



CENTER FOR COASTAL RESOURCES MANAGEMENT

2019 Annual Report

CENTER FOR COASTAL RESOURCES MANAGEMENT



**VIRGINIA INSTITUTE OF MARINE SCIENCE
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GLOUCESTER POINT, VA 23062**

MISSION & PRIMARY ACTIVITIES

The Center for Coastal Resources Management has a general mission to support informed decision making on resource management issues at all levels of government, including private and corporate citizens.

The Center has specific responsibilities for:

- (1) providing technical support for the Commonwealth's tidal wetlands management program, including maintenance of a continuing inventory of the state's tidal wetlands;
- (2) maintaining a continuing inventory of the status and trends of the state's tidal shorelines;
- (3) providing technical support to the Commonwealth's non-tidal wetlands program;
- (4) providing technical support on the issue of coastal marine debris; and
- (5) providing support to the Commonwealth Center for Recurrent Flooding and Resilience.

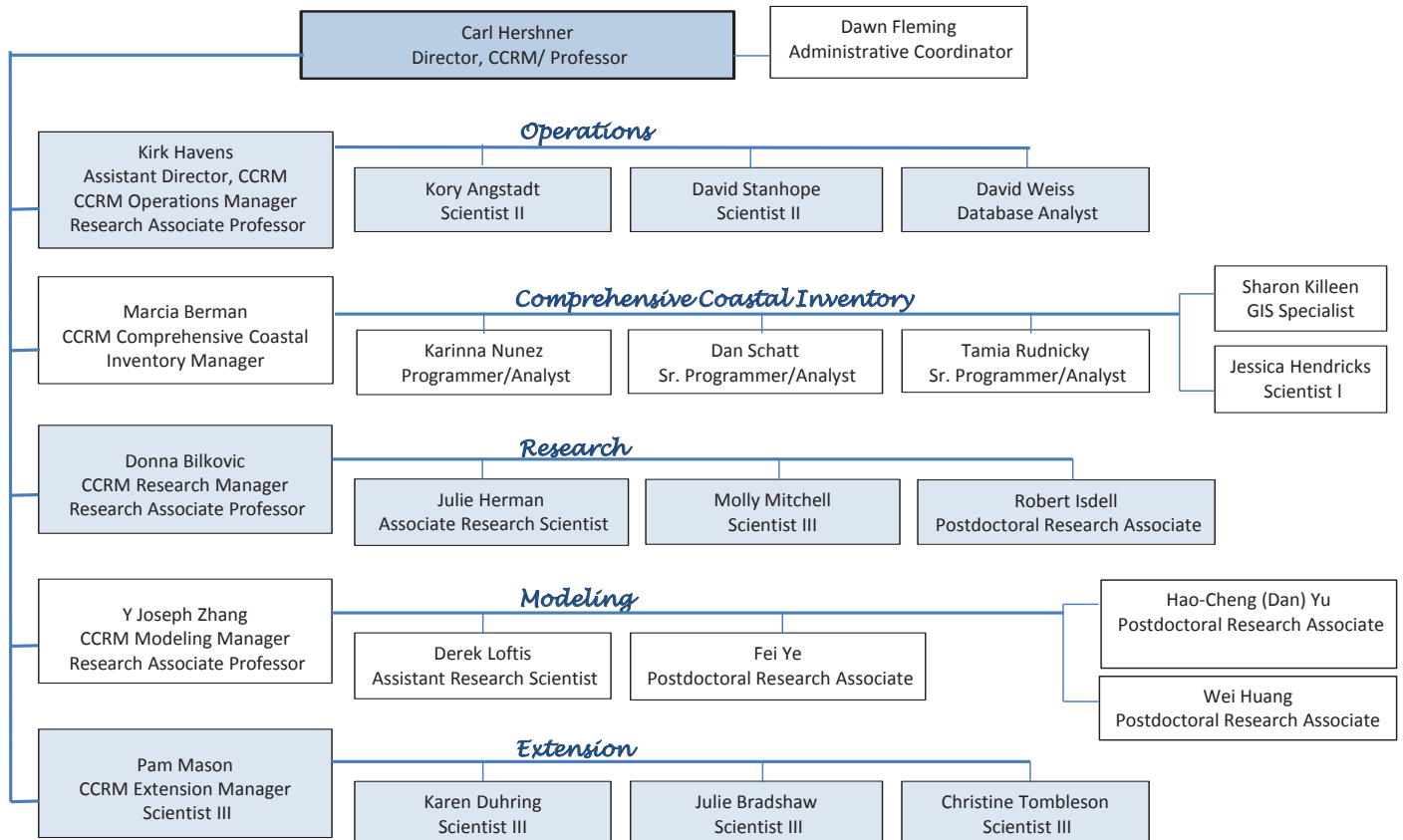
In addition to these primary and continuing obligations, CCRM has provided continuing involvement in the state's Coastal Zone Management Program, significant involvement in the Chesapeake Bay Program and its Scientific and Technical Advisory Committee, and significant involvement and official state representation to the Albemarle-Pamlico National Estuary Partnership and its Leadership Council.

At CCRM, we conduct **actionable science**. Actionable science links science to action with the aim of improving the quality of life for citizens and includes not only information, but also guidance on the appropriate use of that information. This means that our research and expertise helps shape environmental and economic policy decisions.

CCRM is providing Actionable Science towards the goal of resilient and thriving communities, sustainable fisheries, clean water, and healthy productive ecosystems in the Commonwealth.

PERSONNEL

The Center has a staff of about 25 individuals and supports several graduate students.



GRADUATE STUDENTS



PAMELA BRAFF studies the impacts of climate change and sea level rise on coastal eco-systems and communities in the Chesapeake Bay. She is particularly interested in the application of remote sensing and GIS to improve coastal resource management and decision-making. Some of her current projects include mapping hidden wetlands, evaluating the vulnerability of headwater wetlands to climate change, and modeling the impacts of recurrent flooding and sea level rise on coastal road networks. Pamela plans to complete her PhD program in May 2020; her advisors are Dr. Carl Hershner and Dr. Kirk Havens.

