LS Suitability models, etc could help

• $$$ to try some innovative and out-of-the-box design for projects

• Consistent permitting process and knowledgeable permit reviewers
Conclusion

• Living shorelines- very effective in “reducing” erosion and creating/restoring habitats.

• LS Program- many components.

• Collaboration with partners- crucial for a comprehensive program
Bhaskaran Subramanian, Ph.D.
Program Manager, SCS

Ph: (410) 260-8786/ (443) 454-1638

E-Mail: bhaskar.subramanian@maryland.gov

Website:
http://www.dnr.maryland.gov/ccs/livingshorelines.asp