

EMECS9

Managing for Results in our Coastal Seas

**August 28-31, 2011
Baltimore, Maryland, USA**

www.conference.ifas.ufl.edu/EMECS9



Managing for Results in our Coastal Seas

August 28, 2011

Welcome to EMECS 9, Global Summit on Coastal Seas

The EMECS 9 conference planners and supporters wish to welcome all participants to this important gathering to further our knowledge and action to restore, protect, and enhance this globe's coastal seas. From the first EMECS conference held in 1990 in Kobe, Japan and in each of the following eight conferences around the world scientists, government environmental managers, business members, students and citizens have been drawn together to struggle with the complex issues influencing the water quality of these complex coastal water bodies.

From that first meeting in Kobe and with the establishment of the International EMECS Center in the early 1990's the core principle of all involved has been that we have a "shared responsibility" not only to manage coastal seas but to develop sustainable approaches to our resources; human, fiscal, and natural. Without this principle of a "shared responsibility" our efforts become disjointed, fail to address issues in a comprehensive manner, fall short of acknowledging the great diversity of our cultural values, and provide only partial and inadequate approaches.

EMECS's greatest promise through over twenty years, now nine conferences, ongoing environmental training programs, multiple regional and specialized seminars, is the acknowledgment that we have a remarkable diversity of resources and expertise to develop innovative solutions, engage new populations, especially our young people, and that we must continue in a focused mission to discover and implement new approaches.

During the several days of the EMECS 9, a Global Summit on Coastal Seas, participants are afforded unique opportunities to engage each other in lively and productive discussion. The conference planning committee with the efforts of the University of Florida, IFAS Office of Conferences and Institutes have organized this summit to maximize each participants access to a wide range of resources. It is also a time that we share our diverse cultural, regional and national heritages to further expand our vision and ability to protect our coastal seas for this and future generations.

We look forward to a productive and enjoyable summit that builds on over twenty years of thoughtful dialogue and commitment by governments, the business community, NGOs and citizens. We anticipate this ongoing commitment as we step forward to prepare for EMECS 10.

Sincerely,

A blue ink signature of Dr. Bob Summers.

Dr. Bob Summers
Conference Co-Chair

A black ink signature of Mr. David Carroll.

Mr. David Carroll
Conference Co-Chair

A black ink signature of Mr. Dave Nemazie.

Mr. Dave Nemazie
Program Co-Chair

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Conference Purpose

The Ninth International Meeting on the Environmental Management of Enclosed Coastal Seas (EMECS 9) focuses on scientifically sound; sustainable restoration approaches, ensuring accountability and effective communication for successful integrated management of coastal seas. The purpose of EMECS 9 is to improve our ability to manage coastal seas in all of their ecological, economic, and cultural dimensions and bring together stakeholders from government, non-government organizations, academia, and private sector leaders who are interested in the management and policies of coastal seas.

To do this, the conference has drawn on lessons learned and case studies from around the world. EMECS 9 addresses the following themes: accountability, sustainable approaches, finance and funding, multilateral partnerships, innovative education and communication, and underlying science of enclosed coastal sea management.

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Chesapeake Bay Program

John Hopkins University, Whiting School of Engineering

Maryland-Asia Environmental Partnership

Maryland Department of Natural Resources

University of Florida, Institute of Food and Agricultural Science

Detailed Agenda

<i>Saturday, August 27, 2011</i>					
15:00	Exhibitor and Poster Presenter Set-Up - Grand Ballroom Salons VI				
17:00-19:00	Pre-Conference Registration Open - Registration Rotunda on the 3rd Floor				
<i>Sunday, August 28, 2011</i>					
07:00-17:30	Conference Registration Open				
07:00-08:30	Morning Refreshments and Poster Set-Up - Grand Ballroom Salons VI				
General Session - Grand Ballroom Salon V					
08:30-08:50	<p align="center"><u>Conference Introduction and Overview</u> Dr. Bob Summers, Secretary, Maryland Department of the Environment Moderator Assistant: Zoe Newell</p>				
Concurrent Sessions 1					
Session	1A	1B	1C	1D	1E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
09:00-10:25	New Education and Communication Tools	Partnerships in Coastal Restoration I	SPECIAL SESSION: Disseminating the Concept of "Satoumi" Internationally Part 1: Activities in Asia	Underlying Science: Sediment Processes I	SSP: Coastal Community-Based Initiatives to Conserve Coastal Resources
Moderator	Richard Lacouture	Brenton McCloskey	Yves Henocque	Kevin Hedge	George Radcliffe
AV Operator	Kelly Kunsch	Nicole Carlozo	Hotel AV	Sarah Larsen	Zoe Newell
09:00-09:05	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
09:05-09:25	Yoshinari Kobuke Environmental Educational Effects in the Use of New Composite Index of Water Environment	Keisuke Isshiki Development of Water Quality Improvement Channel with Citizens in Amagasaki Canal, Japan	<i>Note: The Satoumi Special Sessions will follow different session timing. A detailed version of this agenda may be found in the program book.</i>	Toru Endo Field Investigation of Oxygen Consumption Characteristic of Sediment in Hypoxic Enclosed Coastal Sea	Student Presentations: Leah Healy and Sophia Scully Likely Implications of Sea Level Rise for North Humboldt Bay, California
09:25-09:45	Satoshi Chiba Pearl Culture Waste, Nutrient Load from Land or Loss of Tidal Flat, What is the Cause of the Deterioration and what should be controlled for the Restoration of Ago Bay Environment?	Thamasak Yeemin An Action Plan for Coral Reef Management in Thailand following Coral Bleaching Events	Opening Remarks: Gov. Toshizo Ido , Hyogo Prefecture, Japan Session Introduction: Tetsuo Yanagi , Convener of Session Osamu Matsuda , Evolution of Satoumi Frame During the Recent International Meetings	Mitsuru Hayashi Estimation of Submarine Groundwater and TP Flux Near the Intertidal Zone by the Budget Analysis Using the Marine Observation Data	Katsuhiko Touzak Let's make the Sea of Amagasaki Blue! Saori Takahashi An Approach to Reduce the Garbage at the Bottom of the Seto Inland Sea Additional Presenters: LeeAnn Hutchison REINS: Riders in the Environment Improving Native Shorelines

Concurrent Sessions 1 - Continued					
09:45-10:05	Jean Paul Ducrotoy Health of Human Populations and Associated Domestic Animals as a Component of the Integrated Coastal Zone Management Approach	Guy Stephens Innovative Web Based Communications and the Chesapeake Bay	Takahiko Chino, Satoumi Policy in Japan Takeshi Hidaka, Rules and Regulations Supporting Satoumi as a Social System Suhendar Sachoemar, Development of Sustainable Aquaculture as a Model of Satoumi and GAPURA to Improve Productivity of Marinal Brackish water Ponds Hideki Kokubu, Evaluation of Tidal Flat Restoration Effect in the Coastal Unused Reclaimed Area by Promoting Tidal Exchange with Public Involvement	Sosuke Otani Relationships between Food Web Structure of Benthic Community and Origin of Sedimentary Organic Matter in Tidal Flats of Two River Mouths in Shikoku Island, Japan Takashi Kawai A Comparative Study of Distribution Pattern of Two Endangered Benthic Animals on Artificial and Natural Tidal Flats	Santiago de la Puente Using Community to Conserve a Great Coastal Ecosystem Panel Discussion- All Presenters
10:05-10:25	Q&A Group Discussion	John Seidel University & Municipal Partnerships in Sustainability – A Model for Success			
10:25-10:50	AM Break - Grand Ballroom Salons VI				
Concurrent Sessions 2					
Session	2A	2B	2C	2D	2E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
10:50-12:15	Sustainability: Reducing Toxic Pollutants	Partnerships in Coastal Restoration II	SPECIAL SESSION: Disseminating the Concept of "Satoumi" Internationally Part 2: Satoumi from the Perspective of Western Society	Underlying Science: Sediment Processes II	SSP: Panel, Social Media: Leverage it to Discuss, Illuminate and Educate
Moderator	Edward Bouwer	Suzanne Bricker	Osamu Matsuda	Ted Gattino	Margaret Enloe
AV Operator	Leah Healy	Nicole Carlozo	Hotel AV	Sarah Larsen	Sophia Scully
10:50-10:55	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
10:55-11:15	Yongseok Hong Assessment of Mercury Contamination and Bioaccumulation in Sarasota Bay	Brenton McCloskey Advancing Watershed Restoration at the Local Level Through the Chesapeake Bay TMDL	Wayne Bell, Historic and Contemporary Land Use on the Chesapeake Bay Watershed: The Relationship of Working Landscape to the Satoumi Perspective	Kevin Hedge Floating Wetland Islands as a tool for Ecosystem Restoration - Basic Science and Future Embodiments	Panel Members: Guy Stephens Nuts and Bolts: Integrating Social Media into your Website

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Concurrent Sessions 2 - Continued					
11:15-11:35	Satoshi Asaoka Granulated Coal Ash Can Effectively Absorb Hydrogen Sulfide	Satoquo Seino Exploring Characteristics of Beach Environments and Issues of Coastal Management through Analysis of Drift PET Bottles along the Shores of Fukuoka/Hakata Bay, Japan	Yves Henocque, Enhancing Social Capital for Sustainable Coastal Developments: Is Satoumi the Answer? Marjo Vierros, The Role of Satoumi in Implementing the Convention on	Maya Matsushige Aftereffects of Hypoxia Exposure on Ruditapes philippinarum in Omaehama beach, Japan	Michael Dougherty It's Scientifically Proven: If You Engage . . . You Win Pamela Wood A Journalist's Perspective on Social Media
11:35-11:55	Amar Wadhawan Effect of Oxygenation on Speciation, Behavior, and Fate of Chromium in Estuarine Sediments	Jeanne Michelle Ryan Chesapeake Bay: A Case Study of Citizen Science and Executive Order 13508	Biological Diversity and Other International Commitments Yoshitaka Ota, Small Coasts, Large Issues - Can Communities Protect Their Coasts?	Alaa Salem Post-Aswan Dam Sedimentation Rate of Lagoons of the Nile Delta, Egypt	
11:55-12:15	Q&A Group Discussion	Q&A Group Discussion	Terry Doss, Sustainable Approaches to Restoring Coastal Habitat in the Heart of New York City Erdal Ozhan, A Comprehensive Regional Effort to Enhance Integrated Coastal Management in the Mediterranean and the Black Sea Countries	Q&A Group Discussion	
12:15-13:30	Lunch on Own				

Concurrent Sessions 3					
Location	3A	3B	3C	3D	3E
Session	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
13:30-14:55	Accountability: Goal Setting & Management Approaches	Sustainability: Tools for Pollution Reduction	SPECIAL SESSION: Disseminating the Concept of "Satoumi" Internationally Part 3: Satoumi from the Perspectives of Asian/Western Society	Accountability: Governance	SSP: Panel- Online vs. Outdoor Education, Dilemma or Opportunity?
Moderator	Zhongyuan Chen	Bob Summers	Tetsuo Yanagi	Dave Nemazie	Coreen Weilminster
AV Operator	Jodi Toll	Leah Healy	Hotel AV	Sophia Scully	Kelly Kunsch
13:30-13:35	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
13:35-13:55	Hideto Uranaka The health examination of Ago Bay	Richard Batiuk Implications of Putting the 17 Million Chesapeake Bay Watershed Residents on a Regulatory Pollution Diet	Catherine Wazniak Early Detection of Coastal Ecosystem Response to Management Actions General Discussion for All Satoumi Sessions	Eric Wolanski The Residence Times of Land-Sourced Contaminants in the Great Barrier Reef Lagoon and Their Impact on Reef Recovery Following Land-Use Remediation in the Watershed	Panel Members: Dann Sklarew Fostering Bay Stewardship Values, Understanding and Action through Blended Indoor, Outdoor and Online Learning: A District-wide Case Study from Prince William County, Virginia Richard Lacouture PLANS: PLankton And Nutrient Studies for the Chesapeake Bay
13:55-14:15	Xiyong Hou Trends in Chlorophyll-a Concentration and its Relationship to An Area-weighted Water Quality Index at the Bohai Sea, China	Ryuji Tomisaka Support Project of Total Pollutant Load Control System introduction		Malgorzata Dereniowska Competing Rationalities in Marine Ecosystem Services Management: Implications for the Polish EEZ	George Radcliffe Birds Can Connect Students with their Coastal Watersheds Jean Paul Ducrotoy Striking a Balance Between Using Electronic Educational Tools and Running Live Sessions
14:15-14:35	Dianne Poster Federal Activities to Support the Determination of Links between Environmental Conditions and the Health of Marine Organisms and Humans	YoonJu Yi An Analysis of Covariance to Determine the Effect of TPLMS in Masan Bay, Korea		Mark Tedesco Integrating Clean Water Act Requirements with Ecosystem Based Management Approaches in the Long Island Sound	
14:35-14:55	Q&A Group Discussion	William Fisher Coral Reef Biological Criteria: Using the Clean Water Act to Protect a National Treasure		William Dennison Innovations in Environmental Synthesis, Communication, Reporting and Governance	MD No Child Left Inside Initiative Panel Discussion- All Presenters
14:55-15:20	PM Break - Grand Ballroom Salons VI				

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Plenary Session - Grand Ballroom Salon V	
15:20-17:00	<p>Hazards Plenary: <u>The Gulf of Mexico Oil Spill and the Japanese Tsunami</u> Moderated By: Dr. Bob Summers, Secretary, Maryland Department of the Environment Dr. Don Boesch, President, University of Maryland Center for Environmental Science - Gulf of Mexico Oil Spill Mr. Bob Perciasepe, Deputy Administrator, U.S. Environmental Protection Agency Dr. Tomoya Shibayama, Professor of Science and Engineering, Waseda University - Japanese Tsunami <i>Moderator Assistant: Jodi Toll</i></p>
17:30-19:30	Welcome and Poster Reception - Grand Salons VI
19:00-20:30	SSP Delegation Meeting

Monday, August 29, 2011					
07:30-17:00	Conference Registration Open - Registration Rotunda on the 3rd Floor				
07:30-08:30	Morning Refreshments - Grand Ballroom Salons VI				
Plenary Session - Grand Ballroom Salon V					
08:30-10:25	<p align="center"><u>Keynote Plenary Session</u></p> <p align="center">Moderated By: Dr. Bob Summers, Secretary, Maryland Department of the Environment Governor Martin O'Malley, Maryland, USA Governor Toshizo Ido, Hyogo Prefecture, Japan Mr. Bob Perciasepe, Deputy Administrator, U.S. Environmental Protection Agency Dr. Motoyuki Suzuki, EMECS International Center Presidential Candidate Dr. Patricia Majluf, Keynote Address Moderator Assistant: Katherine Pordeli</p>				
10:25-10:50	AM Break - Grand Ballroom Salons VI				
Concurrent Sessions 4					
Session	4A	4B	4C	4D	4E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
10:50-12:15	Paying for the Clean Up	Financing and Funding Coastal Restoration I	APN Special Session: Vulnerability and Risk Management of Enclosed Coastal Seas Home to Asian Megacities	Sustainability in Enclosed Coastal Seas I	Session Cancelled, Room Available for Ad-Hoc Meetings
Moderator	Stephanie VonFeck	Dave Nemazie	Akio Takemoto	Court Stevenson	
AV Operator	Sophia Scully	Leah Healy	Hotel AV	Kellie Pelikan	
10:50-10:55	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	
10:55-11:15	Jag Khuman Paying for Point Source Pollution	Jennifer Raulin Putting Resources to the Level Where the Work Gets Done: Accelerating Restoration in Maryland	<i>Note: The APN Special Session will follow different session timing. A detailed version of this agenda may be found in the program book.</i>	Jean Paul Ducrotoy Management Plans for European Estuaries for the Restoration and Protection of their Ecological Functions	
11:15-11:35	Michael Curley Paying for Stormwater	Sarah Lane Investing in Innovative Technologies for Chesapeake Bay Restoration	Opening Remarks: Gov. Toshizo Ido , Hyogo Prefecture, Japan Session Introduction: Akio Takemoto , APN Mark Pelling Vulnerability of Coasts Home to Mega-Cities in Asia	Tamiji Yamamoto Suppression of Phosphate Release from Coastal Sediments using Granulated Coal Ash	