NICOLE CAI earned a Master of Science in Marine Science this year under her advisor, Dr. Joseph Zhang. Her thesis work was on the Impact of Submerged Aquatic Vegetation on Water Quality in Cache Slough Complex, Sacramento-San Joaquin Delta: A Numerical Study. Nicole is continuing her studies at VIMS as a doctoral student working with CCRM's modeling research program. Some of her current projects include evaluating the impacts of sea level rise on hypoxia in the Chesapeake Bay, building up vegetation models in the Chesapeake Bay and studying impacts of salt water intrusion on tidal freshwater vegetations.

JAMES DELBENE earned a Master of Science in Marine Science this year under his advisors, Dr. Donna Bilkovic and fisheries economist Dr. Andrew Scheld. With help from local watermen and state resource managers, Jim created a mail survey to identify commercial crabbers' opinions on derelict blue crab pots in Virginia waters. He shared survey responses with the public, scientists, resource managers, and policymakers to provide a voice for the watermen on the topic of derelict pots.

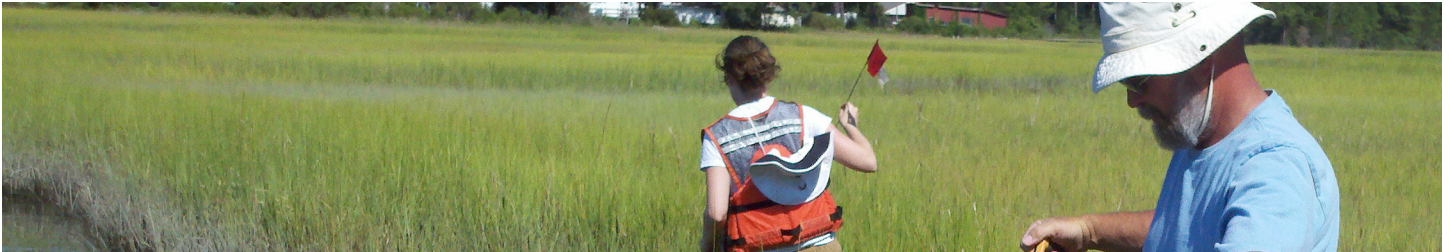
AMANDA GUTHRIE is pursuing her doctorate in Marine Science at VIMS under her advisor Dr. Donna Bilkovic. She researches how living shorelines help support fish communities and mussels in the Chesapeake Bay, and also how people make decisions on if and how to mitigate shoreline erosion on their property. Her work is driven by her goal to discover beneficial solutions for people and our ecosystems.

KARINNA NUNEZ is pursuing her doctorate in Marine Science at VIMS. The main focus of her research is coastal modeling. Karinna has extensive expertise in remote sensing and GIS technology used to address local and regional scientific research questions and management applications. Her model outputs inform stakeholders which helps them to develop appropriate planning and management actions. Karinna's current work is focused on intertidal habitats, coastal management, ecosystem vulnerability assessments, and climate change. She is in the last year of her PhD program; her advisor is Dr. Carl Hershner.

ACTIVITIES

The Center for Coastal Resources Management (CCRM) at VIMS has a formal mission to support informed decision-making on coastal resource management issues from global to local scales. To fulfill this mission, the Center undertakes cross-disciplinary research, provides advisory service, and conducts outreach education. Focus areas of study include:

TIDAL WETLANDS



TIDAL MARSH INVENTORY

Conduct tidal marsh inventory for Essex, Richmond, New Kent, Caroline, Arlington, King William and King and Queen Counties.

TIDAL MARSH INVENTORY CHANGE

Analysis of change between original (1970s) and current tidal marsh inventories.

TIDAL MARSH MODEL

Development of a high-resolution dynamic model of marsh evolution using the SCHISM model framework for hydrodynamic and sediment processes. Model outputs allow coastal planners to more accurately identify the potential future location of marsh habitats where protection and restoration activities can be focused. Data collected for model validation from Taskinas Creek and Carter Creek including shallow water bathymetry and grain size and organic matter.

TIDAL WETLANDS MANAGEMENT TECHNICAL SUPPORT

Through this grant, the Center for Coastal Resources Management (CCRM) staff provide routine advisories; produce materials for outreach education and newsletters; host a website for joint permit application records; and maintain two databases all supporting tidal wetlands management.

ESTIMATING BLUE CARBON STOCKS IN COASTAL WETLANDS TO ENHANCE NRCS SOIL SURVEYS

Calculates blue carbon stocks in tidal marshes of Virginia and North Carolina from field samples and statistical relationships to enhance NRCS soil surveys.

ENHANCING THE ADAPTIVE CAPACITY OF VIRGINIA COASTAL WETLANDS TO LESSEN VULNERABILITY TO CLIMATE CHANGE

Focuses on developing strategies to improve the understanding and strengthen the adaptive capacity of Virginia's coastal wetlands to lessen their vulnerability to climate change. A spatially-explicit Vulnerability Assessment model for Virginia Coastal Wetlands was developed for two time-steps (near and longer-term planning horizons, 2050, 2100) and integrated into the Virginia Wetlands Condition Assessment Tool (WetCAT) to inform wetland managers and policy makers.

TIDAL SHORELINES



COASTAL SEES: SUSTAINABILITY IN CHES BAY SHORESCAPES, CLIMATE CHANGE, MANAGEMENT DECISIONS & ECOLOGICAL FUNCTIONS

Investigates the linkages and feedback between human and natural components of Chesapeake Bay shorescapes (a shoreline zone which includes riparian, intertidal, and littoral areas) to inform decision-making for sustainability.

EXPANDING THE USE OF NATURAL AND NATURE-BASED INFRASTRUCTURE – COASTAL RESILIENCY

Assesses the storm mitigation benefits provided by natural features in the coastal zone, and evaluates the co-benefits those features can provide for other local management objectives. The project develops decision support tools and assesses the exportability of the modeling approach to other coastal states.

