# Preface

*Photo credit: Karen Duhring, VIMS*

Shorelines of all estuaries erode over time, in part a natural process and in part a process exacerbated by human activity. In the Chesapeake Bay, for example, one third of all shorelines are classified as eroding, some areas losing as much as 20-40 cm of shoreline per year (1). At the same time, estuarine areas support a disproportionately large human population that relies on the resources of these sheltered coasts for shipping, fisheries, recreation, transportation, and other uses. For example, 60% of Virginia's population lives in the 22% of the state that falls within its Coastal Zone. Nationwide, 51% of the U.S. population lives in coastal counties, which account for only 13% of the nation's continental area and income per square kilometer in coastal counties is more than eight times that of inland counties (2). As a result of this human reliance on and use of estuarine systems, estuarine erosion has become a problem that requires solutions.

Residents and users of estuarine and open coastal shorelines have, over the past several centuries, worked hard to protect their shorelines from erosion. The methods traditionally employed have focused on structural shoreline armor, such as riprap revetments, bulkheads, and seawalls. In some areas, more than half of the shoreline has been armored. For example, the shoreline of Barnegat Bay in New Jersey is 71% developed, with 45% in bulkhead alone (3). San Diego Bay is 74% armored, providing habitat for open-coast hard substrate species in a traditionally soft-substrate estuary (4). Some sub-watersheds of the Chesapeake Bay are also more than 50% armored (5). Hundreds of miles of Chesapeake Bay shoreline have been armored in Virginia and Maryland since the 1970s (6, 7).

Armor replaces shoreline vegetation, reducing water filtration and habitat functions. These structures, especially bulkheads and seawalls, also steepen shorelines, reducing or removing altogether valuable shallow-water nursery and refuge habitat for many estuarine species. According to the 2006 National Academies report, *Mitigating Shore Erosion along Sheltered Coasts*, the cumulative ecological, water quality, and erosion-control impacts of such armoring have only recently begun to be documented (8). However, impacts of these structures on flora and fauna are beginning to emerge (e.g., 9, 10).

As a result of differences between hard armor and natural shoreline qualitatively observed as early as several decades ago, techniques for incorporating natural habitat elements into shoreline stabilization techniques have been developed as an alternative to hard armor. Restoration scientists in the Chesapeake Bay region have served as initiators of these efforts, coining the phrase "Living Shoreline." This phrase has been defined as shoreline stabilization methods that employ as many natural habitat elements as appropriate for site conditions to protect shorelines from erosion. These natural habitat elements can include emergent marsh grasses, submerged aquatic vegetation, riparian vegetation, coarse woody debris, and oyster reef and shell, and they are hypothesized to provide better habitat and water quality functions, while serving similar, if not better, shoreline protection functions.

The purpose of the Living Shoreline Summit was to investigate the state of the science of living shorelines, identify areas in which additional information is necessary, and investigate paths to increasing implementation of living shorelines as an alternative to hard shoreline armor, where appropriate. The Summit was intended for many audiences, including marine contractors, regulators, policy-makers, scientists, homeowners, marine engineers, consultants, and members of nonprofit groups.

As populations continue to grow along shorelines nationwide and in the Chesapeake Bay, and as sea level continues to rise worldwide, the need for shoreline stabilization will only increase. By 2015, coastal population in the U.S. is expected to increase to 165 million, up 21 million people from 1990 and up 58 million from 1970. An average of 3,600 people move to coastal counties each day (11). The Chesapeake Bay region will experience an even faster rate of growth, with the 16-million person watershed becoming the home to several million additional residents by 2020 (12).

In addition, as we learn more about the Chesapeake Bay and sources of nutrient and sediment pollution, shoreline stabilization will likely become an important area in which sediment reductions can be achieved; currently, it is estimated that 57% of the sediment in the Bay comes from eroding shorelines (13). Though this sediment source may be more 'natural' than other sources (such as sediment input from development or agricultural activities), shoreline stabilization may contribute at least in part to the overall solution for reducing coastal sediments to the tidal Bay.