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Concurrent Sessions 4 - Continued					
11:35-11:55	Stephanie VonFeck Paying for Non-Point Source	Tim Jones Leveraging and Tracking Private and Public Sector Funding to Protect and Restore Enclosed Coastal Seas	Mohammed Rahman Vulnerability of the Bay of Bengal Enclosed Coastal Sea due to Socio-Economic Conditions of the Megacity of Dhaka	William Jones Regulating Air Pollution to Improve Water Quality: An Overview of IMO's Emission Control Area Program	Session Cancelled, Room Available for Ad-Hoc Meetings
11:55-12:15	Paul Marchetti Nutrient Trading	John Campagna Enhancing the Economy and Environment Of our Working Lands and Waters	Piamsak Menasveta The Impacts of Coastal Erosion on the Bangkok-area of Gulf of Thailand Zhongyuan Chen Bohai Bay, Tianjin Panel Q&A Session All speakers Wrap-up Akio Takemoto	Jody Thompson Implementing a Hazard Resilience Tool: The Coastal Community Resilience Index	
12:15-13:30	Lunch on Own				
Concurrent Sessions 5					
Session	5A	5B	5C	5D	5E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
13:30-14:55	Measuring Accountability	Financing and Funding Coastal Restoration II	Partnerships in Large Scale Restoration	Sustainability in Enclosed Coastal Seas II	Public Awareness Through Education and Communication
Moderator	Ann Swanson	Jennifer Raulin	Erdal Ozhan	Thomas Sprehe	Ruben Kos'yan
AV Operator	Katherine Pordeli	Malgorzata Anna Dereniowska	Hotel AV	Melissa Munoz	Sarah Isbell
13:30-13:35	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
13:35-13:55	Peter Tango Chesapeake Bay Program Monitoring Realignment: Reprogramming to Address Senior Management Partnership Priorities	Sasha Koo-Oshima An Economic Approach to Appraise the Restoration of Coastal Resources by Water Reuse	Ivica Trumbic MedPartnership: A New GEF Project in the Mediterranean	Court Stevenson Questions of Sustainability in a Large-scale Tidal Wetland Restoration in Chesapeake Bay	Sharon Walker Bi-National Coastal Ecosystem Learning Center Partnership
13:55-14:15	Thomas Schoenbaum The Scope of Liability for Damages to Private Party Claimants for Accidental Discharges of Oil and Hazardous Substances under United States Law	Joe Berg Towards Sustainable Watershed Restoration Projects: Source Reduction versus Interception	John Tiedemann Fostering Flats Conservation and Stewardship in The Bahamas	Jon Grant A Multi-Tier Modeling Approach to Sustainable Management of Coastal Water and Sediment Quality	Joanna Woerner Connecting Students With Corals & Climate Change: Innovative Web & Classroom Materials

Concurrent Sessions 5 - <i>Continued</i>					
14:15-14:35	Jane Thomas Assessing natural resource condition of Assateague Island National Seashore	Bob Summers Maryland Bay Restoration Fund (aka The Flush Tax)	William Deustch A Trans-Boundary, Community-Based Response to Gulf of Mexico Water Quality Issues	Christopher Overcash Direct Intervention to Improve Hypoxic Conditions: A Baltimore Harbor Pilot Study	Joanna Piwowarczyk Conceptualization of Climate Change and Its Implications for Coastal Management in the Southern Baltic
14:35-14:55	Unmesh Kirtikar Coastal Regulation and Its Enforcements, Case Study : India	Said Chaouki Chakour Economics of (MPAs) and Coastal Environmental Governance in the Western Mediterranean	William Nuttle Bringing the Coast into the Partnership for Ecosystem Restoration in South Florida	Q&A Group Discussion	Q&A Group Discussion
14:55-15:20	PM Break - Grand Ballroom Salons VI				
Plenary Session - Grand Ballroom Salon V					
15:20-17:00	<u>Chesapeake Bay Plenary Panel and Discussion Session</u> Moderated By: Dr. Jonathan Kramer , Director, Maryland Sea Grant College Program Mr. Richard Batiuk , Associate Director for Science, Chesapeake Bay Program Office, U.S. Environmental Protection Agency Ms. Frances Flanigan , Former Director, Alliance for the Chesapeake Bay Mr. Richard Hall , Secretary, Maryland Department of Planning Dr. David Secor , Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science Moderator Assistant: Bronwyn Madeo				
Evening on your own					
19:30	<u>Optional Monday Evening Entertainment:</u> Live Performance by Geoff Kaufman (FREE to all EMECS registrants) “Natural Reflections: Re-finding our Place in Nature through Word and Song” Location: Grand Salon V				

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<i>Tuesday, August 30, 2011</i>					
07:30-17:00	Conference Registration Open - Registration Rotunda on the 3rd Floor				
07:30-08:30	Morning Refreshments - Grand Ballroom Salons VI				
Concurrent Sessions 6					
Session	6A	6B	6C	6D	6E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
08:30-09:55	Partnerships and Risk Management	Sustainability: Fisheries Management	Sustainability: Ports and Mainlands	Accountability: Nutrients and Modeling I	Citizen Science and Citizen-based Monitoring Program
Moderator	William Nuttle	Jon Kramer	George Chmael	Richard Batiuk	Dann Sklarew
AV Operator	Sarah Isbell	Alycen Kus	Hotel AV	Kellie Pelikan	Melissa Munoz
08:30-08:35	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
08:35-08:55	Robert Swett Preserving the Ecological and Recreational Values of Florida Waterways	Piamsak Menasveta Monitoring of Mercury Concentration in Fish in the Vicinity of Natural Gas Production Platform in the Gulf of Thailand	Mario Tamburri Addressing Critical Environmental Issues Facing the Maritime Industry	R. Christian Jones Temporal Variation in Water Quality at a Fixed Monitor on the Tidal Potomac River	William Deutsch A Trans-Boundary, Community-Based Response to Gulf of Mexico Water Quality Issues
08:55-09:15	Satoquo Seino Biological Diversity Policy and Consideration of Marine Protected Areas on Small Island Coasts - Tsushima Island and the Goto Islands	James Uphoff Managing Development and Chesapeake Bay's Estuarine Fish Habitat and Fisheries	Caroline Wicks Assessing the Ecological and Human Health Status of Baltimore's Inner Harbor	Philippe Larroude Sediment Mobility as an Indicator of Vulnerability to Climate Change on a Mediterranean Beach	Jan Marcin Weslawski Citizen science in Baltic Sea – Experience from the Beach
09:15-09:35	Marcus Griswold From Headwater to Sea: Adapting to Climate Change in the Chesapeake Bay	Naotomo Ota A Comparative Study of Shellfish Assemblage Patterns between an Artificial and a Natural Sandy Tidal Flat	Akio Hayashi Restoration of Coastal Environments Using Steelmaking Slag and Dredged Soil	Ryoichi Yamanaka Numerical Study on Dispersion of Turbid Overland Flow in Stratified Waters	Eugene Allevato Integrating Practical Geometry and Statistics into Service Learning Activities: Remediating Stormwater Runoff with Community Rain Gardens
09:35-09:55	Paul Krause Determining the Ecological Value of Shell Mound Reef Habitats Following Decommissioning of Offshore Platform Sites	Said Chaouki Chakour Sustainable Management of Marines' Resources in Algeria: The Contribution of an Empirical Approach	Angela Bandemehr U.S.-Mexico Fuel Switching Demonstration on Oceangoing Vessels in the Gulf of Mexico	Toshihiro Kitada Estimation of Wet and Dry Deposition of Gaseous and Particulate Ammonia and Nitric Acid using Buoy in Mikawa Bay, Japan and Evaluation of its Effect on Eutrophication by Fluid Dynamic-Ecological Mode	Q&A Group Discussion
09:55-10:25	AM Break - Grand Ballroom Salons VI				

Concurrent Sessions 7					
Session	7A	7B	7C	7D	7E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
10:25-11:50	Sustainability: Ecological Thresholds I	Regional Partnerships	Baltimore Harbor Session	Accountability: Nutrients and Modeling II	Coastal Systems in the Classroom
Moderator	Dave Nemazie	Ivica Trumbic	David Carroll	Philippe Larroudé	David Foster
AV Operator	Sarah Isbell	Bronwyn Madeo	Hotel AV	Jodi Toll	Melissa Munoz
10:25-10:30	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
10:30-10:50	R. Christian Jones Eutrophication and Partial Recovery of a Shallow Embayment of the Tidal Potomac River	William Fisher A Decision Framework to Protect Coral Reefs in Guanica Bay, Puerto Rico	Halle van der Gagg Blue Water Baltimore: Developing a Regional/Citizen Based Water Quality and Stream Restoration Strategy	Richard Batiuk Chesapeake Modeling Tools for Integrating Air and Water Environmental Management	Ruben Kos'yan International Conference and Summer School-Seminar "Dynamics Of The Coastal Zone Of Non-Tidal Seas"
10:50-11:10	Xiyong Hou Shifts of the Land-based Human Activities in Circum Bohai Sea Coastal Region in the Early 21st Century	Storm Cunningham Techniques and Tools for Designing, Funding, Implementing, and Managing Large-Scale, Long-Term Ecosystem, Watershed, and/or Fishery Restoration Programs	Laurie Schwartz Baltimore Waterfront Partnership	Eric Wolanski A New Exchange Flow Formulation for the LOICZ Model and the Relative Contribution of Advection and Diffusion to Transport Time Scales	Richard Lacouture PLANS: PLankton And Nutrient Studies for the Chesapeake Bay
11:10-11:30	Fumiko Nogami Relation Between the Decreased Mussels Biomass and Water Quality at Amagasaki port, Osaka Bay, in 2010	Aiko Endo Policies Governing the Integrated Management of Forests, River Basins and Coasts in Japan	Frank Hammons Baltimore Harbor Options Team: Development of a long term strategy for managing dredged material from Baltimore Harbor	Tomohiro Komorita Detailed Monitoring of Nutrient Supply through Tidal Front in Seto Inland Sea, Japan	Dann Sklarew Fostering Bay Stewardship Values, Understanding and Action through Blended Indoor, Outdoor and Online Learning: A District-wide Case Study from Prince William County, Virginia
11:30-11:50	Shilpa Singh Mangrove Ecosystem Changes during the Holocene from Chilka Lagoon, East Coast, India	George Ramseur, Jr. Gulf of Mexico Regional Sediment Management Master Plan	Panel Discussion- All Presenters	Lee Curry Meeting Maryland's Chesapeake Bay TMDL Allocations: Facilitating Stakeholder Involvement in Nutrient Modeling	Q&A Group Discussion
11:50-13:30	Lunch on Own				

EMECS9: Managing for Results in our Coastal Seas

Plenary Session - Grand Ballroom Salon V					
13:30-15:10	<p align="center">Climate Change Panel and Discussion Session Moderated By: Dr. Masataka Watanabe, Chair of Asia-Pacific Adaptation Network Dr. Zhongyuan Chen, Department of Geography, East China Normal University Ms. Zoe Johnson, Maryland Department of Natural Resources Dr. Philippe Larrourdé, Laboratoire des Ecoulements Géophysiques et Industriels (LEGI) Dr. Alaa Salem, Kafrelsheikh University, Egypt Dr. Jan Marcin Weslawski, Marine Ecology Department, Institute of Oceanology, Polish Academy of Sciences Moderator Assistant: Bronwyn Madeo</p>				
15:10-15:35	PM Break - Grand Ballroom Salons VI				
Concurrent Sessions 8					
Session	8A	8B	8C	8D	8E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
15:35-17:00	Sustainability: Ecological Thresholds II	Underlying Science: Nutrient Dynamics I	Preparation for Closing Banquet	Community Partnerships	Accountability: Modeling and Monitoring I
Moderator	William Dennison	Hi-II Yi		Peter Tango	Eric Wolanski
AV Operator	Kellie Pelikan	Alycen Kus		Malgorzata Anna Dereniowska	Sarah Larsen
15:35-15:40	<i>Introduction</i>	<i>Introduction</i>	No Session: Preparation for Closing Banquet	<i>Introduction</i>	<i>Introduction</i>
15:40-16:00	Kenji Sugimoto Changes in Dominant Species of Seagrass Bed Off Lwakuni, Seto Inland Sea, Japan	Kazuo Muramastu The Runoff Characteristic of Nutrients from Kako River in Hyogo Prefecture, Japan		Makamas Sutthacheep Community Participation in Research on Seagrass Ecosystem in Krabi Province, Thailand	Catherine Wazniak Signaling Dissolved Oxygen Response to Eutrophication Using High Frequency Data
16:00-16:20	Nikolai Shadrin Alternative Stable States of Ecosystems, Tipping Points and Management of the Coastal Seas	Kuninao Tada A Review of Nutrient Concentrations in the Eastern Seto Inland Sea, Japan		Sara Powell Partnering with Watershed Organizations to Produce Tributary-Specific Report Cards	Carl Cerco Management Modeling of Suspended Solids and Living Resource Interactions
16:20-16:40	Mohammed Ataur Rahman Study on the Changes of Coastal Zone: Chittagong to Cox's Bazar along the Bay of Bengal	Dann Sklarew In the Context of Climate Variability, Assessing Trajectories from Eutrophication to Restoration Over 25 Years in the Tidal Freshwater Portion of the Potomac River Estuary		R. Heath Kelsey Development of the Great Barrier Reef Annual Report Card	João G. Ferreira Application of System-Scale and Farm-Scale Ecological Models in order to Quantify Interactions Between Aquaculture and Environment Throughout the World
16:40-17:00	Unmesh Kirtikar Sustainability of Coastal Areas in Climate Change : Bengal Delta	Julie Rose An Exploratory Investigation of Nutrient Bioextraction Opportunities in Long Island Sound		Q&A Group Discussion	Kathy Goodin A Coastal and Marine Ecological Classification Standard (CMECS)
18:00-21:00	Closing Dinner Banquet - Grand Ballroom Salon V				

Wednesday, August 31, 2011					
07:30-11:30	Conference Registration Open - Registration Rotunda on the 3rd Floor				
07:30-08:30	Morning Refreshments and Poster Removal - Grand Ballroom Salons VI				
Concurrent Sessions 9					
Session	9A	9B	9C	9D	9E
Location	Grand Salon I-II	Grand Salon III-IV	Grand Salon V	Grand Salon VII-VIII	Grand Salon IX-X
08:30-09:55	Sustainability: Wetland Technologies	Underlying Science: Nutrient Dynamics II	US Army Corps of Engineers Special Session	Citizen Science	Accountability: Modeling and Monitoring II
Moderator	Dave Nemazie	William Dennison	Debbie Larson-Salvatore	John Seidel	Carl Cerco
AV Operator	Nicole Carlozo	Malgorzata Anna Dereniowska	Hotel AV	Alycen Kus	Katherine Pordeli
08:30-08:35	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>	<i>Introduction</i>
08:35-08:55	Joseph Shisler Estuarine Habitat Restoration on an Intertidal/ Submerged Cap	Kazuo Murakami The Estimations of Nutrient Cycles of Artificial Tidal Flat in Tokyo Bay	Amy Guise and Andrew Roach The Evolution of Resilience in Integrated Coastal Systems: Chesapeake Bay	Satoquo Seino Progress of Citizen Participation and Multi-sectorial Collaboration as the Driving Forces of Integrated Coastal Zone Management in Japan	Esteban Mino Field Survey and Satellite Validation of Water Quality Parameters of Rivers in the Surroundings of Santo Domingo Metropolitan Area, Dominican Republic
08:55-09:15	Ted Gattino Floating Wetland Islands in Restoration Ecology in Fresh, Brackish and Salt Water	Susumu Yamochi Effects of Desiccation and Salinity on the Outbreak of a Green Tide of <i>Ulva pertusa</i> at the Artificial Salt Marsh Along the Coast of Osaka Bay, Japan	William Brostoff Estuarine Restoration in San Francisco Bay: Design and Adaptive Management	Carol McCollough Communicating the Health of Maryland's Coastal Bays – Involving Citizens With Science	Won Keun Chang Spatial Pattern of Korean Major 38 Estuaries and their Relationship with Land-based Activities
09:15-09:35	James Bays Using Constructed Treatment Wetlands for Nutrient Load Reduction to Estuaries: An Illustrative Example from Virginia	Yukio Komai Long-term Changes of Nutrients in River Water Flowing into the Osaka Bay, Japan	Debbie Larson-Salvatore, Lauren Leuck, and Charley Chesnutt SAGE: Systems Approach to Geomorphological Engineering Innovative Approach to Coastal Landscape Transformation	Patricia Bradley The Human Component of the Coral Reef Ecosystem: A Framework for Sustainability	Julius Ibukun Agboola Regional Analysis on the Decadal Variation of Water Quality in Three Contrasting Coastal Systems of Ishikawa Coast, Japan
09:35-09:55	Q&A Group Discussion	Ootsuka Hiroyuki Creation of a sandy shore for the Endangered Tiger Beetle <i>Cicindela lewisi</i>	Erik J. Meyers Designing the Salt Marshes of 2100: Climate Adaptation in the Chesapeake Bay	Edwin James Water Quality Monitoring and its Relationship to Riparian Buffer Zones	Q&A Group Discussion
09:55-10:25	AM Break and Poster Removal - Grand Ballroom Salons VI				