ENHANCING THE DECISION SUPPORT PROVIDED BY THE SHORELINE MANAGEMENT MODEL

Updates the Shoreline Management Model to Version 5.1 which allows the model to accommodate shorelines that have already been hardened. The project also addresses opportunities for living shorelines to provide localities with nutrient reduction credits toward TMDL goals and computes the credit potential if shoreline management practices using living shorelines are implemented where appropriate.

SHORELINE EVOLUTION & LIVING SHORELINE CONTRACTOR TRAINING

Updates the VIMS Living Shorelines Design Guidelines to include recent coastal resiliency monitoring data and provide three related marine contractor training workshops.

BUILDING ADAPTIVE SHORELINES & RESILIENT COMMUNITIES IN TIDEWATER VIRGINIA

Assist the James River Association with site selection, design and construction of three living shoreline demonstration projects, conduct three related training workshops, and provide advisory assistance on the content and execution of three Living Shoreline Collaborative Summits for stakeholders in the lower James River region.

ESTABLISHING A SHORELINE CONDITION METRIC OR THRESHOLD

Quantifies the relative effects of shorescape development on forage fish production in the York River sub-estuary with the goal to understand the effects of altered shorelines on relative abundance, mean size (length, biomass), and composition of forage species in the York River sub-estuary.

TIDAL WETLANDS MANAGEMENT DECISION SUPPORT

Provides Education/ Outreach focused on coastal managers and decision-makers and provision of general shoreline guidance to the general public and decision-makers. The focus of the guidance effort is to support the Commonwealth policy to prefer living shorelines as erosion control practices.

LIVING SHORELINE SITE SUITABILITY MODEL TRANSFER FOR SELECTED WATER BODIES WITHIN THE GULF OF MEXICO: A GIS & REMOTE SENSING-BASED APPROACH

Provides support to 5 Gulf Coast regions for running the Shoreline Management Model. Develops a User Manual for for GIS specialists wishing to implement the model in different regions. A new interactive Living Shoreline Decision Support Tool was developed to provide on-the-fly shoreline management recommendations in an interactive user response interface.

EVALUATION OF HURRICANE SANDY COASTAL RESILIENCY PROGRAM

Assisted in all aspects of the evaluation project, with specific focus on the development and updating of a data system for classifying different project activities and project outcomes and the production of case studies.

LIVING SHORELINE SUITABILITY MODEL FOR MARYLAND

Updates the shoreline inventory for selected localities in MD and then uses that data and others to run the Shoreline Management Model in support of MD's Department of the Environment and their initiative to increase the efficiency for implementation and decision making related to MD's living shoreline policy along tidal shoreline.

NONTIDAL WETLANDS



WETLANDS CONDITION ASSESSMENT TOOL (WetCAT)

Assesses wetland capacity to perform habitat and water quality ecosystem services to inform wetland managers and policy makers on wetland condition.

REFINING PROGRAM CAPACITY TO ENHANCE & PROTECT WETLAND RESOURCES IN VIRGINIA

Extends the current online Virginia Wetlands Condition Assessment Tool (WetCAT) to include both tidal and nontidal wetlands as well as nontidal wetlands vulnerable to changing precipitation patterns. Provides for coordinated wetland management by providing comprehensive watershed level maps of wetlands in waterways shared by both Virginia and North Carolina.

SUSTAINING AGRICULTURE IN CHESAPEAKE BAY AT-RISK COASTAL & RIPARIAN LANDSCAPES

Develops a strategy and work plan for technical assistance providers, farmers, land trusts, and local, state, and federal agencies managing farms lands at-risk from rising sea level for multi-benefit conservation and economic outcomes.

MARINE DEBRIS



DETERMINING EFFECTIVE DERELICT GEAR MITIGATION STRATEGIES BY EVALUATING FISHER PREFERENCES

Determine commercial crabber opinions on derelict blue crab pots in the Chesapeake Bay and coastal waters of Virginia using a mail survey to identify commercial crabber preferences for derelict pot mitigation activities and incentives to participate in those activities. Conduct outreach to share survey results on commercial crabber preferences for derelict pot mitigation activities and incentives to participate in those activities.

ENGAGING CITIZENS & WATERMEN IN REMOVAL OF DERELICT BLUE CRAB TRAPS IN CHESAPEAKE BAY

Provided a STEM challenge to high school students to develop a CRAB TRAP APP for use by citizens to document derelict blue crab traps. Established a citizen scientist volunteer corps for removal of derelict traps.

TARGETED HOTSPOT REMOVAL OF DERELICT BLUE CRAB TRAPS IN CHESAPEAKE BAY

Employs five commercial watermen to remove derelict blue crab traps from targeted 'hotspots' during the closed fishing season.

BIO-HINGE FOR DUNGENESS CRAB TRAPS

Working in Alaska and Washington State using biopolymer technology to mitigate the impact of lost dungeness crab traps.

BIOPOLYMER PRODUCT DEVELOPMENT

Biopolymer product development including test pattern analysis, velocity determination, and biodegradation experimentation.

ADVISORY



ADAPT VA

Maintain AdaptVA website that serves as a gateway to information for individuals, local programs, and agencies engaged in climate adaptation. Provides legal and policy resources, stories that explain adaptation through maps and pictures, and mapping tools that address short and long-term predictions for rising water levels.

CHESAPEAKE BAY PROGRAM/PARTNERSHIP

Assist in the science of Chesapeake Bay restoration with staff and faculty membership on CBP committees, goal implementation teams, and workgroups.

VIRGINIA DEPARTMENT OF TRANSPORTATION – MOU

Develop tools to identify management strategies for road segments subject to current or future flooding by tidal waters and provide a forecast of impacts and mitigation options for transportation infrastructure interaction with coastal ecosystems that provide habitat for fish and wildlife; including migratory birds, and rare, threatened or endangered species impacted by rising sea levels.

GOVERNOR'S COASTAL RESILIENCE MASTER PLAN

Assisting the Governor's Special Assistant for Coastal Adaptation and Protection and the Commonwealth's Chief Resilience Officer in the development of Virginia's Coastal Resilience Master Plan.