The goal of the information contained in these Proceedings is to encourage use of shoreline stabilization methods that serve habitat, water quality, and erosion control functions. Papers focus on the design of living shorelines and criteria to consider, evaluation of the functions of living shorelines, regulatory processes and suggested ways to improve them, landowner decision-making processes and ways to incentivize living shorelines, and finally next steps in promoting living shoreline implementation in areas that are conducive to the techniques.

This information is intended for a wide range of audiences. The shoreline community will rely on its scientists and engineers to take the next steps to fill in information gaps on design and function, on its contractors to use this new information to market living shorelines to their clients, on its policy-makers and managers to use the information in decision-making, and on its property-owners to make informed choices for their land as 85% of the Chesapeake Bay shoreline is privately owned (14). It is the goal of Living Shoreline Summit participants that the recommendations on next steps serve to accelerate progress on investigation and implementation of nonstructural shoreline protection techniques.

## References

1. Chesapeake Bay Program, Tidal Sediment Task Force of the Sediment Work Group. 2005. Sediment in the Chesapeake Bay and Management Issues: Tidal Erosion Processes. CBP-TRS276-05.
2. Rappaport, J. and J.D. Sachs. 2003. The U.S. as a Coastal Nation. J. Econ. Growth 8:5-46.
3. Lathrop, R.G., Jr. and J.A. Bognar. 1997. Monitoring Habitat Loss and Alteration in the Barnegat Bay Region. In Flimlin, G.E., Jr., Kennish, M.J., editors. The Barnegat Bay Ecosystem Workshop. Cooperative Extension of Ocean County, Toms River, N.J. pp. 243-253.
4. Davis, J.L.D., L.A. Levin, and S.M. Walther. 2002. Artificial Armored Shorelines: Sites for Open-coast Species in a Southern California Bay. Mar. Biol. 140:1249-1262.
5. Berman, M.R., H. Berquist, S. Dewing, J. Glover, C.H. Hershner, T. Rudnicky, D.E. Schatt, and K. Skunda. 2000. Mathews County Shoreline Situation Report, Special Report in Applied Marine Science and Ocean Engineering No. 364, Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, College of William and Mary, Virginia.
6. Virginia Institute of Marine Science. 2004. The Virginia Wetlands Report 19(2). Gloucester Point, Virginia.
7. Titus, J. 1998. Rising Seas, Coastal Erosion and the Taking Clause: How to Save Wetlands and Beaches Without Hurting Property Owners. Maryland Law Review, 57(4):1281-1399.
8. National Research Council (NRC). 2006. Mitigating Shore Erosion along Sheltered Coasts. National Academies Press, Washington, DC. 138 pp.
9. Chapman, M.G., 2003. Paucity of Mobile Species on Constructed Seawalls: Effects of Urbanization on Biodiversity. Mar. Ecol. Prog. Ser. 264:21-29.
10. Peterson, M.S., B.H. Comyns, J.R. Hendon, P.J. Bond, and G.A. Duff. 2000. Habitat Use by Early Life-history Stages of Fishes and Crustaceans along a Changing Estuarine Landscape: Differences Between Natural and Altered Shoreline Sites. Wetlands Ecol. Management 8:209-219.
11. U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century. Washington, D.C.
12. McConnell, R.L. 2005. The Human Population Carrying Capacity of the Chesapeake Bay Watershed: A Preliminary Analysis. Popul. Environ. 16:335-351.

13. Langland, M. and T. Cronin (eds.) 2003. A Summary Report of Sediment Processes in Chesapeake Bay and Watershed. USGS Water Resources Investigations Report 03-4123 http://pa.water.usgs.gov/reports/wrir03-4123.pdf

14. Chesapeake Bay Program, Tidal Sediment Task Force of the Sediment Work Group. 2005. Sediment in the Chesapeake Bay and Management Issues: Tidal Erosion Processes. CBP-TRS276-05.