EMECS9: Managing for Results in our Coastal Seas

Plenary Session - Grand Ballroom Salon V	
10:25-12:00	<p><u>Closing Ceremonies</u></p> <p>Moderated By: Mr. Dave Nemazie, University of Maryland Center for Environmental Science</p> <p>Mr. David Carroll, Poster Awards</p> <p>EMECS SSP Delegation, Student Declaration</p> <p>Dr. Wayne Bell, Conference Declaration</p> <p>Dr. Masataka Wantanabe, Chair, the Scientific and Policy Committee of the EMECS International Center; Conference Review</p> <p>Mr. Keitaro Sato, Director General, Department of Environment, Hyogo Prefecture; Address of Appreciation</p> <p>Region Host, Future EMECS Announcement</p> <p>Mr. Dave Nemazie, Closing Remarks</p> <p><i>Moderator Assistant: Kelly Kunsch</i></p>
12:00	<i>Conference Concludes</i>
12:30-13:00	Tour Participants Only: Meet in Hotel Lobby for Boxed Lunch and to Load Buses
13:00-19:00	Post-Conference Field Trips
12:00-14:00	Exhibit Removal - Grand Ballroom Salons VI

Poster Directory

Poster

- 1 **Mario Tamburri**, University of Maryland Center for Environmental Science, Solomons, MD, United States
"Real-Time Environmental Monitoring of the Patuxent River"
- 2 **Zhongyuan Chen**, State Key Laboratory for Estuarine and Coastal Research, East China Normal University, Shanghai, China
"Reclamation and its Effect to the Process of Hydrodynamics and Geomorphology in the Yangtze River Mouth, China"
- 3 **Kazuhiko Ichimi**, Kagawa University, Takamatsu, Japan
"Impacts of Human Fishing Pressure and Water Fowl Predation on the Standing Stock of Bivalves at an Estuarine Tidal Flat in the Seto Inland Sea"
- 4 **Mamoru Ishigaki**, Hiroshima Institute of Technology, Hiroshima, Japan
"Optimization of Nutrient Cycling and Balance of Osaka Bay for Coastal Environmental Restoration"
- 5 **Masashi Kodama**, National Research Institute of Fisheries Science, Fisheries Research Agency, Yokohama, Japan
"Relationships Between Environmental Factors and Fishery Production in Japanese Enclosed Coastal Seas"
- 6 **Zachary Cole**, University of Florida, Gainesville, FL, United States
"Mapping Social Values of Coastal Use Relative to Ecosystem Services in Sarasota Bay"
- 7 **Julie Harrington**, Florida State University, Tallahassee, FL, United States
"Florida Climate Institute"
- 8 **Ryo Murakami**, Osaka Institute of Technology, Osaka, Japan
"Spatial and Temporal Distribution of Total Carbonic Acid in the Seto Inland Sea"
- 9 **Dianne Poster**, National Institute of Standards and Technology, Gaithersburg, MD, United States
"Standards to Support Sustainable Sediment Management"
- 10 **Kazuhiro Sato**, Ajinomoto, Tokyo, Japan
"Characteristics of Periphytic Algae on Concrete Contained Amino Acid"
- 11 **EMI Terasaki**, Hokkaido University, Sapporo, Japan
"Relation between depositional environment and scallop culture at subarctic lake, Japan"
- 12 **Yuho Yoshikawa**, Osaka Institute of Technology, Osaka, Japan
"Characteristics of Water Quality and Phosphorus in Bottom Sediment in Strong Enclosed Sea Area"
- 13 **Melissa Munoz**, Mount St Mary's College, Sunland, CA, United States
"Integrating Practical Geometry and Statistics into Service Learning Activities: Remediating Stormwater Runoff with Community Rain Gardens."
- 14 **Saori Takahashi**, Sanyou-joshi High School, Kobe, Japan
"Approaches to Reduce the Garbage at the Bottom of the Seto Inland Sea"

EMECS9: Managing for Results in our Coastal Seas

Poster

- 15** **Katsuhiko Touzaki**, Amagasaki Oda High School, Kobe, Japan
“Let’s Make the Sea of Amagasaki Blue! – A Project on Restoration of Osaka Bay”
- 16** **Michaela Beggins**, St. Michaels Middle-High School, Talbot County Public Schools, St. Michaels, MD, United States
“The Feasibility of Alternative Energy Sources for Private Homeowners”
- 17** **Kristin Treat**, Easton High School, Talbot County Public Schools, Easton, MD, United States
“The Effects of Debris on Marine Mammals and Sea Turtles”
- 18** **Afshin Danehkar**, University of Tehran, Karaj, Islamic Republic of Iran
“Coastal Hazard Management of Iran”
- 19** **Afshin Danehkar**, University of Tehran, Karaj, Islamic Republic of Iran
“Integrated Coastal Zone Management of Iran”
- 20** **Afshin Danehkar**, University of Tehran, Karaj, Islamic Republic of Iran
“Threats and Opportunities against to Mangrove Forests in Iran”

Abstracts

About the Abstracts

The abstracts submitted for the EMECS 9 Conference were reviewed for their relevance to the ecological, economic, geographic, institutional, and management aspects of enclosed coastal seas. Because of the constraints of time and conference topics, fewer than 175 submissions were able to be accepted as oral presentations. Our remaining contributions have been accepted as poster presentations; and all accepted submissions are found in this document.

Abstracts have been organized in alphabetical order by the presenting author's last name. In addition to the detailed conference agenda and poster directory preceding this introduction, an author index is located at the end of the book to facilitate the search for abstracts.

The EMECS 9 abstracts reflect the diversity of the topic of enclosed coastal seas and the exciting future it holds. Thank you to all of the authors who have agreed to share their work.

Regional Analysis on the Decadal Variation of Water Quality from Ground-based and Remotely Sensed Data in Three Contrasting Coastal Systems of Ishikawa Coast, Japan

Julius I. Agboola¹, G. Terauchi² and A. McDonald¹

¹United Nations University, Institute of Advanced Studies, Operating Unit in Ishikawa/Kanazawa, Ishikawa, Japan

²Northwest Pacific Region Environmental Cooperation Center, Toyama city, Toyama, Japan

Understanding and predicting change in the world's coastal zones requires baseline assessments for trends over a long time on regional scale. Using ground-based and remotely sensed data, this study examined trends of change over time in some water quality parameters from three contrasting coastal system (Kanazawa area- KNA, Noto area- NTA and Nanao area- NNA) of Ishikawa coast. Mean annual concentration of COD has decreased by ~20% and 48% at KNA and NNA, respectively, between 1984 and 2009, whereas, NTA which had lowest COD concentration in 1984 had increased by one-third (~31%) as at 2009, possibly as a result of human perturbation from tourism, agricultural and fishing activities. Observed trend showed a significant ($P < 0.05$) inverse corresponding relationship with DO especially at KNA and NTA. Similarly, within the last two decades, pH value has dropped between 0.14 – 0.18 along the coast (KNA, NTA and NNA), suggesting climate change impact on coastal waters quality of Ishikawa. The decreasing pH correlates with increase in CO₂. While total nitrogen (T-N) and phosphorus (T-P) loading have significantly reduced by 30-40% between 1984 and 2009 at KNA, there has not been significant reduction at NNA, suggesting a coastal system potentially vulnerable to eutrophication due to often restricted water exchange with the adjacent ocean. Also, annual time series of Chlorophyll a concentration derived from satellite image revealed increasing (more than tripled between 1997 and 2009) trends of phytoplankton biomass build-up (Chlorophyll a) at NNA. Although, there is uniform approach to the development of water quality standards in Japan; setting more strict standards will be required by the prefecture in collaboration with industry, stakeholders groups and coastal community resource users. An attempt, therefore, to maintain the coastal water quality through continuous monitoring of coastal developments and activities will be a more targeted and effective adaptation strategy. Further studies to this will detail on the socio-economic drivers of observed change and climate change impacts on Ishikawa's coastal living resources majorly at NNA and policy response required for future decision making.

Contact Information: Julius I. Agboola, United Nations University, Institute of Advanced Studies, Ishikawa, 920 0962 Japan, Phone: +81 80 4259 2801; Email: agboola@ias.unu.edu

Integrating Practical Geometry and Statistics into Service Learning Activities: Remediating Stormwater Runoff with Community Rain Gardens

Eugene Allevato

Mount St. Mary's College, Los Angeles, California USA

With the increasing urgency to restore and manage coastal seas, the more you communicate and educate today's younger generation on environmental issues the better solutions will arise. In this respect, it is crucial to identify appropriate teaching strategies and other means to sensitize future teachers to practical aspects of math and science in order to motivate, develop awareness, and instill engagement and social responsibility skills in our youngsters. This paper will present an instructional model that was utilized to instruct statistics and geometry to future elementary school teachers from a transdisciplinary perspective.

The model involved practical aspects of geometry and statistics in the context of current environmental issues. This project took place primarily in a charter school where future teachers were able to introduce basic skills in geometry and implement environmental solutions to runoff pollution by engaging charter school students in building rain gardens at a community center. The concept that teachers can connect course content to real world problems and concurrently contribute to the development of students' critical thinking skills has been discussed previously elsewhere but little has been done to implement this concept on the professional development curriculum of future elementary school teachers.

Assessment of learning outcomes was based on a questionnaire implemented before and after instruction at the Charter school. Analysis of the effectiveness in active learning linking lecture with a practical activity was evaluated based on the level of environmental consciousness and the understanding of mathematical processes to solve real world problems. This instructional model emphasized the importance that future teachers implement systemic thinking to integrate subject content and real world problems in order to develop creative and critical thinking skills in our children to live each day of their lives with an environmental consciousness and to become better decision-makers.

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Granulated Coal Ash Can Effectively Adsorb Hydrogen Sulfide

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[1. Introduction] Sediments lying under enclosed water bodies often contain high amount of hydrogen sulfide due to sulfate reduction under anoxic conditions. In addition to their acute toxicity, hydrogen sulfide may cause depletion of dissolved oxygen in the bottom water and resulting deterioration of benthic ecosystems. Therefore, it is very important to reduce the concentration of hydrogen sulfide from sediments so as to maintain healthy ecosystems.

Although granulated coal ash (GCA), a byproduct from coal thermal electric power stations, is usually reused as construction materials, new uses of GCA should be explored in order to promote a recycling conscious society. The purpose of this study is to investigate hydrogen sulfide adsorption behavior onto GCA in terms of utilizing the latter as a remediation agent of organically enriched marine sediments.

[2. Experimental] GCA (0.2 g) was added to 50 mL of hydrogen sulfide (initial concentration; 5-500 mg/L) de-aerated solution at pH 8.2 and agitated moderately at 100 rpm at 25°C. Time course of hydrogen sulfide and sulfate concentrations, pH and oxidation reduction potential (ORP) were monitored. After the adsorption of hydrogen sulfide, the GCA samples were air-dried for 2 d in a dark place, and sulfur species adsorbed on the GCA were identified by X-ray adsorption fine structure analysis (XAFS).

[3. Results and discussion] Hydrogen sulfide (initial concentration: 8 mg/L) was removed completely within 45 hr after the addition of GCA. Accordingly, the ORP value and sulfate concentration in the liquid phase increased. In this case, it was estimated that ca. 20% of hydrogen sulfide was oxidized to sulfate ion in liquid phase while ca. 80% was adsorbed onto GCA. The sulfur K-edge XANES spectra of GCA (solid phase) revealed that a new peak at 2472 and 2478 eV were observed after hydrogen sulfide adsorption. These peaks represent sulfur and sulfite, suggesting that hydrogen sulfide was adsorbed onto the GCA and was successively oxidized to sulfur and sulfite.

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U.S.-Mexico Fuel Switching Demonstration on Oceangoing Vessels in the Gulf of Mexico

Angela Bandemehr¹, Louis Browning², Kenneth Gathright³, Bryon Griffith⁴ and Wayne Miller⁵

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⁵University of California at Riverside, CA, USA

This project was the result of a partnership between the EPA, the Port of Houston Authority, the Mexican federal government, the U.S. Maritime Administration, and two major shipping companies, Maersk Line and Hamburg Süd. Additionally, ICF International and the University of California-Riverside managed the technical elements of the program, including emission inventory development, dispersion modeling and the emission measurements on the Hamburg Süd vessel. This first-ever fuel switch demonstration in the Gulf of Mexico focused on illustrating the effectiveness of fuel switching on oceangoing vessels to reduce impacts to the Gulf of Mexico and its coastal populations. EPA engaged the maritime shipping industry and government representatives from Mexico at the local, municipal, state and federal levels, including the State of Veracruz, SEMARNAT (Secretaría de medio ambiente y recursos naturales, Mexico's Ministry of Environment and Natural Resources) and PEMEX (Mexico's state-owned petroleum company), to showcase the environmental benefits of implementing an Emission Control Area (ECA), which requires fuel switching on oceangoing vessels; and the project also helped raise awareness of the upcoming North American ECA in the U.S. and Canada, which will be effective in August 2012 per international standards under the International Maritime Organization. Emission measurements were taken while a Hamburg Süd vessel steamed between ports, approached selected ports, and docked at the ports, and found that switching to low-sulfur marine fuel (0.1% fuel sulfur) achieved significant reductions in emissions of nitrous oxide, sulfur oxide and particulate matter (2.5 micron in size) – five, 90 and 81 per cent respectively – at only a 2% increase in vessel operating costs. The results of the demonstration were presented to Mexican stakeholders at meetings and workshops in Mexico. They will also be presented to the general public in the Gulf of Mexico via information kiosks at Coastal Environmental Learning Centers located in major aquariums throughout the Gulf. The fuel switching demonstration along with emission reduction estimates and dispersion modeling informed policy makers in Mexico of the potential health and environmental benefits of fuel switching in Gulf of Mexico waters through the implementation of an ECA using the Ports of Veracruz and Alta Mira as case studies.

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Chesapeake Modeling Tools for Integrating Air and Water Environmental Management

Lewis C. Linker¹, Gary W. Shenk¹, **Richard A. Batiuk¹**, Robin Dennis² and Ping Wang³

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Atmospheric deposition loads are the highest source of nitrogen loads in the watershed, but also are controlled by a national regulatory program that has the highest rate of nitrogen load reduction from 1985 to the present, relative to other Chesapeake point source and nonpoint source control programs.

To simulate the fate and transport of nutrients in the Chesapeake watershed and airshed as well as the effects of nutrient loads on Chesapeake water quality, the integrated models of the Chesapeake Bay airshed, watershed, estuary, and living resources were developed. Applied in the assessment of the Chesapeake TMDL water quality standards, the models provide the most complete integration of air and water controls yet developed in a large aquatic ecosystem. Atmospheric deposition loads of nitrogen to the coastal ocean are also tracked, as well as its influence on Chesapeake ocean boundary conditions.

The Airshed Model estimates atmospheric deposition loads of nitrogen to the watershed, tidal Bay, and adjacent coastal ocean. The Airshed Model is a combination of two models—a regression model of atmospheric wet deposition and a fully developed air simulation of the North American continent called the CMAQ Model.

In the Chesapeake TMDL, the loads of atmospheric nitrogen deposition that are directly deposited to the tidal waters of the Chesapeake are an explicit TMDL load. The nitrogen TMDL allocation given to the EPA is 15.7 million pounds. Reducing current nitrogen deposition loads to achieve this allocation will be through national regulatory programs of NO_x emission reduction. In addition, State reductions in air emissions of nitrogen loads beyond what's needed to achieve air quality standards can also be included in the TMDL accounting as avoided nitrogen loads delivered to the tidal waters with credit given to the State reducing the emissions.

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Implications of Putting the 17 Million Chesapeake Bay Watershed Residents on a Regulatory Pollution Diet

Richard Batiuk

U.S. Environmental Protection Agency, Region 3, Chesapeake Bay Program Office, Annapolis, MD, USA

Against the backdrop of over 45,000 TMDLs approved by EPA nationwide over the past two decades, the six watershed states, the District of Columbia, and EPA have developed a historic and comprehensive “pollution diet” with rigorous accountability measures to initiate sweeping actions to restore clean water in the Chesapeake Bay and the region’s streams, creeks and rivers. Despite extensive restoration efforts and significant pollution reductions during the past 25 years, the TMDL was prompted by insufficient progress and continued poor water quality in Chesapeake Bay and its tidal tributaries.

The Chesapeake Bay TMDL was designed to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025, with at least 60 percent of the actions completed by 2017. The TMDL assigns responsibilities for reducing and then capping sources through waste load and load allocations to regulated and non-regulated sources, respectively. Separate nitrogen, phosphorus, and sediment allocations were made for each of 92 watershed draining directly into each tidal Bay segment, further subdivided by state jurisdiction. These allocations will be further subdivided to ‘local area targets’ by the seven watershed jurisdictions working with local governments and stakeholders during the Phase II of the Bay TMDL process.

The Bay TMDL is supported by rigorous accountability measures to ensure cleanup commitments are met, including short-and long-term benchmarks, a tracking and accounting system for jurisdiction activities, and federal contingency actions that can be employed if necessary to spur progress. Watershed Implementation Plans, which detail how and when the six Bay states and the District of Columbia will meet pollution allocations, played a central role in shaping the TMDL.