EASTERN SHORE DITCHES

Develop GIS methodology for analysis of ditches on the Eastern Shore for the Accomack-Northampton PDC. Provide preliminary analyses for validation and calibration of methods.

LIVING SHORELINE POLICY

Provide reports on shoreline management outcomes over the past 40 years for Secretary of Natural Resources and DEQ.

EXPANDING VIRGINIA'S OYSTER INDUSTRY WHILE MINIMIZING USER CONFLICT

Examines potential opportunity for the expansion of aquaculture activity within Virginia's Chesapeake Bay. It closely reviews the viability of ongoing shell replenishment of the Public grounds (Baylor), the cost benefit of that activity, and the potential alternative use of that public resource for aquaculture in the future, as well as the current use of private leases through the mandatory harvest reporting system. Proposes alternative strategies for Virginia policy makers to ensure the wise use of these areas for future aquaculture and economic growth. In addition, the project examines the co-relationship between caged-based aquaculture and the presence of SAV to determine if the current policy is warranted and/or adequate.

PREDICTION OF FUTURE SEPTIC SYSTEM FAILURE SITES (WASTEWATER ISLANDS)

Analysis of failed septic systems (repair permits) data and locations; Lancaster, Gloucester, Accomack, Northampton, Isle of Wight.

SEA LEVEL RISE IMPACTS ON LOCAL TAX BASE

Analysis of physical and socio-economic parcel vulnerability and comparison with property value.

HB1094 (GENERAL ASSEMBLY)

Provide maps and elevation profiles of RPA buffers, elevation contours, and parcel information for a report for Delegate Hodges.

SEA LEVEL RISE REPORT CARDS

Uses MMSL data collected from 1969-present for 33 water level sensors in continental US and computes linear and quadratic sea level forecasts with 95% confidence intervals (high and low) from quadratic trends established from data.

TIDAL SHORELINE MANAGEMENT POLICIES AND PROCEDURES HANDBOOK

A new website resource to support tidal shoreline decision-making. This digital format replaces the 30 year old Wetlands Management Handbook for local wetlands boards.

WATERSHED IMPERVIOUS COVER MAPS FOR MIDDLE PENINSULA

Uses the most recent version of Virginia's 6th order National Watershed Boundary Dataset to show the boundaries of each watershed located partially or wholly within the Middle Peninsula planning district localities. The map indicates the percentage of impervious cover within each watershed.

WASTEWATER INFRASTRUCTURE WORKGROUP

Assisting the Deputy Secretary of Natural Resources and the Virginia Department of Health in a multi-agency effort to identify areas of potential septic system failure in the coastal plain and across the state.

STUDY OF CHANNEL DEEPENING IN LOWER CHES BAY TO SUPPORT SHIP SIMULATION

Final assessment of the channel deepening in lower Chesapeake Bay on flow and water quality for Moffatt & Nichol and Virginia Port Authority.

WATER QUALITY & DROUGHT DECISION SUPPORT TOOL NEEDS ASSESSMENT

Conducted a needs assessment of water quality and drought decision support tools for the water planning community focused on identifying existing water quality and drought decision support tools, conducting stakeholder engagement to identify strengths and gaps in those tools, and then providing suggestions to NOAA about how to fill those gaps.

GARDEN CLUB OF AMERICA COASTAL WETLANDS STUDIES SCHOLARSHIP

Serve as technical review committee for GCA merit-based scholarships that promote wetlands conservation through the support of young scientists in their field work and research.

VIRGINIA MASTER NATURALIST PROGRAM

Serve as sponsoring agency for statewide volunteer program, offer basic training and continuing education for coastal chapters, and provide a chapter advisor for the Middle Peninsula Master Naturalists.

COMMONWEALTH CENTER FOR RECURRENT FLOODING RESILIENCY



DEVELOPMENT OF A STREET-SCALE HYDRODYNAMIC MODEL CALIBRATION, & FUTURE SCENARIOS – PORTSMOUTH

Assessed the flooding in the City of Portsmouth under a series of separate planning scenarios selected by the Planning office in 2 phases. First, exploring the influences of a storm surge similar to 2003 Hurricane Isabel in the year 2040 and in the year 2075 under different sea level rise and subsidence scenarios. The 2nd phase did the same but with an extratropical storm event: 2009 Nor'Ida.

TIDEWATCH

Provides a map for the visualization of the magnitude and impacts of coastal flooding within the Chesapeake Bay and along Virginia's Eastern Shore. The data are generated in 36 hour forecasts each morning and evening and the display is updated twice daily.

DEVELOPMENT OF HIGH-RESOLUTION FLOOD GRIDS FOR GUIDANCE IN BUILDING-LEVEL DAMAGE ASSESSMENTS IN NEWPORT NEWS, VIRGINIA FOR IFLOWS

Research collaboration between VDEM, the Virginia Institute of Marine Science, and Old Dominion University, to build a dynamic inundation model scenario builder and real-time visualization engine for Salters Creek and Newmarket Creek in Newport News as a demonstration of candidate technologies that may be integrated into VDEM's IFLOWS system.

VIRGINIA KING TIDE MONITORING VIA SEA LEVEL RISE APP

Coordinates volunteers to collect data annually during Catch the King tidal flooding event using the Sea Level Rise Mobile Application.

CRCF2019: STORMSENSE-VIMS, A VIRTUAL MONITORING SYSTEM USING AWS DEEPLENS AI

Commercialize a video camera system that is capable of detecting water level data in real-time, named the StormSense-Video Inundation Monitoring System (StormSense-VIMS).

OTHER MODELING RESEARCH



EVALUATION OF THE DISCHARGE OF BACK RIVER SEWAGE TREATMENT PLANT EFFLUENT TO BALTIMORE HARBOR: PHASES 1 & 2

Assesses the impact of effluent discharges on water quality in the Baltimore Harbor.

IMPLEMENTING SCHISM MODEL AS PART OF NOAA INTEGRATED WATER MODELING PROJECTS

First phase of this NOAA project on the study of compound flooding hazards in eastern and Gulf States.