## Living Shorelines Summit Steering Committee

| | |
|---|---|
| **Brian Barnes** | GreenShore Solutions |
| **David Burke** | Burke Environmental Associates and Keith Campbell Foundation for the Environment |
| **Jana Davis** | Chesapeake Bay Trust |
| **Karen Duhring** | Virginia Institute of Marine Science, Center for Coastal Resources Management |
| **Sandra Erdle** | Virginia Institute of Marine Science, Chesapeake Bay National Estuarine Research Reserve in Virginia |
| **Chris Jett** | Richmond County, Land Use Office |
| **Audra Luscher** | Maryland Department of Natural Resources, Maryland Coastal Zone Management Program |
| **Laura McKay** | Virginia Department of Environmental Quality, Coastal Zone Management Program |
| **Shep Moon** | Virginia Department of Environmental Quality, Coastal Zone Management Program |
| **Walter Priest** | National Oceanic and Atmospheric Administration, Restoration Center |
| **William Reay** | Virginia Institute of Marine Science, Chesapeake Bay National Estuarine Research Reserve in Virginia |
| **Kevin Sellner** | Chesapeake Research Consortium |

# Living Shorelines Summit: Sponsors and Partners

**Chesapeake Bay National Estuarine Research Reserve (MD)**
http://www.dnr.state.md.us/bay/cbnerr/

**Chesapeake Bay National Estuarine Research Reserve (VA)**
http://www.vims.edu/cbnerr/

**Chesapeake Bay Trust**
http://www.chesapeakebaytrust.org/

**Chesapeake Research Consortium**
http://www.chesapeake.org/

**Keith Campbell Foundation for the Environment**
http://www.campbellfoundation.com/

**Maryland Coastal Zone Management Program**
http://www.dnr.state.md.us/bay/czm/

**NOAA Chesapeake Bay Office**
http://noaa.chesapeakebay.net/

**NOAA Restoration Center**
http://www.nmfs.noaa.gov/habitat/restoration/

**Virginia Coastal Zone Management Program**
http://www.deq.state.va.us/coastal/

**Virginia Department of Conservation and Recreation**
http://www.state.va.us/dcr/

**Virginia Institute of Marine Science**
http://www.vims.edu/

**VIMS Center for Coastal Resources Management**
http://ccrm.vims.edu/

## Changes in Maryland Living Shorelines Policy

Just prior to final publication of the Proceedings of the Living Shoreline Summit, the Maryland General Assembly passed, and Governor Martin O'Malley signed, the Living Shoreline Protection Act of 2008 (House Bill 973, introduced by Delegate M. McIntosh for the Maryland Department of Environment). This new law defines living shorelines as the "preferred method of shore protection," and finds that shoreline protection practices should consist of nonstructural methods wherever technologically and ecologically appropriate.

Specifically, the new law amends the Annotated Code of Maryland's Environmental Article (Section 16-201) to require property owners to use nonstructural shoreline stabilization measures that "preserve the natural environment, such as marsh creation," where feasible. Areas deemed not feasible for living shorelines include those subjected to excessive erosion (greater than two feet per year, which characterizes about 10% of the Chesapeake Bay shoreline), are subjected to heavy tides, and areas too narrow for living shorelines. Property owners who believe that living shorelines are not appropriate must demonstrate to the Maryland Department of Natural Resources lack of feasibility of this approach through a waiver process. The Living Shoreline Protection Act of 2008 goes into effect October 1, 2008.

Prior to the enactment of this new law, tidal wetland regulations outlined an order of preference for shore erosion control measures as follows:

1) no action and relocation of structure,
2) nonstructural shoreline stabilization, including beach nourishment and marsh creation,
3) revetments, groins, and breakwaters designed to promote viability of nonstructural stabilization projects,
4) revetments,
5) breakwaters,
6) groins, and
7) bulkheads.

The new living shoreline law was driven in part by a recommendation by the Maryland Commission on Climate Change in January 2008 and in part by the advances in living shoreline science. This new law is similar to policy in Kent County, Maryland (see Luscher et al., this volume), and in North Carolina (see the North Carolina Living Shorelines Law, House Bill 1028, passed in 2003).

Text of the new Maryland law can be found at:
http://mlis.state.md.us/2008rs/chapters_noln/Ch_304_hb0973E.pdf