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Using Constructed Treatment Wetlands for Nutrient Load Reduction to Estuaries: An Illustrative Example from Virginia

James S. Bays¹, T. Nobinger², V. Jarrin¹ and J. Kirk¹

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²PMUSA, Richmond, VA, USA

Constructed wetlands, commonly accepted as a “Best Management Practice” for amelioration of nonpoint source loading, are seen as the cost-effective technology applicable to the landscape scale necessary to reverse estuarine hypoxia attributable to agricultural nitrogen pollution. Because wetlands are shallow (30-60 cm) and with hydraulic residence times of days to weeks, and pollutant removal rates vary with the pollutant, land area requirements per unit flow can range from ~11-106 m²/m³•d (~10-100 acres/mgd). Establishing load restrictions to surface waters through TMDLs poses an opportunity to use treatment wetlands to provide cost-effective load reductions, where land is available.

As a mass load reduction technology, treatment wetlands are robust, easily maintained, and self-sustaining when hydraulic and nutrient loading is maintained within acceptable envelopes of performance. High rates of flow through a wetland can achieve significant mass reductions. Mass loads decrease relatively quickly through the wetland flow path and gradually level out as concentrations begin to approach the background. Wetland efficiency diminishes with diminishing mass loading, and suggests that a wetland could be configured to an optimum area based upon the rate of mass removal, related to hydraulic loading rate.

The Park 500 Natural Treatment System (NTS) operated by PMUSA near Richmond VA provides a recent constructed wetland case history with features that provide a relevant basis for discussion of this concept. Constructed in 2008 as a voluntary method of improving the quality of the facility’s wastewater discharge, Park 500 consists of six emergent marshes totaling 17 ha (43 ac) and receiving 4500 m³/d (1.2 mgd) of tobacco product process wastewater. Flow is distributed across two flowpaths (E, W) and through three cells in series. The NTS is designed to remove phosphorus and nitrogen mass loads in discharges to the James River.

Inlet phosphorus concentrations averaging 0.35 mg/L are reduced to outlet concentrations of ~0.08 mg/L, and mass removal rates decrease from over 4 g/m²/yr in the inlet cells to 2.5 g/m²/yr in the terminal cells. Conceptually, to achieve greater phosphorus concentration reductions at Park 500, the wetland area could be increased, or the hydraulic loading rates reduced. To emphasize more efficient mass removal, the given footprint of land occupied by the wetlands, conceptually 2x more mass could be removed with a three-fold increase in flow. By distributing the highest strength inflow to all cells, each cell would receive the greatest mass loading possible and achieve the greatest mass removals in proportion to mass loading. Nitrate reductions are even more pronounced in the wetland and show the same general relationship. Park 500 provides a pertinent example of the expected performance of a temperate zone wetland that demonstrates the versatility of wetland configurations to emphasize nutrient mass removal, as appropriate for TMDL compliance or concentration reduction.

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The Feasibility of Alternative Energy Sources for the Private Home Owner

Michaela Beggins

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The topic of alternative energy sources, their benefits, and the cost-effectiveness of their use, is quickly becoming more crucial as a part of the plan to meet the world's ever increasing energy demands. However, there is often a lack of information, and to some extent interest, when the debate reaches a local scale. The goal of this project was two-fold: first to research the feasibility of using wind, solar, geothermal and/or nuclear power on a small scale and secondly to learn about the knowledge and curiosity of the residents of St. Michaels, Maryland regarding these energy sources. Mr. Michael Kabler, an account executive with Aurora Energy, provided local expert knowledge on the use of solar energy as well as the other sources. Approximately one hundred people from the town of St. Michaels and St. Michaels High School were invited to participate in a brief questionnaire on alternative energy sources. The survey data were analyzed to gather insights into how the local residents feel about wind, solar, geothermal and nuclear power. Together with information gathered through background research and the interview with Mr. Kabler, the analysis pointed to some of the misconceptions those surveyed have about alternative energy. It also allowed for a determination of how education on specific topics could give residents a clearer understanding of the energy sources available to them as private homeowners.

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Historic and Contemporary Land Use on the Chesapeake Bay Watershed: The Relationship of Working Landscape to the Satoumi Perspective

Wayne H. Bell

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The ratio of Chesapeake Bay watershed area to estuary volume, $166,400 \text{ km}^2 : 70 \text{ km}^3 = 2,400$, is more than an order of magnitude greater than that of any major coastal system on earth. It follows that the nature of land use on this watershed has a major influence on the ecology of estuary itself.

Humans have occupied the lands of the Chesapeake Bay watershed for at least 10,000 years. Evidence from recent archeological studies indicates that the peoples who lived here prior to European contact around 1500 used extensive burning to create and maintain a grassland/savannah landscape that fostered abundance of game and permitted extensive agriculture. Estimates differ, but perhaps 80% or less of the pre-contact watershed was forested. Early colonists and pioneers initially melded New World crops with Old World practices to develop a small-scale subsistence agriculture that persisted on the watershed for nearly 200 years. Introduction of the moldboard plow after 1700 promoted large-scale agriculture for cash grain crops that required extensive land clearing. By the time of the American Civil War around 1863 the Chesapeake Bay watershed was only 20% forested. As the soil lost its fertility and richer lands became available west of the Appalachian Mountains, wholesale abandonment of farmlands allowed the forest to return through the process of ecological succession. This, coupled with additional large-scale changes in farming practices and with governmental policies that encouraged the residential development of formerly rural lands, have created today's watershed landscape that is approximately 60% forested, 25% agricultural, 10% urban, and 5% lands in transition.

History now tells us that humans have been integrally associated with the Chesapeake Bay watershed since their arrival 10,000 years ago and continuing to present day. People have managed these lands for the benefit of their communities and the lands in turn have influenced the nature, well-being, and culture of those communities. We call this relationship a "working landscape" and suggest that the most successful environmental policies are those implemented to keep the landscape truly "working" for the mutual benefit of the natural resources and the human communities that share the system together. Satoumi is a key perspective that links the "working landscape" of a watershed with the management of its associated coastal sea in a manner that maximizes aquatic "productivity and biodiversity with human interaction."

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Towards Sustainable Watershed Restoration Projects: Source Reduction versus Interception

Joe Berg

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Significant efforts are invested in identifying, prioritizing and selecting restoration projects for implementation. Implementation funds are always in shorter supply than restoration projects. Selecting the 'best' restoration projects for implementation is an iterative process. Many local watershed or government entities (e.g., Township, County) select one or more projects to put forward for grant funding, the granting agency looks at many applications and selects the most promising projects to fund, and the selected projects are implemented. The criteria for identifying and selecting the 'best' restoration projects are varied, perhaps the largest area per unit cost, a suite of water quality benefits, etc.. Most often, source control projects are not scored highly because their unit costs are high and the project area is usually limited. Alternatively, projects which intercept and treat large volumes of storm water score high due to their more modest cost per unit area.

This presentation focuses on a watershed restoration plan, two alternative restoration projects, and a more complicated but still simple evaluation of cost-benefit analysis. The most highly recommended restoration project involved the modification of ~9.4 acres of forested floodplain to retain ~38,000 CY of storm water runoff for a cost of \$550,000. A second restoration site which was not selected for submittal to the granting agency involved the restoration of approximately 1,100 lf of stream, the modification of 6.5 acres of forested floodplain to retain ~6,000 CY of storm water runoff, for a cost of \$450,000. The former project was estimated to deliver water quality benefits for ~14.50 per CY of water. The latter project was estimated to deliver water quality benefits for ~\$75 per CY of water. Based on this analysis, it appears clear the former project has the 'bigger bang' and this was the basis for selecting the project.

However, going beyond this '1st cost analysis', and considering the cause and source of water quality degradation (e.g., hydro-modification and sediment supply), a different analysis yields a much different understanding. In this analysis, the former project does nothing to reduce sediment supply at the source (e.g., eroding stream channel), but effectively interrupts the sediment supply for only ~1 1/2 to 3 1/2 years before the storm water storage volume is filled with sediment from upstream channel erosion, and the project is in equilibrium with its sediment supply. This results in a total project cost of ~\$160,000 to \$440,000 per year for the short life of the project. Over a 50 year project life, this project traps up to 19,000 CY of sediment at a cost of ~\$29/CY, but has lost all sediment trapping and hydro-modification capability after 1 1/2 to 3 1/2 years. Alternatively, the latter project fixes the problem at its source, eliminating between 240 CY and 622 CY of sediment per year for every year with no prospect for loss of this function and it retains a 6,000 CY storm water volume to support hydro-modification. Over a 50 year project life, this project eliminates 12,000 CY to 31,000 CY of sediment at a cost of \$37.50 to \$14.40 per CY with no loss in function. This source control restoration project appears to be a more sustainable restoration project.

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The Human Component of the Coral Reef Ecosystem: A Framework for Sustainability

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This presentation will provide an overview of EPA's Coral Reefs Research Project. The goal of the research is to provide national, state and local decision-makers with information and tools to routinely account for the effects of human activities on the value of coral reef ecosystems. The project is highly collaborative and emphasizes strong interactions with clients to incorporate ecosystem services and values into policymaking. The research includes a series of workshops with jurisdiction decision-makers and resource managers in Florida, Puerto Rico, and USVI to identify relevant decisions and to characterize legal authorities, decision flows and decision landscapes.

The project is an example of integrated transdisciplinary research, combining deep understanding of environmental science with theory and empirical methods in behavioral and decision science. An organizing framework – DPSIR (Driving forces, Pressures, State, Impact, and Response) is being used to organize and better characterize the interactions among coral reef services, environmental effects of human activities, and policy responses influencing human behavior. The research will help decision makers to find holistic sustainable solutions.

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Estuarine Restoration in San Francisco Bay: Design and Adaptive Management

Eric F. Jolliffe, William N. Brostoff and Fari Tabatabai
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The San Francisco District of the U.S. Army Corps of Engineers (USACE) is one of several agencies working together to reverse the trend of wetland loss in the Bay estuary by restoring large areas of former tidal salt marsh. The USACE is the federal lead agency on several large scale estuarine wetlands restoration projects which are at varying stages of completion.

The Hamilton Wetlands Restoration Project (HWRP) is approximately 1,000 acres of estuarine and seasonal wetlands currently under construction. The dredged material placement component of the project constituting 7.0 million cubic yards has been completed. When complete, the project will support a mosaic of tidal wetlands, seasonal wetlands, and uplands.

The planning, design, and adaptive management plan have been developed in part based on lessons learned from the Sonoma Baylands Project, another USACE wetlands restoration project based on beneficial use of dredged material. These center around several project objectives, the main of which is to maintain habitat for the federally endangered California clapper rail and salt marsh harvest mouse, shorebirds, and estuarine fish species.

Information from Sonoma Baylands was used to predict tidal marsh evolution rates and optimal tidal connection design dimensions. Similarly the adaptive management plan for HWRP drew upon monitoring data and lessons learned from Sonoma Baylands.

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Enhancing the Economy and Environment of our Working Lands and Waters Ecosystem Markets and Private Investment Strategies

John Campagna

Restore Capital, Baltimore, MD, USA

Goal

Show how **Private Investment Capital** can fund environmental restoration through **Ecosystems Markets** (ESMs) and enhance our Environment and Rural Economies.

Presentation Topic

Successful Ecosystem Markets exist today in the US. For example, the Clean Water Act requires that any wetland destroyed through development or infrastructure construction must be replaced at a 1:2 ratio. The preferred method is to purchase credits from a Wetland Mitigation Bank that has restored a large wetland for the purpose of offsetting damage. The market has restored over 160,00 acres of wetlands and **generates over \$1.7 billion annually** in economic activity.

EPA has recently set a 'pollution diet' for the Chesapeake Bay. If a Restoration Economy based on ecosystem markets are part of this policy a developer, water treatment plant or farmer who puts too much runoff into the Bay will be able to purchase offsets or water quality credits from another entity that has reduced their runoff below required limits thereby neutralizing the pollution. This allows businesses, municipalities and farmers to offset and reduce pollution as they continue to grow their business, services and products.

Furthermore, these types of offsetting activities boost the economy more broadly than other industries (construction, high tech, etc). In the Chesapeake region water quality credits and the related pollution reduction can be generated cheaper through restoration practices than large capital projects such as a water treatment plant upgrade. These land practices also have a larger economic impact by creating over twice as many jobs per dollar invested compared to investment in infrastructure construction.

We as investors can provide the needed capital. With traditional funding for ecosystem restoration being reduced (government subsidies and charities) ESM's allow loans to be used by landowners, farmers and others to implement the needed land-based practices to offset access runoff. Now private capital can finance environmental restoration and improve the economy by promoting jobs and new income.

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Management Modeling of Suspended Solids and Living Resource Interactions

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Chesapeake Bay, the United States' largest, most valuable, estuary, is a classic example of a system in distress from eutrophication. The management and restoration of Chesapeake Bay has been the focus of the Chesapeake Bay Program for more than 25 years. Restoration is primarily focused on reducing nutrients and solids loads from the surrounding watershed. Mathematical modeling of the watershed and estuary has provided management guidance since the foundation of the program.

Management goals focus on relieving three water quality impairments: low dissolved oxygen, excess chlorophyll, and poor water clarity. Suspended solids, both organic and inorganic, are significant contributors to poor water clarity. Consequently, accurate, realistic, representation of suspended solids concentrations, loads, and processes is crucial in the management model suite.

Frequently, suspended solids modeling is considered from purely a physical approach. Suspended solids transport is often considered as an add-on to hydrodynamic models. However, biological processes contribute to and can dominate suspended solids transport and processing. Examples of biological processes include primary production of particles, particle filtration and removal by bivalves, and damping of resuspension by aquatic vegetation. Consequently, optimal modeling of suspended solids requires combining representations of physical processes with biological processes.

We have incorporated a fully-predictive suspended solids model into the Chesapeake Bay eutrophication model. The model includes four inorganic solids classes as well as multiple forms of organic solids. Physical processes include three-dimensional transport and particle resuspension due to currents and wind-generated waves. Biological processes include particle primary production and influences of aquatic vegetation and bivalves.

The model has been used in a range of management scenarios aimed at examining the effects of nutrient and solids load reductions on water clarity. Three broad conclusions can be reached: 1) The poorest water clarity is usually caused by high inorganic solids concentrations; 2) Inorganic solids respond to load controls only near local loading sources from the watershed; 3) The major improvements in water clarity are realized through reduction of organic solids and epiphytes achieved via nutrient controls.

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Economics of (MPAs) and Coastal Environmental Governance in the Western Mediterranean

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Long neglected, the Mediterranean marine environment appears to receive increasing attention, but only 200 square kilometers of marine area protected as wilderness areas were identified. Like their terrestrial counterparts, the majority of marine protected areas lack effective management, adequate governance, oversight and effective human and financial resources at stake.

Having realized the great coastal environmental issue, Algeria, in its economic recovery plans, incorporates a number of environmental investments, including its coastal areas given its strong demographic and economic dynamics. In this context, Marine Protected Areas (MPAs) are presented today as a tool to provide lasting protection to ensure a continuing balance between human activities and natural heritage. This article attempts to highlight the contribution of MPAs in the governance of the coastal environment in the Western Mediterranean, through the Algerian case.

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Sustainable Management of Marines' Resources in Algeria: The Contribution of an Empirical Approach

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The irreversible character of the management of a renewable resource, in this case halieutic, makes the intervention of public authorities urgent. In addition, this intervention must be directed by an economic analysis. In our case, an appeal for the economic analysis of fishing via bio-economic modelling becomes a necessity. On the other hand, the lack of data conjugated into unreliable statistics, the marginal interest given to the research in this field and the absence of multi-disciplinary approaches, make the approach increasingly difficult in developing countries. In this context, the purpose of this paper is to put into evidence the possibility of offsetting the different conceptual and methodological constraints in return for empirical approaches based on investigations. The forward setting of the contribution of such approaches to help taking decisions, by the conception of lasting development models while endowing managers of the fishing sector with relevant information, is also one of the objectives of this paper.

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Spatial Pattern of Korean Major 38 Estuaries and Their Relationship with Land-based Activities

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Coastal areas serve as a base of socio-economic activities of Korea. As of 2006, around 35% of the land was considered as coastal areas which accommodated 47% of the population and most industrial parks. However, the water quality of coast is being deteriorated, especially in estuarine environment.

Pollution loads from land-based sources are believed as the main cause of the degradation of the coastal environment. Around 62% of wastewater-discharging-facilities are located in the coastal areas of Korea. They emit about 190,000 tons of waste water every day. Worse still, 113 domestic sewage treatment plants, that is 39% of the nation's total, are located in coastal watershed releasing one billion tons of treated waste water.

Cluster Analysis (CA) was used to group the 38 major estuaries by using the data set of coastal water quality parameters from 38 estuaries included: dissolved oxygen, total phosphorus, total nitrogen, dissolved inorganic phosphorus, dissolved inorganic nitrogen, ammonia, nitrates, nitrites, etc. Based on the analysis, 38 estuaries were divided into three different groups.