IMPROVING TIDAL-ESTUARY REPRESENTATION IN MPAS-OCEAN

Involves the coupling of the VIMS SCHISM hydrologic model with the MPAS-Ocean model (Los Alamos National Laboratory) in order to improve modeling in estuaries.

STUDY THE IMPACT OF SUBMERGED AQUATIC VEGETATION ON H2O QUALITY – SAN FRANCISCO BAY-DELTA

Applies a sophisticated modeling system comprised of SCHISM, a wind wave model, a sediment transport model and a water quality model, all with explicit consideration of submerged aquatic vegetation, to San Francisco Bay and Delta area.

OREGON TSUNAMI HAZARD MITIGATION FOR COLUMBIA RIVER

Delivered the results on combined tsunami and tidal current to the Oregon Department of Geology and Mineral Industry which has been used in maritime evacuation planning in and around Columbia River, including simulated maximum elevation and current speed inside Coos Bay as a result of the combined tides and Cascadia and Alueutian Subduction Zone tsunamis.

DEVELOPMENT OF AN OPERATIONAL OCEAN PREDICTION MODEL

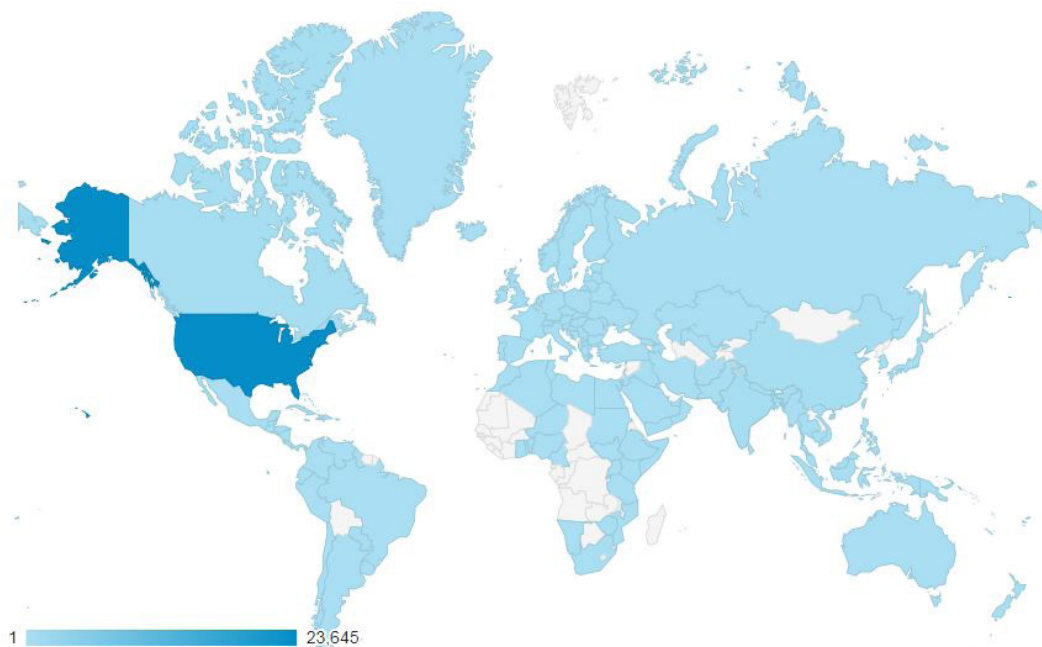
Building up an operational forecasting system around Taiwan.

EVALUATION OF THE APPLICATION OF OYSTER REEFS IN SHORELINE PROTECTION

Evaluates wave attenuation and shoreline stabilization by US Atlantic and Gulf coast oyster reef living shorelines in collaboration with University of Melbourne and leading researchers in the living shoreline field in the United States.

WEBSITES

The Center website (www.vims.edu/ccrm) had 23645 unique visitors worldwide in 2019.



In addition to the CCRM website, center personnel maintain the ADAPTVA.ORG website.

PUBLICATIONS

Center publications have a world-wide reach with 13224 downloads through Scholarworks in 2019.



PEER-REVIEWED

AN ANALYTICAL PHYTOPLANKTON MODEL AND ITS APPLICATION IN THE TIDAL FRESHWATER JAMES RIVER.

Wang, Zhengui; Wang, Harry; Shen, Jian; Ye, Fei; Zhang, Yinglong; Chai, Fei; Liu, Zhuo; Du, Jiabi. 2019. Estuarine, Coastal and Shelf Science.

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CITIZEN-SCIENCE FOR THE FUTURE: ADVISORY CASE STUDIES FROM AROUND THE GLOBE. Simoniello, C; Jencks, J; Lauro, FM; Loftis, JD; Deja, K; Forrest, DR; and at, et. (2019). VIMS Articles. 1398. ([link](#))

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DEFINING BOAT WAKE IMPACTS ON SHORELINE STABILITY TOWARD MANAGEMENT AND POLICY SOLUTIONS. Ocean and Coastal Management. Bilkovic D.M., M. Mitchell, J. Davis, J. Herman, E. Andrews, A. King, P. Mason, N. Tahvildari, J. Davis, R. Dixon. 2019. Ocean & Coastal Management, Volume 182. ([link](#))

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EXAMINING DERELICT POT IMPACTS ON HARVEST IN A COMMERCIAL BLUE CRAB *CALLINectes sapidus* FISHERY. Delbene, J. D.M. Bilkovic, A. Scheld. 2019. Marine Pollution Bulletin 139:150-6. ([link](#))

THE APPLICATION OF OYSTER REEFS IN SHORELINE PROTECTION: ARE WE OVER-ENGINEERING FOR AN ECOSYSTEM ENGINEER? Morris, R., Bilkovic, D.M., Boswell, M., Bushek, D. Cebrian, J., Goff, J., Kibler, K., La Peyre, M.K., McClenahan, G., Moody, J., Sacks, P., Shinn, J., Sparks, E., Temple, N., Walters, L., Webb, B., Swearer, S. 2019. Journal of Applied Ecology 56(70):1703-1711. ([link](#))

THE FLOODWATER DEPTH ESTIMATION TOOL FOR IMPROVED REMOTE SENSING ANALYSIS OF COASTAL FLOODING. Cohen, S; Raney, A; Munasinghe, D; Loftis, Jon Derek; and et al. (2019). VIMS Articles. 1781. ([link](#))

THE FUTURE OF COASTAL AND ESTUARINE MODELING: FINDINGS FROM A WORKSHOP. Fringer, Oliver B.; Dawson, Clint N.; He, Ruoying; Ralston, David K.; and Zhang, Y. Joseph. (2019). VIMS Articles. 1804. ([link](#))

THE INVISIBLE FLOOD: THE CHEMISTRY, ECOLOGY, AND SOCIAL IMPLICATIONS OF COASTAL SALTWATER INTRUSION. Tully, K., Gedan, K., Epanchin-Niell, R., Strong, A., Bernhardt, E.S., BenDor, T., Mitchell, M., Kominoski, J., Jordan, T.E., Neubauer, S.C. and Weston, N.B., 2019. BioScience, 69(5), pp.368-378.

THIRD-ORDER WENO TRANSPORT SCHEME FOR SIMULATING THE BAROCLINIC EDDYING OCEAN ON AN UNSTRUCTURED GRID. Ye, Fei; Zhang, Yinglong J; He, Ruoying; Wang, Zhengui; Wang, Harry V; Du, Jiabi. 2019. Ocean Modelling

TREADING WATER: TOOLS TO HELP US COASTAL COMMUNITIES PLAN FOR SEAL LEVEL RISE IMPACTS. Smith, E.A., Sweet, W., Mitchell, M., Domingues, R., Weaver, C., Baringer, M., Goni, G.J., Haines, J., Loftis, J.D., Boon, J. and Malmquist, D., 2019. Frontiers in Marine Science, 6, p.300. ([link](#))

VALIDATING AN OPERATIONAL FLOOD FORECAST MODEL USING CITIZEN SCIENCE IN HAMPTON ROADS, VA, USA. Loftis, Jon Derek; Mitchell, Molly; Schatt, Daniel; Forrest, David; Wang, Harry V.; Mayfield, David; and Stiles, William A. (2019). VIMS Articles. 1671. ([link](#))

REPORTS

EXPANDING THE USE OF NATURAL AND NATURE-BASED INFRASTRUCTURE TO ENHANCE COASTAL RESILIENCY. Berman, M., Mason, P., & Rudnicki, T. (2019). Virginia Institute of Marine Science, College of William and Mary. ([link](#))

THE PROBLEM OF FAILING SEPTIC SYSTEMS. Center for Coastal Resources Management, Virginia Institute of Marine Science. (2019). Rivers & Coast, Summer 2019, Vol. 14. Virginia Institute of Marine Science, College of William and Mary. ([link](#))

VIRGINIA STORMWATER ACT, TIERED APPROACH FOR RURAL TIDEWATER LOCALITIES: GENERATION OF WATERSHED IMPERVIOUS MAPS. Tombleson, C. (2019). Virginia Institute of Marine Science, College of William and Mary. ([link](#))

AWARDS

CATCH THE KING is a citizen-science flood mapping initiative centered in Hampton Roads, VA, that maps the annual king tide. It won a Guinness World Record in 2019 for “Most Contributions to an Environmental Survey” after overwhelming volunteer participation in its inaugural year. ([link](#))

STORMSENSE has installed more than 40 water level sensors to help better predict flooding resulting from storm surge, rain, and tides. It has received numerous awards since its inception this year it added the ESRI Special Achievement in GIS Award and Virginia Governor’s Technology Awards to the list. ([link](#))

VIRGINIA WETLAND CONDITION ASSESSEMENT TOOL - WETCAT was also recognized with a Virginia Governor’s Technology Award. WetCAT won in the category of “IT as Efficiency Driver - Government to Citizen”. This versatile online tool allows users to look at wetlands in the landscape, determine their stress levels, and link to impaired waters and other resources. ([link](#))

DR DONNA MARIE BILKOVIC was awarded the Reveley Faculty Fellowship. Under this fellowship Drs. Bilkovic and Hale will develop and teach an interdisciplinary undergraduate course, *Plastics in Society and the Environment: Problems and Solutions*.

PAMELA BRAFF received a Virginia Seagrant Graduate Fellowship and the 2019 Coastal Resource Management Fellowship. She was also awarded a Knauss Fellowship and has taken a position as an executive fellow with NOAA's National Ocean Service, as a policy specialist for coastal inundation and resilience.

NICOLE CAI received a Community Surface Dynamics Modeling System - CSDMS Scholarship in May, 2019.

JIM DELBENE received a Virginia Seagrant Graduate Fellowship and the 2019 Coastal Resource Management Fellowship, and the Knauss Fellowship. Jim will be working as a legislative fellow in the office of Senator Lisa Murkowski (R-Alaska) for one year.

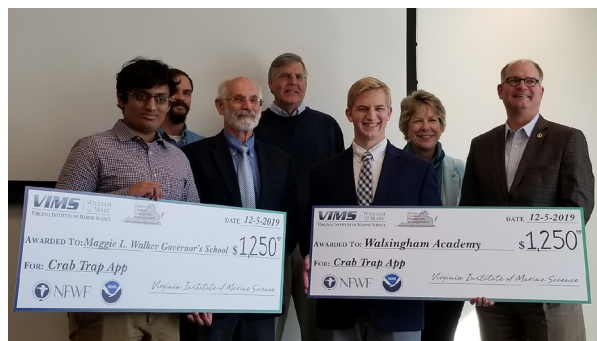
AMANDA GUTHRIE received the MacWhorter Family Fellowship (\$2,700) from the VIMS Foundation for academic year 2019-2020, the 2019 Coastal Resource Management Fellowship, travel awards from CERF to attend CERF 2019, and she was nominated for the PEO Scholar Award.