For each group, Principal Component Analysis was employed to extract the spatial characteristics of the watershed in each group from the watershed characteristics data such as river input, land use (urban, forest, agriculture, and the others), mean slope, imperviousness, population density, livestock, etc. Group one out of three was mainly influenced by river input; another group with high TP and TN concentration was affected by population density, livestock and imperviousness; and the other is dependent on forest and mean slope of watershed, respectively.

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Reclamation and Its Effect to the Process of Hydrodynamics and Geomorphology in the Yangtze River Mouth, China

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In the present study, Digital Elevation Model (DEM) was used, in combination with the historical data (~150 yr) of water-sediment flux of Yangtze River and its estuarine branches, to examine the complex interaction between the tideland reclamation and hydro-geomorphologic evolution of the Yangtze Estuary.

The results demonstrated a significant transition from the natural process to the anthropogenic process on the tideland transformation, which was suggested by an acceleration of the tideland transformation from 7 km²yr⁻¹ of natural process (1864-1926) to 11.2 km²yr⁻¹ (1959-1993) and 18.7 km²yr⁻¹ (1993-2005) of anthropogenic process.

In the past century, intense tideland reclamation tremendously altered the water-sediment diversion of estuarine branches and hydro-geomorphologic evolution in the Yangtze Estuary. i.e. 1) the rapid reclamation of the Chongming island led to the narrowing of the North Branch (NB), which was witnessed by the change from southward expansion of the north bank of NB before 1926 to northward expansion of the south bank of NB after 1958; the net siltation of the NB was also obviously decreased from 4.9×10⁷m³ yr⁻¹(1864-1958) to 1.2×10⁷m³ yr⁻¹(1959-2005); in addition, the proportion of water-sediment flux of the South Branch (SB) to the Yangtze River increased significantly from 80%~95% to 5%~120% since 1958.

The rapid reclamation of the Changxing-Hengsha Island and the south bank of the Yangtze River also resulted in the significant hydro-geomorphologic process of the South Channel (SC) and the South Passage (SP), i.e. the transition from the erosion to siltation process after the year of 1958, which was demonstrated by the decreasing trend of the water-sediment flux proportion of the SB and the SP to the SB after the year of 1958.

To sum up, it can come to a conclusion that the intense human reclamation has significantly altered hydro-geomorphologic process in the Yangtze Estuary, revealed by the DEM results on the basis of the water-sediment data of Yangtze River.

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Pearl Culture Waste, Nutrient Load from Land or Loss of Tidal Flat, What is the Cause of the Deterioration and What Should Be Controlled for the Restoration of Ago Bay Environment?

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Ago bay is a small semi-enclosed coastal sea and is known as a typical “Sato-Umi” area of Japan. The economy of the area has prospered due to rich fishery resources including its famous pearl culture industry. This water body has been extensively used for pearl culture since the 1950s and is now suffering from environmental deterioration such as the settlement of hypoxia water, the accumulation of organic matter in the sediment and the reduction of diversity in the benthos ecosystem. Pearl production has also gradually dropped and is currently only one-fifth of the production of the 1960s. Self-pollution by the pearl culture industry has been suspected as the sole cause of the deterioration, but recent studies performed by the authors have led to a new view of the cause.

As presented in the previous EMECS8 conference, we developed an integrated ecosystem model of Ago Bay by gathering a large number of observations and experimental data, and by tuning parameters of the model with that data. The model consists of a low-trophic ecosystem model in water, a one-dimensional early diagenesis model of sediment and a multi-generation pearl oyster growth model. This time, we utilized the model to measure the contribution of several environmental factors. The factors we considered are the number of the cultured oysters, the nutrient load from the watershed area as well as that from the outer sea, and the areal change of tidal flats. We performed a long-term simulation that covers 50 to 100 years to take into account the slow process in the sediment.

The results show that pearl culture does not have direct influence on the degree and extent of the hypoxia seawater, contrary to the common belief. The influential factors on the hypoxia seawater around the bay head area are the nutrient load from both the watershed area and the outer sea, and the areal change of tidal flats. The degree of influence from the outer sea was comparable with that from the watershed area. The efficacy of tidal flats very much depends on the difference between the amount of influx and efflux of nutrients. The most noticeable point is that the number of pearl oysters, which determines the amount of pearl culture waste, has little influence on the hypoxia seawater. This result comes from the fact that the total amounts of particulate organic matter (POM) settled down to the sea bed of the entire bay are not increased by the cultivation activity.

On the other hand, up to 50% increase of POM in the sediment in the vicinity of culture rafts was confirmed. The concentration of AVS was also higher there and the effusion of hydrosulfide occurred in the extreme case. These results brought us a new view of the function of pearl culture. That is, to say, a deterioration of the habitat of benthos. The destruction of the benthos ecosystem by the pearl culture could be linked to the deepening of the hypoxia seawater through a reduction of POM decomposition rate in the sediment.

Recently, the council for nature restoration of Ago Bay area which is expected to play a principal role in the planning and execution of restoration projects was organized by including administrators, fishermen and citizens of the district (Shima city) and researchers. We are going to present the current conclusion to the council.

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Sato-umi Policy in Japan

T. Yamada, H. Hashimoto and Y. Muroishi -- presented by **Takahiro Chino**

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In Japan, Sato-umi is defined as a coastal zone where the livelihood of human beings and the blessings of nature coexist harmoniously with coastal area eco-systems. Sato-umi has long been important in supporting fisheries, transport and culture, while helping to integrate management of land and coastal sea areas and preserve high productivity and biodiversity in the wake of the human interaction.

Sato-umi has become rooted in Japan since "Becoming a Leading Environmental Nation in the 21st Century" and "The National Biodiversity Strategy of Japan" made it national policy. "The Basic Plan on Ocean Policy" describes the embodiment of the concept of Sato-umi in the conservation and management of fishery resources.

The Ministry of the Environment (MOE) in Japan began supporting Sato-umi activities in 2008, based on a national strategy and policy, in order to achieve public consensus for marine environmental conservation and preserve high productivity and biodiversity in coastal sea areas. MOE projects to support Sato-umi Creation comprise the following.

- 1) Support of local activities for Sato-umi Creation (Model Project)
- 2) Execution of Sato-umi Creation plans
- 3) Execution of a Sato-umi Creation manual
- 4) Selection of examples of activities for advanced Sato-umi Creation
- 5) Construction of a website, "*Sato-umi Net*"
- 6) Publication of pamphlets, leaflets etc.
- 7) Holding of symposia

Such efforts by the Ministry of the Environment, in combination with efforts by local public organizations, environmental groups and local residents, have improved the awareness of Sato-umi and increased the momentum for Sato-umi creation activities in local areas. Moreover, the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 10), which was held in Japan in October 2010, included a COP 10 Side Event entitled, "*The Role of SATO-UMI in Preserving Biodiversity*", at which an exchange of views was held regarding the importance of Sato-umi as a venue for the provision of ecosystem services and the coexistence of human beings with nature etc.

Efforts to promote the creation of Sato-umi in Japan will be continued, and information on Japan's Sato-umi activities will be provided both domestically and internationally in an effort to help preserve coastal zone environments.

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Mapping Social Values of Coastal Use Relative to Ecosystem Services in Sarasota Bay

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Effective spatial planning and management of coastal zones is essential for resolving conflicts and adapting to changes in environmental conditions as human use of coastal regions increases. Research and planning applications developed for terrestrial systems may be useful and adaptable to coastal and marine environments as a means of evaluating critical factors in coastal systems. Assessment of comprehensive coastal ecosystem services stands to benefit from research incorporating social values information into more complete understandings of natural and social interactions in coastal regions. This work describes ongoing efforts to extend the functionality of a GIS application, *Social Values for Ecosystem Services (SoLVES; <http://solves.cr.usgs.gov>)*, to a region of the Gulf of Mexico with important environmental and social attributes. The health and vitality of Sarasota Bay is essential to local quality of life while contributing significantly to the region's economy and international reputation as a desirable destination. SoLVES has been successfully used in other locations to map the social values of various subgroups of survey respondents, which were differentiated according to their attitudes about human use of the landscape. Information about social values was correlated with landscape metrics in a regression model to predict potential areas for increased attention by planners and managers, either because of their high value for a particular group, or because of their potential for conflict between groups. This application of the SoLVES tool is mapping social values of Gulf coast residents such as recreation, aesthetics and biodiversity conservation, and relating them to attitudes toward public uses of the coastal region including, for example, energy development, fishing (commercial and recreational), shipping, and tourism. The efforts of this work are focused on a region of the Florida Gulf Coast, Sarasota Bay, a 56-mile long coastal lagoon comprised of a large bay segment and several smaller embayments. The goal of this SoLVES application is to evaluate social science information that can support effective coastal and marine spatial planning (CMSP) and represents a potentially valuable tool to integrate social science in ecosystem-based decision support by planning and management entities. Techniques and tools for designing, funding, implementing, and managing large-scale, long-term ecosystem, watershed, and/or fishery restoration programs

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Techniques and Tools for Designing, Funding, Implementing, and Managing Large-scale, Long-term Ecosystem, Watershed, and/or Fishery Restoration Programs

Storm Cunningham

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When ecosystem and natural resource restoration projects reach certain geographic sizes and/or chronological lengths, challenges can arise that are minor or non-existent at smaller/shorter scales. Some of these factors—such as restoring links among isolated ecosystems—are within the expertise and comfort zone of practitioners.

Other challenges that emerge at large/long scales are outside both the expertise and comfort zone of most ecosystem restoration practitioners, and might require the use of unfamiliar tools that were unnecessary at smaller scales. Most ecosystem restoration practitioners are not equipped—and are often not willing—to address overlapping or conflicting renewal agendas. These include—but are not limited to—heritage restoration, agricultural revitalization, infrastructure renewal. Many of these agendas affect ecosystems, or are affected by them. Some agendas, such as infrastructure renewal, can be key to technical ecosystem restoration success. Other agendas are extrinsic, but can prevent the approval or success of the ecosystem project/program if not effectively addressed.

Such constraints generally fall into two categories: 1) integrating the renewal of the natural, built, and socioeconomic environments, and 2) engaging and partnering with all the stakeholders—private landowners, citizens, businesses, government, non-profit, and academic—needed to design, fund, or implement the restoration program.

A method has been developed that addresses both of these complex challenges at the community, regional, and even (theoretically) national scales. Moreover, a software tool has been developed to make this complexity more manageable.

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Meeting Maryland Chesapeake Bay TMDL Allocations: Facilitating Stakeholder Involvement In Nutrient Modeling

Lee Currey

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Environmental mathematical models can be applied to enhance understanding of complex physical phenomena and allow informed decision making, which when combined have significant policy, economic and accountability implications.. Recent advancements in the EPA Chesapeake Bay Program Modeling System (Bay Model) have increased its complexity, improving accuracy and predictability, but this has resulted in less accessibility and transparency for local decision makers. Maryland recognizes the need for and benefit of communicating this model, and particularly providing accessibility to the EPA suite of models in a simple and transparent tool.

Maryland's Assessment and Scenario Tool (MAST) was developed to function as an on-line accessible scenario development and management tool. It enables local planners, decision-makers and stakeholders to assemble nutrient and sediment load reduction strategies in the form of quantified assemblages of best management practices to meet the pollution reduction goals of the Chesapeake Bay TMDL and the State's Phase II Watershed Implementation Plan (WIP). The tool brings transparency to this process by opening up what for the lay person is the "black box" of the EPA models through the practical application of these complex modeling systems.

Through extensive outreach, including webinars and hands-on MAST training sessions, Maryland's local and federal WIP development partners are learning that MAST makes the Bay Modeling inputs and results understandable and accessible. MAST is used to provide approximate scenario load results in several seconds, merge many scenarios together, and then directly link with the Bay Model, which takes several hours to run, to obtain more detailed results. The timely results of MAST allows it to function as a sensitivity analysis tool by isolating and assessing the benefit of different practices in specific geographic locations and also function as a decision management tool by quickly screening many initial management decisions across several source sectors. Ultimately MAST will directly link the narrowed down management options to the Bay Model for final verification of water quality standards attainment through generation of an "input deck" to the model. Above all, MAST illustrates the practicality and transparency of modeling and in the process empowers stakeholders by providing them the ability to see the underlying input information and quickly predicting the results of their proposed load reduction strategies. All of which are key objectives in complex environmental decision making.

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Coastal Hazard Management of Iran

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1. Purpose

Coastal areas are usually subjected to disasters due to natural hazards. Hazard management is one of the main objectives of an Integrated Coastal Zone Management program. Hazard management is to minimize the loss of life and property caused by improper development in flood-prone, storm surge, geological hazard, and erosion-prone areas and in areas likely to be affected by or vulnerable to sea level rise, tsunami, and landslide.

The effects of natural hazards can include destruction of habitats, structural damage to buildings and services, disruption to transportation routes, destruction of commercial centers and residences, loss of crops and stock and can result in the loss of human life. It is not possible to avoid natural hazard occurrence, however it is possible to manage the effects of land use activities with a view to avoiding or mitigating adverse effects of natural hazards.

2. Scope

Coastal zones are exposed by Natural Hazards. Main hazards in coastal areas are consisting of Flooding and eroding. Water and sediment quality, and marine habitat are the main issues in environmental management. Since, shoreline, where is defined between sediment transport active boundary in seaward and Hazard Line in landward, is faced to invasion of waves, sediment transport, dynamic changes in coast line, and comprise major marine habitat, has special seriousness in hazard and environmental management. For mitigation of these damages, it is necessary to investigate the phenomena, to define the acceptable strategies and to schematize suitable plans. Without specific policies or restrictions, development resulting in massive economics damage and losses of life. The best way to avoid coastal hazards is to avoid inappropriate development in the coastal zone by proactive management.

3. Methods

Coastal natural hazards were studied in 3 categories: 1-Geological hazards; 2- Marine hazards & 3- Climatic hazards.

Collection of information related to areas susceptible to hazard occurrence, frequency of occurrence, and intensity of the potential hazards and identification of information inadequacies are key preliminary factors in hazard management.

Geologic structure and tectonics of Iranian coastlines were reviewed and documented using corresponding maps (1:100,000) provided by Geological Survey of Iran. Earthquake, liquefaction and landslide hazard maps were prepared in 21 sheets for each of the 7 coastal provinces of Iran.

Important marine hazards include wave attack, inundation and erosion hazards. Inundation may occur because of a temporary rise in sea level due to storm surge or tsunami, or because of long-term sea level variations (such as the Caspian Sea level).

The highest elevation that water may reach at a location (Inundation Level) was obtained from the following relation:

$$\text{Inundation Level} = \text{High Water Line} + \text{Wind Surge} + \text{Pressure Surge} + \text{Wave Setup} \\ + \text{Wave Runup} + \text{Sea Level Rise}$$

Surge, setup and runup values were determined using 50-year return period winds and waves at 250 locations along Iranian coastlines. Elevation of the High Water Line is determined by Mean High Tide in the south and a projected Caspian Sea level in the north.

Extreme 50-year wave height was mapped along the Iranian coastlines using the colored classification. Tsunami inundation maps were prepared based on numerical simulation results of the Makran 1945 earthquake.

Climatic hazards are caused by one or a combination of droughts, strong wind storms, heavy rainfall (river flood), and snow and ice.

In order to provide an overall representation of hazard in each area, hazard components presented were ranked with numbers 1 to 4, with 4 being the most intensive level of each hazard. A nominal Overall Hazard Assessment (OHA) for the coast was then calculated by squaring each intensity value, doubling the squared value of the dynamic hazards, and averaging the weighted values. Squaring each intensity level gives greater emphasis to high intensity hazards, which generally constitute the greatest threat.

4. Results and Conclusion

The results indicate that the northern Iranian coastal provinces are most prone to geological hazards and the associated risk increases from west to east along the Caspian Sea coastline. There have been numerous earthquake, liquefaction and landslide events in these areas.

Among the southern coastal provinces, Hormozgan Province has the most intensive history of earthquakes, liquefaction and landslides. The risk of liquefaction increases towards the east end of this province and in Sistan and Baluchestan Province's coastlines on the Oman Sea. Risk of liquefaction and settlement also exist along the coastline of Khuzestan. Risk of earthquake is high along the east half of Bushehr Province's coastlines.

Ranking hazard intensity is based on a number of variables that minimum and maximum indicate most and least value of intensity level of a specific hazard. Certain hazards are more dynamic than others, including seismicity, high waves, high winds, and tsunami inundation. These hazards may achieve a high level of severity in a relatively short time. Long-term sea level rise and beach erosion do not constitute a life threatening hazard, although they certainly may exacerbate the others. The dynamic hazards constitute a greater risk and thus are assigned an additional weighting factor of 2, after they are squared. The sum of the squared and doubled values is averaged and the resulting value is used to assign a nominal overall hazard rank in a 1 to 7 scale, with 7 being the most severe hazard level.