DR JON DEREK LOFTIS was the co-winner of VIMS' inaugural Innovation Fund competition designed to support efforts by VIMS scientists to innovate, commercialize products and services, and spur job growth. ([link](#))

DR MOLLY MITCHELL was selected as one of nine national Early Career Leadership awardees by the US Climate Variability and Predictability Program. She was one of only three scientists recognized for her efforts to understand the predictability of the oceans and climate across time scales, advance climate predictions and projections, and quantify / communicate skill and uncertainty. ([link](#))

KARINNA NUNEZ earned a Rouse-Bottom Foundation Fellowship from the CBNERRS program.

NEW TOOLS

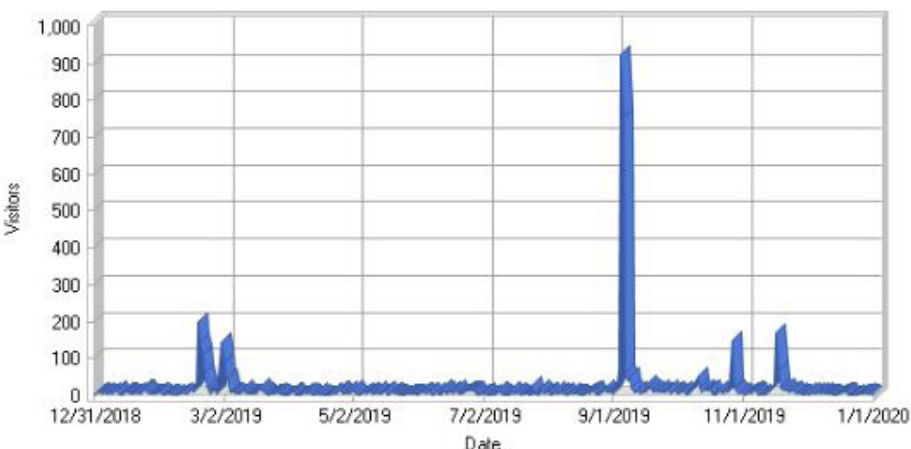


CRAB TRAP APP

CCRM has been studying the impacts of derelict blue crab traps and ways to reduce the economical and environmental problems. High school students recently joined the trap removal effort in Virginia waters by participating in a 'Crab Trap App' STEM Challenge to help develop an app to document the location of derelict blue crab traps. Registered volunteer citizen scientists can record derelict trap data on their smart phones in the winter when the fishery is closed. ([link](#))

TIDEWATCH MAP®

Tidewatch brings our coastal flooding predictions to the landscape, making it easier to visualize impacts to roads, properties, and structures. The spike in daily visitors to the website (right) corresponds to the period of time when Hurricane Dorian was moving through the Atlantic. Virginia was in the cone of uncertainty and people were concerned about significant flooding in the area. ([link](#))



OUTREACH

The Center for Coastal Resources Management (CCRM) staff produced materials for outreach education, and communicated relevant information through talks, workshops, e-newsletters, our website, and Facebook posts; all supporting actionable science.



PRESENTATIONS

Center staff attended more than 100 events in which we reached a combined 9658 people. These events varied, some were small individualized trainings or skyping with a scientist while others were large international conferences. CCRM presented on a wide range of topics including everything from climate change, sea-level rise and flooding risk management to marine debris, living shorelines and bay-friendly gardening to audiences made up of the general public; local, state and federal government; other scientists and students of all ages.

WORKSHOPS

One of these events was CCRM's annual Tidal Wetlands Workshop on May 2, 2019 at VIMS which was attended by 157 participants. "Building Momentum for Coastal Resilience" focused on actions currently underway in Virginia to prepare for and respond to coastal hazards. ([link](#))

E - NEWSLETTERS

CCRM distributes a quarterly e-newsletter which summarizes and communicates current issues that support integrated management of coastal zone resources; announces pertinent publications, programs and events; and points the reader to more detailed information on our website (and others).

- FEBRUARY 2019 ([link](#))
- JULY 2019 ([link](#))
- SEPTEMBER 2019 ([link](#))

WEBSITE

THE VIMS TEACHING MARSH is a 1-acre demonstration habitat built 20 years ago. Recent retrofits were made to aging infrastructure through a grant from William & Mary's Green Fee fund that supports advancements in sustainability on campus, including VIMS. The improvements include a new larger, higher, floating pier and Virginia's first demonstration of an 'amphibiated' floating shed. The Teaching Marsh web pages were also updated and provide information about various features and demonstrations at this outdoor classroom, including: Native Plants & Habitats; Fish & Wildlife; Living Shoreline Demonstrations; and Coastal Resilience Adaptations. ([link](#))

THE VIRGINIA SHORELINE INVENTORY CCRM researchers finished the latest iteration of online maps that display the condition of the Bay shoreline along its entire length (11,885 miles)—every beach, breakwater, boathouse, boat ramp, bulkhead, dock, jetty, living shoreline, marina, mud flat, oyster reef, tidal marsh, and tree-lined bank. The resulting coastal inventory was the first of its kind worldwide, and is accessible via web pages for each of Virginia's 44 coastal localities in "Comprehensive Coastal Resource Management Portals" or CCRMPs. ([link](#))

FACEBOOK

New this year was CCRM's social media effort via Facebook which was initiated as another approach to inform the public about coastal issues in Virginia. CCRM Facebook page fans mostly live in the United States, although we reached another 26 countries worldwide. ([link](#))