5. Recommendations

Ranking of hazard intensity in a region requires applying scientific judgments grounded in a thorough understanding of the specific history of hazardous phenomena and a familiarity with local environmental processes. It is necessary that the hazard data set will continue to be maintained and updated in the interest of eventually achieving a statistically robust capability to predict hazard chronology and intensity.

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Integrated Coastal Zone Management in Iran

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1. Purpose

Iran, having two separate coastlines at its north and south of about 5790 km in length, with very different characteristics, suffers from various coastal problems. While its northern coastal area is over-populated and its sensitive and unique habitats must be protected from destruction, most of its southern coastal areas are undeveloped and deserted. Intense oil and gas exploitation activities in this part and occurrence of two wars in the Persian Gulf during the last two decades have rendered hydrocarbon pollution, a major issue for this country's marine and coastal environment. Biodiversity is under threat in some areas and natural resources are deteriorating. To overcome the problems, Integrated Coastal Zone Management has been considered by Iranian Port and Maritime Organization as a long-term solution.

2. Scope

The goal of Integrated Coastal Zone Management (ICZM) is to establish social activity and sustainable economic levels in the coastal areas while protecting the coastal environment. It brings together all those involved in the development, management and use of the coast within a framework that facilitates the integration of their interests and responsibilities.

In Iran's ICZM study project, baseline studies along with social, economical, and spatial planning studies in the coastal provinces are carried out in order to achieve the desired outcomes as a number of strategic plans for the coastal areas that are to be implemented by a coastal management entity. Providing the required laws and regulations for establishing such a management body is also under way.

Iranian ICZM is defined as "A dynamic inter sectoral and multi aspect program that according to ecosystem based planning establishes sustainable use of coastal zones".

3. Methods

Iran's ICZM has been conducted in three main steps through eight years (2002-2010): Step one which carried out basic studies and literature review, producing main datasets such as existing land use at 1/25000 scale, using proper satellite images. Step two, which was involved in conducting segregated studies in various partial fields and extracting the main outcomes of each group. Step three deduced of all studies and synthesizing the main outcomes to provide an integrated result which can improve the government's policy making in an integrated way.

SMCE method was used for designation and zoning the main land use in terrestrial part of the coastal zone for urban development, industrial development, tourism development, agriculture development and protected areas in coastal zone by using environmental criteria. Five main layers were selected: Functional Zoning, Hazard Zoning, Managerial Zoning, Ecological Potential Zoning and Threat-Opportunity Zoning. The first is the basic zoning layer which articulates how different activities can be located across the Iranian coastal areas. The other four layers presented as overlay zones which might bring additional regulations to ensure sustainable development.

4. Results and Conclusion

Coastal zones were divided into 5 different areas: 1-Coastal Water Zone (CWZ), 2-Near Shore Zone (NSZ), 3-Sea level Fluctuation Zone (SLFZ), 4-Hazard Zone (HZ) & 5-Coastal Area (CA) by technical and socio-economic criteria.

As zoning represents a flexible structure for planners, they can precise their policies in a spatial format and limit or intensify the developments in some cases. In order to facilitate benefiting these zoning files that are accompanied with regulations, a DSS (Decision Support System) was designed to summarize all information in a simple way for local and national managers.

5. Recommendations

Iranian ICZM Plan provides main strategies for sustainable use of coastal zones at its north and southern parts in a national scale. Local scope of this approach is necessary for each coastal province at the next step for the near future.

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Threats and Opportunities Against to Mangrove Forests in Iran

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Purpose

Mangroves represent a rich and diverse living resource. Mangrove forests are now recognized as being a major protector of coastal environment and a valuable national economic resource. However, the total area of mangrove forests in Iran has been declining due to human activities. Iranian university researchers and NGOs have taken various initiatives to address the problems of mangrove forest resources degradation. Bringing in the capability and limitations of mangroves can help finding a way to rescue the vast mangrove areas in the Persian Gulf region.

Scope

Iranian mangrove forests occur between the northern orbits 25°09'–27°84'. This area covers the north part of the Persian Gulf and Oman Sea, and three coastal provinces in the south of Iran (from southwest to southeast: Bushehr, Hormozgan and Sistan & Balouchistan).

Mangrove forest covers about 120.00 km² in 9 main regions and all regions are protected by Department of the Environment of Iran. There are 1 national park (in Nayband bay), 1 Biosphere Reserve and 3 Ramsar Sites in mangrove regions of Iran.

Two species of mangroves are found within Iranian mangrove forests, *Avicennia marina* (family Avicenniaceae) and *Rhizophora macrunata* (family Rhizophoraceae). Local communities are related to mangroves for foliage harvesting, fishing and tourism activities. Some industrial activities, particularly oil and gas related production growth, as well as road and port development, are located close to some mangrove regions.

Methods

SWOT method was used for designation and assessment of internal and external factors that affect mangrove forests. According to literature review, interview, questionnaires and field check we identified Strengths, Weakness, Threats and Opportunities. Then the external and internal factors by EFE & IFE matrix were evaluated. We also determined main strategies and activities resulted by SWOT matrix for sustainable management purposes. QSPM method was used to rank obtained strategies.

Results and Conclusion

The following have been identified as factors contributing to the destruction or damage to mangrove forests:

- Overexploitation of mangrove leaves and branches as fodder for domestic animals by rural communities.
- Severe waves and extreme tidal action can uproot mangroves, decreasing growth and reproduction in some regions.
- The alternation of rivers and delta directions towards the sea reduces mangrove areas.
- Climatic changes resulting in drying of land and retardation of inundation period contributes to mangrove destruction.
- Mangrove trees, resistant to most plant diseases, are susceptible to insects of the Cynipidae family, genus *Neuroterus* (unknown species, possibly *Neuroterus lenticularis* or *Neuroterus lanuginosus*)
- Mammals, such as *Ratus ratus* consume mangrove seeds, fruits and leaves, causing damage to these forests.
- Road construction within the Nayband forests has created seawater connections in some parts of the region, destroying part of the mangrove forests.

- The lack of conservation program, control and preservation plan, in order to prevent the destruction of forests by villagers and surrounding population.
- Even some mangrove species show adaptability to salt stress. Freshwater extraction may cause high salt level and reduced mangrove forests in Persian Gulf.
- Urban and industrial wastewater and sewage discharge into the forest areas generate microbial pollution.
- Marine Pollution, especially oil pollution in the Nayband Bay, as a result of development of the southern Pars oil field in Assaluyeh region, has resulted in damage.

Recommendations

Public participation plan and international technical support is necessary to control mangrove degradation and support mangrove regeneration in northern part of Persian Gulf & Oman Sea.

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Innovations in Environmental Synthesis, Communication, Reporting and Governance

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The coastal zones of the world provide some of the most acute environmental challenges on the planet. The proliferation of coastal megacities and coastal population pressures impact coastal ecosystems, leading to degradation of coastal ecosystems like salt marshes, mangrove forests, seagrass meadows and coral reefs. Iconic regions like Chesapeake Bay and the Great Barrier Reef are threatened by various human pressures, including accelerated climate change. These challenges promote a search for innovations in environmental synthesis, communication, reporting and governance.

Environmental synthesis activities have been enhanced with synthesis centers, which convene working groups that create, analyze and interpret global data sets and write high profile synthesis papers for scientific journals. This synthesis process will need to evolve better communication to resource managers and policy makers.

Science communication innovations include the development of online conceptual diagram drawing programs, the evolution of design/layout communication products for print and ereader formats, and video seminars and training content.

Environmental reporting innovations include environmental report cards (e.g., Chesapeake Bay, Great Barrier Reef, Southeast Queensland), which have evolved to include citizen science monitoring, management response monitoring, and public health monitoring.

Governance innovation is exemplified by regional resource management authorities (e.g., Great Barrier Marine Park Authority; Chesapeake Bay Program) and by a rigorous evidence-based approach to decision-making (e.g., BayStat).

These innovations in environmental synthesis, communication, reporting and governance will need to be tested and applied more widely across the globe so that scientists can solve, not just study, environmental problems.

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Competing Rationalities in Marine Ecosystem Services Management: Implications for the Polish EEZ

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Marine ecosystem services (MES) are the foundation of sustainable development in coastal areas. However, the management in the Polish Exclusive Economic Zone (EEZ) does not acknowledge this paradigm, but instead takes a sector-by-sector and case-by-case approach. Moreover, the participation of individual actors in decision-making processes is limited. The purpose of our paper is to examine the reasons for fragmented and short-term coastal management, its perceived detachment from the reality of interdependence between MES and economic development, and the competing rationalities of different institutional spheres involved (individuals and decision makers). We adopt an institutional framework, assuming rationality to be a pluralistic and socially constructed concept driven by various ideologies.

Our analysis addresses and re-defines key issues of coastal management: participation, integration, accountability and interdependence in relation to the Polish EEZ. In order to investigate the rationales supporting the objectives adopted in local development strategies, we studied the national marine spatial planning policy, the relevant national sectoral policies and the strategic documents of three coastal provinces and ten coastal towns and cities with more than 10,000 inhabitants. We used a content analysis to examine (i) the integration of management objectives, (ii) whether precautionary principles are followed, and (iii) whether benefits and future opportunities of MES are considered. In addition, we used a discourse analysis to analyze individual actors' approaches and their perceptions of MES in urban areas.

Analysis of the rationalities of institutional and individual actors revealed that neither consider MES crucial and instead, their motivations are ideological in terms of means and ends contested philosophy. This results in short-term goals which are often in conflict with the principles of sustainable development. Because of underfunding and unclear responsibilities, conflicts are not prevented but are addressed only once they have escalated. Moreover, MES seem to be one of the most undervalued elements in the planning processes where they tend to be limited to tourism and recreation only.

Although all the different institutional spheres acknowledge environmental issues, specific conservation and protection measures are not considered in detail: they are the subject of bounded rationality. We argue that before a compromise between different rationalities can be achieved, their paradigms need to be made visible and become a subject of public dialog on the basis of a democratic, pluralistic discourse within all the institutional spheres. The decision-making process needs to be made more transparent, science-based and participatory. These objectives require an institutional change in the process that transforms existing regimes in accordance with cooperative rationality. We argue that the estimation of the economic value of MES is crucial for improved MES management. It would also indicate the economic potential lost because of the current trade-offs between the environment and economic development most often solved in favor of the latter. This could be complementary to the already existing regulatory measures that aim to prevent further degradation of the recognized elements of marine ecosystems.

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A Trans-Boundary, Community-Based Response to Gulf of Mexico Water Quality Issues

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Global Water Watch (GWW) is a community-based water monitoring and watershed stewardship program based at Auburn University, and GWW, Inc. is an incorporated nonprofit organization with members in several countries, including Mexico. GWW was funded by the USEPA Gulf of Mexico Program Office, Gulf of Mexico Alliance (GOMA), to conduct a three-year (2009-2011) project that fosters awareness of Gulf water quality issues, and promotes water data collection by certified community volunteers. The project is focused in the Mobile River Basin of Alabama, USA, and the La Antigua River Basin of Veracruz, Mexico. Both of these basins extend hundreds of kilometers inland, and include mountains up to 5,000 m, upland forests, intensive agriculture, and major drainages to the Gulf of Mexico. Excess nutrients, periodic low oxygen and toxins have been identified as problems in the coastal zones of both of these basins.

Target audiences included fish and livestock producers, middle and high school students and teachers, community volunteer water monitoring groups, and the general public. Numerous workshops were conducted throughout the study area using GWW bilingual training manuals to certify interested people in monitoring water quality according to a USEPA approved quality assurance project plan. An aquatic science curriculum called, *Exploring Alabama's Living Streams* (EALS), previously developed by GWW and endorsed by the Alabama Math, Science and Technology Initiative, was translated into Spanish (*Explorando Nuestros Ríos Vivientes*, or ENRV). Several workshops were conducted for scores of educators to show how the EALS and ENRV curricula could be taught in a variety of ways to grades 4-12. An online Directory of Environmental Centers in the six Mexican and five USA States that border the Gulf is being compiled and will be linked to GWW and GOMA-related websites.

Thousands of water data records have been submitted by volunteer monitors via the Internet to the GWW customized relational database. All data are publically accessible and may be analyzed, graphed and shared in a variety of formats. Data have been used to remediate pollution problems and influence watershed management plans and water policy. Animal producers, from trout farmers in Veracruz to cattle farmers in Alabama, have participated in the project, become more aware of the potential negative impacts of their operations on Gulf water quality, and learned about sustainable alternatives. Students have benefited from place-based environmental education including outdoor classrooms and personal involvement in collecting valid water data.

Overall, project participants including policy makers, educators and the general public have learned about the importance of taking a watershed approach to solving problems of the Gulf of Mexico. The challenges of protecting and restoring the Gulf are impossible to solve solely through professional research and regulation. Community involvement through standardized water monitoring and mutual learning is effective in mobilizing thousands of people from numerous stakeholder groups, and should be a component of any coastal sea management strategy.

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Sustainable Approaches to Restoring Coastal Habitat in the Heart of New York City

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Jamaica Bay has evolved over the past 25,000 years as an important and complex network of open water and coastal habitat. The wildlife use of these systems is commensurate with this complex network of natural systems – the 20,000 acres of diverse habitat support seasonal or year round populations of over 214 species of special concern. Because of its geographic size and diverse habitats, Jamaica Bay is a nationally and internationally renowned birding destination.

However, the valuable resources that comprise Jamaica Bay have been lost over time due to development. The current Jamaica Bay is only half of its pre-colonial extent. Filling, dredging, pollution, shoreline hardening, and other degradations have synergistically affected historic flow and sedimentation patterns in the Bay, eradicating natural habitat, impacting water quality, and modifying the rich ecosystem that was present prior to the extensive urban development of the watershed.

This presentation examines new approaches for ecosystem restoration and sustainability within the complex, urban environment of Jamaica Bay. A series of ecological pilot projects first identified in the Jamaica Bay Watershed Protection Plan have been implemented and are currently being monitored. The purpose of the pilot studies is to address uncertainties associated with these new approaches under NYC climate and environmental conditions to guide future practices, while also attempting to restore and maintain water quality and ecological integrity with the New York City metropolitan area. These pilot projects are unique in their exploration of sustainable approaches to address urban water quality and ecological concerns.

For example, eelgrass and oyster restoration studies are widely used elsewhere, but are new to the waters of NYC. Until recently, little attention has been paid to eelgrass and oyster enhancement and restoration in urban watersheds such as Jamaica Bay in waters that are closed to fishing and shellfishing. Over the past two years, we have been undertaking pilot projects within the Bay to restore eelgrass and oysters in Jamaica Bay, and will discuss the unique challenges of carrying out these projects, the lessons learned, and the direction for future efforts.

Other pilot projects include using wave attenuators to slow erosion of wetlands, testing the infiltration capacities of mussels to improve water quality, and harvesting algae for biofuel production.

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It's Scientifically Proven: If You Engage...You Win

Michael Dougherty

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Social media is no longer a one way street of communication, where organizations merely push info out; it is a back and forth dialogue of information and ideas. This segment will discuss the ways social media should and shouldn't be done and illustrate how it can be used to effectively broaden knowledge and understanding and grow strong networks.

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Health of Human Populations and Associated Domestic Animals as a Component of the Integrated Coastal Zone Management Approach

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For three decades, Integrated Coastal Zone Management (ICZM) has been instrumental in promoting interdisciplinary studies, considering managerial issues through tentative common approaches between biologists, sociologists and, rather recently, economists. Even if for ecologists it seemed rather obvious to include the human dimension into the approach, it is only rather recently that the human dimension has been fully adopted by ICZM. Managers have finally realised that value networks governing human exchanges are inevitably at the root of how ecosystems are used and evolve under the influence of humans, hence highlighting the dominating influence of profitability and socioeconomic factors for political agendas.

On the one hand, the scientific debate, based on an eco-systemic (“systemic” as in “systemic approach”...) approach needs to be promoted, reviving fostered awareness, based on a robust scientific approach (both theoretical and practical) of complex systems where quantitative and qualitative linkages can be demonstrated from a molecular to a population level. On the other hand, such systemic interactions have to be placed in a context influenced by resources, governance, end-users and stakeholders in a given social, economic and political setting.

The prioritisation of human “well-being” might be a good way to focus on pressures and impacts inflicted to ecosystems, emphasising the ensuing suboptimal health of ‘natural systems’, including human and animal life in existence within these systems. Therefore, the eco-ecosystemic approach requires understanding of, firstly, social, political, economic and, secondly, ecological structures and functions fundamental to health care provision for growing populations of humans and livestock and other domestic animals. Ecology stands out as a key component to understanding the instrumental factors to decision-making bottlenecks and to identify weaknesses in the socio-economic system. The disparity in environmental ‘health’ on the planet is reflected by the strong divide between developing and industrialised countries. And this is a growing phenomenon. Crises are looming with regards to the use of natural resources (biological and mineral) and, in particular, water and associated health challenges. There may be a case for turning the problem on its head and for environmental scientists to consider the issues from the human health and food production perspectives. An eco-systemic approach to health and “well-being” should help in managing goods and services to a society which relies on functions realised by ecosystems.

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Management Plans for European Estuaries for the Restoration and Protection of Their Ecological Functions

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The Coordination Action ENCORA, within the Sixth Framework Programme of the European Union, concluded that training programmes should on the one hand, embrace all Integrated Coastal Zone Management (ICZM) approaches to expose students to diverse options, and on the other hand, better respond to the specific needs of different types of coastal practitioners and policy makers. Clearly, employers now expected newly recruited personnel to be able to tackle the complexity of present society from day one of work. The enquiry further showed that in general, current education and training efforts are mainly directed towards preparing new coastal professionals, but not reinforcing the capacities of those professionals already involved in decision and policy making as though they did not need to be educated throughout their professional life.

The findings showed that such professionals require training tailored to their specific needs. These needs should be identified by a thorough assessment of the roles they play within organizations in the public and private sectors (also including political spheres, NGOs and the general public). As a result, overall, there was a need to introduce a more flexible education in our present world. There was also a need for greater emphasis on the designing of courses, teamwork, interdisciplinarity, communication, problem solving and self-directed learning. Today, in the classroom, seminars, workshops and projects now replace many of the more theoretical lectures supported by tutorials. Students also navigate the Internet, which is a most uncoordinated, unsupervised, unstructured mass of information of which most might be irrelevant and/or incorrect. There is a danger that the media become the accepted means of information transfer and that transmission of knowledge suffers. So, there is a need for organised and well structured courses to be made available via the world wide web in combination with live sessions on campus.

The paper looks at requirements for making such on-line courses attractive to professional managers, politicians and to NGOs as well as the general public. It considers various aspects of teaching on-line, in particular transfer, communication, and management of knowledge, problem solving from experience provided by examples. The authors further explore the possibility to organise seminars, project presentations, field visits and practicals in the lab at certain stages of the studies. They consider live sessions as essential in comparison to the passive use of PowerPoint presentation, TV programs, videos, and other multimedia.

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Striking a Balance between Using Electronic Educational Tools and Running Live Sessions

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The Coordination Action ENCORA, within the Sixth Framework Programme of the European Union, concluded that training programmes should on the one hand, embrace all Integrated Coastal Zone Management (ICZM) approaches to expose students to diverse options, and on the other hand, better respond to the specific needs of different types of coastal practitioners and policy makers. Clearly, employers now expected newly recruited personnel to be able to tackle the complexity of present society from day one of work. The enquiry further showed that in general, current education and training efforts are mainly directed towards preparing new coastal professionals, but not reinforcing the capacities of those professionals already involved in decision and policy making as though they did not need to be educated throughout their professional life.

The findings showed that such professionals require training tailored to their specific needs. These needs should be identified by a thorough assessment of the roles they play within organizations in the public and private sectors (also including political spheres, NGOs and the general public). As a result, overall, there was a need to introduce a more flexible education in our present world. There was also a need for greater emphasis on the designing of courses, teamwork, interdisciplinarity, communication, problem solving and self-directed learning. Today, in the classroom, seminars, workshops and projects now replace many of the more theoretical lectures supported by tutorials. Students also navigate the Internet, which is a most uncoordinated, unsupervised, unstructured mass of information of which most might be irrelevant and/or incorrect. There is a danger that the media become the accepted means of information transfer and that transmission of knowledge suffers. So, there is a need for organised and well structured courses to be made available via the world wide web in combination with live sessions on campus.

The paper looks at requirements for making such on-line courses attractive to professional managers, politicians and to NGOs as well as the general public. It considers various aspects of teaching on-line, in particular transfer, communication, and management of knowledge, problem solving from experience provided by examples. The authors further explore the possibility to organise seminars, project presentations, field visits and practicals in the lab at certain stages of the studies. They consider live sessions as essential in comparison to the passive use of PowerPoint presentation, TV programs, videos, and other multimedia.

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Policies Governing the Integrated Management of Forests, River Basins and Coasts in Japan

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From the mid-1950s to mid-1970s, during the period of high economic growth in Japan, development and industrialization by large-scale logging of natural forests, river development and dam construction, and coastal land reclamation were conducted. As a result, flood hazards, water shortages, sediment runoff, water pollution from industrial drains, degradation of agricultural production capacity, and fisheries and aquaculture damage occurred frequently in Japanese coastal areas. As a result of this environmental deterioration, conflicts occurred between industries that promoted development and citizens who tried to protect their communities and environment, and citizen movements developed.

The reasons why these problems occurred is that consideration was not given to the fact that land-based human activities in forests and river basins were having an impact on coastal resources and the natural environment, and forests and river basins and coasts were being functionally developed and utilized sectorally.

After the 1980s, sustainable development and resource use based on environmental conservation gained global consensus, allowing the reconsideration of values other than economic ones regarding the local resources of forests, rivers, and coasts, socio-cultural values such as multifunctionality, for example, have since been reconsidered, and awareness of integrated management of forests, river basins and coasts has increased.

However, forests, river basins, and coasts still face several problems. As a result of depopulation and an aging society in forested and agricultural lands, under-use results in abandonment and ruin of formerly cultivated land due to depopulation in the upper stream areas and population density in down stream ones: marine debris through runoff via rivers and streams further aggravates the loss of mudflats and shallow sea areas due to reclamation and over-exploitation reduces fisheries production. To solve these problems, integrated management of land and coastal areas is needed, but because of sectoral management, lack of cooperation and coordination, and sectoral and national legislation, these localized problems cannot yet be solved.

Against such a background, the Basic Act on Ocean Policy and Basic Plan on Ocean Policy, which promote integrated management of the coastal zone, were enacted in 2007 and in 2008 respectively in Japan.

The objective of this study is to clarify the necessity for integrated management of forests, river basins, and coastal areas by considering needs and measures, and to contribute to the formulation of policy for securing functional integrity and sustainable use of coastal areas by sharing and disseminating research results.

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Field Investigation of Oxygen Consumption Characteristic of Sediment in Hypoxic Enclosed Coastal Sea

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In enclosed coastal seas, hypoxia occurring at the bottom of sea during summer season is serious environmental problem. Many restoration technologies for promoting oxygen supply to the bottom of sea are developed. It is necessary to understand the oxygen consumption characteristics of sediment before applying these techniques in the actual seas because it is thought that the oxygen demand of sediment during hypoxic season increases. In this study, we carried out field investigations during the year in the enclosed coastal sea for measuring the oxygen consumption fluxes across the sediment by using a new chamber method.

Field investigations were carried out at intervals of weeks from May 2008 to April 2009 in the enclosed coastal zone, Sakai-Senboku port in Osaka bay, Japan. The chamber which can supply oxygen into the chamber was put on the seabed and the time variations of dissolved oxygen (DO) concentration of seawater inside the chamber were measured at intervals of 15 minutes. Oxygen consumption fluxes across the sediment were calculated from these data. It is notable that the seawater inside the chamber was replaced by re-aerated bottom seawater during summer hypoxic season.

According to the result of the field investigations, it was found that the oxygen consumption characteristic of sediment with oxygen supply was varying with time while the sediment was consuming the oxygen inside the chamber. The oxygen consumption fluxes were large just after supplying oxygen into the chamber, but the fluxes decreased with time. There was a correlation between time variations of the oxygen consumption fluxes and the DO concentrations of seawater inside the chamber. In order to evaluate the oxygen consumption characteristic quantitatively, the oxygen consumption fluxes varying with time were defined by following equation. $FLUX = a \cdot C + b$. C is the DO concentration of seawater inside the chamber. a is the parameter considered as chemical effect on oxygen consumption and b is the parameter considered as biological effect. The value of a was 2.0-5.0 mg/day during summer hypoxic season but the value of a was 0 mg/day in winter. On the other hand, value of b in summer hypoxic season was ten times larger than that in winter. These findings suggested that the oxygen consumption rate of sediment with oxygen supply during hypoxic season became larger than that without oxygen supply in winter.

In this study, we found out the oxygen consumption characteristic of sediment that the oxygen consumption rate becomes large during summer hypoxic season. Therefore, it is important to consider the effect of the oxygen consumption potential of sediment when restoration technologies for promoting oxygen supply are applied in hypoxic sea.

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Social Media: Leverage It to Discuss, Illuminate, and Educate

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Panel Overview

Over the past several years as the Internet has continued to evolve the role of social media has expanded significantly. Whether it's Facebook, Twitter, Flickr, Google+ or any of the other numerous tools, more and more web users today are involved in online social networks. As they create and consume increasingly large quantities of content, users have made and continue to make the web a more interactive experience than it was only a decade ago. Through powerful social networks, individuals and organizations can find content that is highly correlated to their individual needs and interests, while companies and organizations use these powerful tools to build relationships and spread their messages.

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Application of System-scale and Farm-scale Ecological Models in Order to Quantify Interactions between Aquaculture and Environment Throughout the World

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Ecological models have been applied at different scales in many parts of the world to simulate the production of cultivated shellfish, and the positive and negative environmental effects of this culture, as well as for carrying capacity and site selection. We present examples of these applications for estuaries, bays, and inland cultivation in ponds, in order to compare the relative roles of different types of aquaculture.

We draw from case studies from Asia, Europe, and South America, for different species of shrimp and bivalves, to illustrate how models can be used for evaluating the environmental externalities resulting from these activities. Tools such as the Farm Aquaculture Resource Management (FARM) model can be used for the assessment of the production, profitability, and environmental footprint of bivalve shellfish cultivation, while the equivalent tool (POND) for land-based cultivation of finfish or shellfish provides decision-makers with an assessment of discharge to coastal areas. Both of these tools quantify a number of the relevant ecosystem goods and services, and allow farmers and decision-makers to experiment with different cultivation densities, siting, etc, without the corresponding financial, environmental, and social costs of direct implementation.

We also present examples from China and Brazil showing how models may be used to evaluate the role of integrated multi-trophic aquaculture (IMTA), both in ponds and open water, as a means to increase the yield of aquatic products, while reducing the environmental impacts of fed aquaculture. Finally, the modelling results from Brazil, Chile, China, and Ireland are extended to analyse the potential role of shellfish aquaculture in helping to manage nutrient inputs from land in the United States and in Europe, particularly as nitrogen and phosphorus loads shift primarily to diffuse sources.

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Coral Reef Biological Criteria: Using the Clean Water Act to Protect a National Treasure

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Coral reefs worldwide are experiencing the greatest decline of their known existence and few tools are available to offset the growing impacts from human coastal and watershed activities. Biological criteria (biocriteria) developed under the authority of the Clean Water Act (CWA) are a potentially effective means to evaluate and restore impaired waters. Widely implemented in freshwater systems, biocriteria are not currently used in a marine environment even though the authority of the Clean Water Act extends at least to the 3-mile territorial waters. The objective of the CWA is to restore and maintain the chemical, physical and biological integrity of U.S. waters. Biological endpoints are often overlooked for more easily measured physical and chemical thresholds, but maintaining a natural biological condition is a primary goal of the CWA. Like its counterparts, biological standards and criteria can be defined under the CWA to protect valued aquatic resources such as coral reefs, mangroves, oyster beds, seagrasses and wetlands.

Biocriteria are an important addition to existing management tools for coral reef ecosystems. Simply stated, biocriteria are expectations set by a jurisdiction for the quality and quantity (condition) of living aquatic resources in a defined waterbody. Biocriteria follow the same process and draw on the same CWA authorities as the more familiar physical and chemical criteria. Because they are regulatory, biocriteria must be developed using established methods with transparency, clear objectives and defensible science. Scientific aspects include development and testing of indicators sensitive to human disturbance, delineation of reference conditions and condition gradients using indicator values, and development of a long-term regional monitoring program capable of detecting differences relative to reference condition.

A collaborative Environmental Protection Agency effort is underway to elucidate the technical aspects of coral reef biocriteria implementation. A stony coral rapid bioassessment protocol has been introduced and applied in the Florida Keys and U.S. Virgin Islands, where several indicators were validated for sensitivity to human disturbance. Additional assemblages (fish, octocorals, sponges) are now being examined for responsiveness. Linkage of coral condition to watershed land use activities, using landscape characterization, has been demonstrated in the U.S. Virgin Islands. Assessment options for long-term programs, such as rotating panel designs, have been elucidated and technical guidance developed. Once adopted, a bioassessment monitoring program for biocriteria will provide legally-defensible records of coral condition and regulatory compliance.

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A Decision Framework to Protect Coral Reefs in Guánica Bay, Puerto Rico

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A Watershed Management Plan (WMP) for Guánica Bay, Puerto Rico, was introduced in 2008 by a nonprofit organization, the Center for Watershed Protection, with the intent of protecting coral reefs from damage related to watershed discharges. The plan was initially generated with the collaboration of federal agencies in the Coral Reef Task Force. The National Oceanic and Atmospheric Administration (NOAA) and U.S. Department of Agriculture (USDA) took lead roles for the project in collaboration with Puerto Rico Department of Natural Resources and the Environmental Quality Board. They were joined by the National Fish and Wildlife Foundation (NFWF), U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency (EPA) in a comprehensive effort to reduce sediment and nutrient efflux to coral reefs from the Guánica Bay watershed.

Among the contributions of EPA is a decision framework that captures the objectives and means of the original plan as well as additional objectives and means that have evolved from additional partners and stakeholder perspectives. A Decision Workshop, which was held to elicit comments and insights to the proposed actions of the WMP, resulted in a broader perspective and recognition of greater value throughout the watershed from environmental conservation efforts. It also identified multiple objectives and decision options of partners and stakeholders. Ultimately, the management initiatives proposed by the WMP for Guánica Bay were expanded by the explicit identification of a set of fundamental objectives that represent diverse concerns. Means-ends networks were also created to demonstrate the interactions of the fundamental (end) objectives and possible means of achieving them through interactions of different partners. The decision analysis clarified the trade-offs that must be considered by managers in the region and the measures that must be defined in order to evaluate management success. With clearly defined objectives, policymakers and stakeholders can more easily predict, monitor, and communicate the benefits from management decisions throughout the Guánica Bay Watershed.

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Floating Wetland Islands in Restoration Ecology in Fresh, Brackish and Salt Water

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Floating Wetland Islands are man-made replicas of natural peat based systems found around the world. Using a fibrous recycled material (matrix), Floating Islands are manufactured to any shape and size. Floating Islands can be installed in fresh, brackish and saltwater environments. The interstitial spacing of the recycled materials allows naturally occurring microbes to colonize the fibrous surfaces creating a wetland where denitrification occurs. The amount of denitrification has been tested and verified in lab tests at a rate of 759 mg/day/ft² island in both fresh and brackish water without the use of aeration. The Naor project at Harborview East and 4 other locations around the Inner harbor involves installing 18 acres of Floating Wetland Islands. The project is divided into 2 phases. Phase 1 involves 2 acres and phase 2 involves installing the remaining 16 acres. If the nutrient rates from the lab study were to hold true in an outdoor environment, installing 2 acres (8,092 m²) of Floating Wetland Islands in Baltimore's Inner Harbor would effectively remove ~145 lbs/day of N or 52,925 lbs/year. The cost per pound of N removed is \$2.19/lb over 30 years. Installing the full 18 acres of Floating Wetland Islands would remove ~1312 lbs/day N and 478,880 lbs/year.

Habitat is also created both above and below the surface of the water. During a 3 month period in the Fall of 2010, several 4" round, 2" thick sections of the Island matrix were left hanging approximately 3 ft below the water surface. These pieces of matrix were pulled and observations showed that on one piece, 644 native Dark False Mussels were colonizing the matrix. This species was not found on adjacent pier pilings or bulkheads indicating a preference for attachment to the matrix substrate. Given the surface area of the 2 acres in phase I, there is the potential capacity of 168,315,840 Dark False Mussels colonizing the Island matrix to enhance the nutrient uptake and TSS removal above and beyond the numbers listed above, cleansing the waters of the Inner Harbor and helping the City of Baltimore and the State of Maryland to meet the TMDL requirements under the newly promulgated laws pushed down by EPA.

Other benefits include robust fish habitat, shading of deep water reducing thermal pollution, reflect wave energy reduction (82%) from boat traffic, safety platforms for egress from the water during accidents (current bulkhead heights are 5-10' with no egress ladders).

The Naor project is a capital improvement project creating acres of floating wetland parks reconnecting waterside promenades, creating dozens of green jobs, eco-tourism and enhancing the quality of life of the citizens of Maryland. The multiple benefits this project brings to Baltimore and the State of Maryland drives the cost per unit of value down to pennies per square foot. Using Floating Wetland Islands as a restoration tool is both cost effective and environmentally sound.

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A Coastal and Marine Ecological Classification Standard (CMECS)

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The Coastal and Marine Ecological Classification Standard (CMECS) provides a uniform approach for identifying, characterizing and naming ecological units in coastal and marine systems. It is intended to facilitate the study, monitoring, protection, restoration and management of habitats supporting commercially- and recreationally-important species, vital habitats for protected species, unique biotic assemblages, and key ecosystem features. CMECS describes standards for classifying ecological units in the benthic, sub-benthic, geological, and water column regimes and proposes unit definitions for inventorying, sampling, and mapping activities.