INSTITUTIONAL PARTNERS

GOVERNMENT AGENCIES

ACCOMACK-NORTHAMPTON PLANNING DISTRICT COMMISSION
 ALABAMA GEOLOGICAL SURVEY
 CALIFORNIA DEPARTMENT OF WATER RESOURCES
 CENTRAL WEATHER BUREAU - TAIWAN
 COMMONWEALTH OF VIRGINIA
 ENVIRONMENTAL PROTECTION AGENCY
 FEDERAL EMERGENCY MANAGEMENT AGENCY
 FEDERAL HIGHWAYS ADMINISTRATION
 FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
 FRENCH EMBASSY
 HAMPTON ROADS PLANNING DISTRICT COMMISSION
 HAMPTON ROADS SANITATION DISTRICT
 MIDDLE PENINSULA PLANNING DISTRICT COMMISSION
 NOAA – CHESAPEAKE BAY OFFICE
 NOAA – COASTAL SURVEY DEVELOPMENT LABORATORIES
 NOAA – FISHERIES AUKE BAY LABORATORIES
 NOAA – MARINE DEBRIS PROGRAM
 NOAA – MIDATLANTIC REGIONAL INTEGRATED SCIENCES AND ASSESSMENTS
 NOAA – NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM
 NOAA – RESTORE SCIENCE PROGRAM
 NATIONAL ACADEMY OF SCIENCE
 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 NATIONAL FISH AND WILDLIFE FOUNDATION
 NATIONAL PARK SERVICE
 NATIONAL SCIENCE FOUNDATION
 NATIONAL WILDLIFE FEDERATION
 NATURAL RESOURCES CONSERVATION SERVICE
 NATURAL RESOURCES CONSULTANTS, INC
 NORTH CAROLINA DIVISION OF COASTAL MANAGEMENT
 NORTH CAROLINA DIVISION OF MARINE FISHERIES
 NORTHERN NECK PLANNING DISTRICT COMMISSION
 MARYLAND DEPARTMENT OF ENVIRONMENT
 SECRETARY OF NATURAL RESOURCES
 US ARMY CORPS OF ENGINEERS - RESEARCH AND DEVELOPMENT CENTER
 US ARMY CORPS OF ENGINEERS - INSTITUTE FOR WATER RESOURCES
 US DEPARTMENT OF AGRICULTURE
 US DEPARTMENT OF DEFENSE
 US DEPARTMENT OF ENERGY
 US ENVIRONMENTAL PROTECTION AGENCY
 US FISH AND WILDLIFE SERVICE
 US GEOLOGICAL SURVEY
 US STATE DEPARTMENT
 VIRGINIA COASTAL ZONE MANAGEMENT PROGRAM
 VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION

VIRGINIA DEPARTMENT OF EMERGENCY MANAGEMENT
 VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
 VIRGINIA DEPARTMENT OF HEALTH
 VIRGINIA DEPARTMENT OF SOCIAL SERVICES
 VIRGINIA DEPARTMENT OF TRANSPORTATION
 VIRGINIA GEOGRAPHIC INFORMATION NETWORK
 VIRGINIA MARINE RESOURCES COMMISSION

UNIVERSITIES / INSTITUTES

DUKE UNIVERSITY
 FLORIDA INTERNATIONAL UNIVERSITY
 GEORGE MASON UNIVERSITY
 GULF OF MEXICO UNIVERSITY RESEARCH COLLABORATIVE
 HAMPTON UNIVERSITY
 INSTITUTE OF MOLECULES AND MATERIALS OF LE MANS - FRANCE
 LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER
 MISSISSIPPI STATE UNIVERSITY
 NATIONAL CHENG KUNG UNIVERSITY - TAIWAN
 OLD DOMINION UNIVERSITY
 PRINCETON UNIVERSITY
 RUTGERS UNIVERSITY
 SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER
 TEXAS A&M UNIVERSITY
 TROY UNIVERSITY
 UNIVERSITY OF CENTRAL FLORIDA
 UNIVERSITY OF DELAWARE
 UNIVERSITY OF GEORGIA
 UNIVERSITY OF LA ROCHELLE - FRANCE
 UNIVERSITY OF MAINE
 UNIVERSITY OF MELBOURNE - AUSTRALIA
 UNIVERSITY OF NEW ORLEANS
 UNIVERSITY OF PENNSYLVANIA
 UNIVERSITY OF SOUTH ALABAMA
 UNIVERSITY OF TASMANIA - AUSTRALIA
 UNIVERSITY OF VIRGINIA
 UNIVERSITY OF WASHINGTON
 VIRGINIA SEA GRANT
 VIRGINIA TECH
 WAGENINGEN UNIVERSITY AND RESEARCH - THE NETHERLANDS
 WATER INSTITUTE OF THE GULF
 WILLIAM & MARY - KECK ENVIRONMENTAL FIELD LABORATORY
 WILLIAM & MARY - VIRGINIA COASTAL POLICY CENTER

NON-GOVERNMENT ORGANIZATIONS

ABT ASSOCIATES
 ALBEMARLE-PAMILICO NATIONAL ESTUARY PARTNERSHIP
 AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION

CHESAPEAKE BAY FOUNDATION
CHESAPEAKE BAY PROGRAM
CHESAPEAKE BAY TRUST
CHESAPEAKE RESEARCH CONSORTIUM
DEAL ISLAND PENINSULA PROJECT
GALVESTON BAY FOUNDATION
GARDEN CLUB OF AMERICA
HELMHOLTZ-ZENTRUM GEESTHACHT - GERMANY
ICF CONSULTING, INC
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JAMES RIVER ASSOCIATION
LAKE PONTCHARTRAIN BASIN FOUNDATION
NATURAL RESOURCES CONSULTANTS, INC
PARTNERSHIP FOR DELAWARE ESTUARY
RAND CORPORATION
RAPPAHANNOCK RIVER BASIN COMMISSION
SITKA SOUND SCIENCE CENTER
THE CONSERVATION FUND
VIRGINIA EXTENSION MASTER GARDENERS - GLOUCESTER
VIRGINIA EXTENSION MASTER GARDENERS - NEWPORT NEWS
VIRGINIA EXTENSION MASTER GARDENERS - NORTHERN NECK
VIRGINIA EXTENSION MASTER GARDENERS - YORK/POQUOSON
VIRGINIA MASTER NATURALISTS - HISTORIC RIVERS
VIRGINIA MASTER NATURALISTS - HISTORIC SOUTHSIDE
VIRGINIA MASTER NATURALISTS - MIDDLE PENINSULA
VIRGINIA MASTER NATURALISTS - NORTHERN NECK
VIRGINIA MASTER NATURALISTS - PENINSULA
VIRGINIA MASTER NATURALISTS - RIVERINE
VIRGINIA MASTER NATURALISTS - TIDEWATER
WETLANDS WATCH
YORK RIVER AND SMALL COASTAL BASIN ROUNDTABLE