CMECS is intended to create a comprehensive ecological classification, build on existing work, be easily compatible with mapping, document terminology, and allow for dynamic content. It is the product of development, testing and validation by experts from multiple federal and state agencies, academia and non-governmental organizations, led by NOAA and NatureServe. It is designed for use in North American marine, estuarine, and Great Lakes ecosystems, but is applicable world-wide.

In August 2010, CMECS was published in the Federal Register by the Federal Geographic Data Committee's (FGDC) Standards Working Group as a proposed federal standard. The results of the review are now being incorporated to complete a final draft of the standard. Proposed changes to the draft standard will be highlighted. The CMECS team encourages pilot projects and crosswalks with approaches presently in use to test and enhance the compatibility and applicability of CMECS.

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A Multi-tier Modelling Approach to Sustainable Management of Coastal Water and Sediment Quality

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Eutrophication remains a persistent problem in coastal waters, affecting both water and sediment quality, and leading to undesirable effects on turbidity, oxygenation, and aquatic vegetation. Turning off nutrients in source waters has provided some relief, but mitigation of eutrophication is also achieved by increasing herbivory via cultured bivalves. Regulation of eutrophication is amenable to simulation modeling, and scenarios involving the added benefit of commercial shellfish are valuable not only for control of coastal nutrients, but for planning and management of shellfish culture. Several levels of modeling may be undertaken in order to optimize both model effort and spatial resolution. A primary effort is ASSETS (Assessment of Estuarine Trophic Status), a screening model involving quantitative and qualitative indicators of pressure, state and response. A second tier of modeling includes spatially discrete dynamic ecosystem models resolved as boxes or finer grids, generating time series of variables such as nutrients and chlorophyll. An approach between screening and full ecosystem models includes the FARM (Farm Aquaculture Resource Model) model of local seston depletion within aquaculture leases. In all cases, sustainability criteria are generated as a function of targeted state variables, for example whether suspension-feeders influence chlorophyll beyond the bounds of natural variation. Integration of watershed submodels is particularly important, including those that incorporate land use, since development scenarios and nutrient responses are core components of this approach. Examples of the application of these models are presented for estuaries in Europe and Canada. Together the models constitute an operational approach to management of coastal ecosystems, amenable to quantification of present conditions, as well as scenario-building and prediction.

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From Headwater to Sea: Adapting to Climate Change in the Chesapeake Bay

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In the United States, Maryland was identified as one of the three most vulnerable states to sea level rise. Led by Governor Martin O'Malley and the Maryland Commission on Climate Change, Maryland has taken a proactive role in preparing for the risks associated with climate change. With the input from state and regional experts, the State has released two strategy reports that utilize a holistic, cross-agency approach to adapt to the impacts of climate change. Recognizing the impacts of climate change cast a wide net outside of the coastal zone, the strategies examine impacts and solutions to sea-level rise, and the impacts of increased temperature and altered precipitation patterns on human health, water resources, agriculture, terrestrial and aquatic ecosystems, and built infrastructure. As a result, the Department of Natural Resources has been working with other state and local agencies to incorporate climate change adaptation into planning processes and policies. Efforts here and other efforts across the country present one of the best opportunities for working collaboratively across agencies and sectors.

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The Evolution of Resilience in Integrated Coastal Systems: Chesapeake Bay

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The Baltimore District, U.S. Army Corps of Engineers (USACE), in partnership with the Maryland Department of Natural Resources (DNR), has studied erosion on the shorelines of the Chesapeake Bay mainstem and tidal tributaries in Maryland. This study effort has resulted in a Management Guide for shoreline erosion in the Chesapeake Bay in Maryland, as well as a technical guide that is in preparation for solutions to shoreline erosion. The Management Guide was prepared to address three primary needs:

- Identify areas around the Chesapeake Bay in Maryland where ecological, socioeconomic, or cultural resources may be vulnerable to effects from shoreline erosion over 50 years.
- Provide information on using stand-alone and online Geographic Information Systems (GIS) tools to screen and evaluate potential impacts from shoreline erosion
- Present background data and studies that may be used to support shoreline erosion project formulation.

The identification of areas that may be vulnerable to shoreline erosion was based on a projection of shoreline erosion over a 50-year planning window. The Erosion Vulnerability Assessment (EVA) is an online mapping application utilizing a suite of shoreline related data providing planners, managers, and the general public with information about resources, land use, features, and infrastructure susceptible to shoreline erosion over the 50-year planning horizon. The location of various resources with respect to the predicted 50-year shoreline was evaluated. Criteria were developed to rank erosion vulnerability of ecological resources such as wetlands and beaches during the 50-year window. Socioeconomic features were depicted with respect to the zone of vulnerability defined by the 50-year planning window. In conjunction with projections of sea-level rise and shoreline condition, the EVA tool and the Management Guide help to identify resilient shorelines, wetlands, and infrastructure.

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The Florida Climate Institute - University of Florida and Florida State University – Building a Sustainable Future Through Research, Teaching and Outreach

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The Florida Climate Institute (FCI) is a multi-disciplinary network of national and international research and public organizations, scientists, and individuals seeking a better understanding of climate variability and change. The FCI was founded in 2010 by the University of Florida and the Florida State University and is supported by the two university's affiliated colleges, centers, and programs.

Climate variability and change pose significant economic, food security, and environmental risks. Policy makers, farmers, and the public need information at local and regional levels and at a short time-scale.

The FCI brings together outstanding expertise from across disciplines, universities, organizations, and industry to develop projects that integrate research, education, and outreach to identify and evaluate potential societal responses to climate change and variability, and to meet the stakeholders needs for climate information and technology options.

The FCI has developed stakeholder climate working groups (involving scientists, agencies, private sector), technical working groups to respond to stakeholders needs. The FCI has submitted interdisciplinary proposals to federal agencies, and organizes monthly seminars and annual conferences.

The ongoing projects at FCI are developed to improve our understanding of climate dynamics and management practices, and reduce the climate risks to communities, the economy, and natural resources.

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Restoration of Coastal Environments Using Steelmaking Slag and Dredged Soil

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Supply of iron ions is considered to be effective for the growth of kelp (a kind of seaweed). In the present research, a demonstration experiment in which seaweed beds/shoals were formed using a mixture of steelmaking slag and dredged soil was carried out in a marine area of Kawasaki City, Japan. The average strength of the mound for seaweed beds, which was made of a mixture of dredged soil and steelmaking slag, was 109.7kN/m². The shape of the mound was stable during the experiment period. The iron content of the water above the mound made of the mixture was around 5ppm higher than that above mounds made of natural stones. The average dry weights of the soft seaweed (*Undariapinnatifida*) and brown seaweed (*Sargassumhorneri*) taken from mounds of the mixture including steelmaking slag were 1.1 times and 2.1 times more than that at mounds of natural stones, respectively. These results indicate that iron ions which dissolved from the steelmaking slag have a positive effect on the growth of brown seaweed.

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Estimation of Submarine Groundwater and TP Flux near the Intertidal Zone by the Budget Analysis using the Marine Observation Data

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Submarine groundwater (SGW) flux and total phosphors (TP) flux with SGW near the intertidal zone of Omae beach was estimated by the budget analysis using the marine observation data. Omae Beach located in Shuku River mouth in the northeastern part of Osaka Bay. It is a natural beach, but is surrounded by reclaimed grounds. SGW is discharged and is recharged from/to the sea bottom of coastal zone of the beach, though that detail of it is not clarified yet. Therefore we estimated not only SGW flux but also its TP flux based on the marine observation data.

Coastline of the beach is about 900m and the length of intertidal zone is about 150m. Marine, river and groundwater observations were carried out in Oct. 10 and 11, 2007. Salinity observations at 5 stations were carried out every high tide, mean level and low tide. Water level was measured at offshore of the intertidal zone during about 24 hours. Flow speeds of two rivers were measured at high and low tide. The analyzed area, which is surrounded by the beach and the outer boundary, is about $1860 \times 10^6 \text{ m}^2$.

The through water volume of the boundary, C , was calculated by the summation of temporal variation of volume of the area, dV , river discharge, Q , precipitation volume, P and evaporation volume, E . Temporal variations of salt volume of the area could account by C . However, temporal variations of TP volume of the area were not balanced with TP volume by C . It is suggested that water and salt budgets of the area is dominated by through flow, but TP flux with SGW can not neglect for TP budget, because TP concentration of pore water is very high generally.

Water balance included SGW was estimated by water budget, $dV=Q+P-E+C_s+SGW$. C_s is through water volume formulated by salinity. Temporal variations of TP flux with SGW were also estimated by TP budget. In this time, TP flux with SGW means summation of submarine fresh groundwater (SFG), recirculated saline groundwater (RSG) and TP release from the bottom sediment (pore water) by diffusion. SGW discharged during flood tide and recharged during ebb tide. It agrees with the previous study. TP flux with SGW was larger than that with through flow across the boundary, and was about ten times of the popular release velocity of TP. It means that the bottom sediment and pore water is important for the source of TP to the water column, and TP is supplied by not only release by diffusion but also groundwater flow.

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Likely Implications of Sea Level Rise for North Humboldt Bay, California

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The California State Government Climate Adaptation Report of 2009 uses an estimate for sea level rise of 20-55" by 2100. Coastal areas in California, including the low lying Humboldt Bay Area will be affected. Students in the Humboldt State University senior Environmental Management and Protection Planning Practicum in spring semester 2011 developed an assessment of likely implications of sea level rise for the North Humboldt Bay Area. Students developed a conceptual model of likely implications of sea level rise for this region through a review of the literature and numerous key informant interviews. They interviewed staff from local, state and federal agencies, local elected officials, landowners, business owners and real estate brokers about likely implications and responses. Direct effects of inundation are expected to occur locally with variable severity and at unpredictable rates. Indirect effects will be to the land, water and wetlands and to infrastructure. Students focused in particular on effects to agricultural lands, wetlands and habitat for endangered species, transportation corridors, brownfields, homes and businesses. Additional factors the region will need to cope with are its geographic and political remoteness and constraints posed by existing legislation such as the Coastal Zone Act and Clean Water Act which limit mitigation and retreat due to effects on current wetlands. A mix of local responses is expected from selective mitigation efforts to retreat and adaptation. Responses will need to include changes in local and state policies, fully transparent prioritization of mitigation efforts, adaptation of local planning guidelines and public education and outreach efforts.

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Floating Wetland Islands as a Tool for Ecosystem Restoration - Basic Science and Future Embodiments (Leviathan® Island Systems)

Kevin Hedge and *Ted Gattino*

Managing Partner, BlueWing Environmental Solutions & Technologies, LLC

Floating Wetland Islands are man-made replicas of natural peat based systems found around the world. Using a fibrous recycled material (matrix), Floating Islands are manufactured and installed in all types of water. The interstitial spacing of the recycled materials allows naturally occurring microbes to colonize the fibrous surfaces creating a diverse wetland ecosystem where waterborne pollutants and contaminants are bio-processed into and out of the food chain.

We will examine the key processes present in the floating wetland system and details of system dynamics that are optimized with the current island design. The massive potential of this habitat and nutrient processing tool will also be examined, along with the potential for future embodiments that utilize to reduce dead zones in all impaired waterways.

The most prominent (and most recent development) in the floating treatment wetland technology is called Leviathan® and it eats dead zones. How? By combining the best of wetland science, ecosystem design and processing, along with proven wastewater treatment technologies, we are able to process and treat 8000 gallons of water per minute, while oxygenating and treating impaired waters. This system has been effectively shown to reduce temperature and oxygen (DO) stratification in deep water ponds. The system is designed to easily allow removal of pollutants from the aquatic environment for proper storage, disposal and processing.

Participants will learn about the Biomimicry, concentrated wetland effect, biofilm, and ecosystem services.

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Enhancing Social Capital for Sustainable Coastal Development: Is *Satoumi* the Answer?

Yves Henocque

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Social capital constitutes the cultural component of modern societies. Building social capital has typically been seen as a task for 'second generation' economic reform, but unlike economic policies and institutions, social capital is not created or shaped by public policy but is inherited throughout local communities successive generations. Enhancing social capital therefore is about promoting local knowledge deeply rooted into local communities' practices on land and at sea. In Japan, the culturally specific interaction of humans with nature has led to the emergence of specific socio-ecosystems called '*sato-yama*' on the land side and '*sato-umi*' on the coast and sea side. Here, characteristics of related local knowledge include information about a variety of components of these ecosystems like wild edible plants or seaweeds, and learning by doing practices like traditional rice cultivation or sea ranching. This knowledge has developed over centuries and has been handed down from generation to generation. There are actually other types of *sato-yama* and *sato-umi* which have been flourishing around the world though the latter (*sato-umi*) probably has no equivalent in other countries' coastal areas because of the unique Japanese fishing rights system. First largely ignored as a social capital, *sato-umi* has emerged as a new concept only a few years ago. In the frame of the recently adopted national ocean policy, it remains to be seen how such a social capital may be associated with integrated coastal zone management processes and tools for the sake of sustainable coastal development in Japan.

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Rules and Regulations Supporting Satoumi as Social System

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In Satoumi, its bio-diversity is maintained or enhanced in spite that Satoumi is common property. In order to protect and maintain bio-diversity, the system to control and manage co-use of common property is needed. In Japan, the social system supporting Satoumi consists of Japanese traditional fishing right institution, self imposed rules formed through negotiation between users and spontaneous activities to protect the sea environment by NPOs. Details of actual systems are diverse depending on each situation and have improved along with the times.

Out of the Japanese fishing right institution, common fishing right deeply connects with Satoumi. Common fishing right is a privilege to fish exclusively within a designated area as fishing right ground. A fisherman's cooperative association (FCA) authorized by local government have rights and duties claims to control and manage there and set up rules and regulations autonomously to do so. According to them, member fishers use fishing right ground commonly. Therefore, the Japanese common fishing right institution is a proto-type of Satoumi.

While diverse use other than professional fishing had increased in the 1980th, it had become harder and harder for the common fishing right institution to control and manage them. To resolve the conflict between conventional uses and new recreational uses, voluntary self regulations were formed through negotiation among these users. The self-regulation includes rules and regulations to which are consented by relevant users improved based on common fishing right. These are called local rules of coastal zone and supported through some judicial precedents.

On the other hand, in the 2000th, some fishers and non-fishers have started voluntary initiatives as NPOs to protect the sea environment. They are interested in the sea environment itself more than fisheries resources. While FCAs and fishers have protected the value of fishing ground and fisheries resource, NPOs seem to create the value of the environment itself.

At present, more controversial issue is how to manage wider sea area like Seto-inland Sea as Satoumi. In wider Satoumi, responsibility and functions of government becomes more important differently from smaller Satoumi, where users' responsibility is heavy. In that case, an intermediary organization integrating wider Satoumi and smaller Satoumi will become more important.

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Creation of a Sandy Shore for the Endangered Tiger Beetle *Cicindela lewisi*

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A very rare attempt to mitigate the loss of habitats for an insect in a coastal ecosystem has been made. We will introduce the progress of this attempt and discuss some attendant issues.

In 2002, a project to construct a new freeway along the Okinosu shore, located in Tokushima Prefecture in southwestern Japan started. However, the process of this construction involved land reclamation along the shore line where the endangered tiger beetle *Cicindela lewisi* inhabited. In compensation for the loss of their original habitats, the creation of a new artificial shore in the adjacent area was planned. Observational surveys in the original habitats demonstrated that adults of the tiger beetle usually utilize the vegetated area in the upper part of the shore and the larvae make nesting holes in the bare sand area of relatively lower zone. For closely mimicking these conditions of their original habitats, the direct transplantation of coastal vegetation and surface soil from the natural coast was conducted. After these fundamental arrangements for existence of the tiger beetle in the new shore were finished in 2007, a corridor was made between the newly created and the original habitats for facilitating natural movements of tiger beetle. In the summer of the same year (2007), adult tiger beetles had been already observed in the created shore. In the next spring, the larvae and their nesting holes were also observed. Moreover, the numbers of the both adults and larvae have still increased until now suggesting that this mitigation is a success at this stage.

The government of Tokushima Prefecture has been directly managed this created shore since 2007 for 5 years through monitoring surveys on the distribution of tiger beetles and the conditions of other environments. During the past 4 years, some improvements of environmental conditions have been made according to the advices by some experts. This framework for the management will be finished in the next spring of 2012. However, the necessity of the continuous environmental monitoring of longer duration is suggested for a reasonable assessment of the stability of the created ecosystem and an appropriate adaptive management.

On the other hand, the other main purpose of the shore creation is the provision of amenity space. The human use is often considered to be incompatible with the environmental conservation. We conducted the workshop for considering the rules of shore use and its management systems in 2009 including locals. We agreed on making the rules that restricts human activities to harmless level for tiger beetle activities. However, no consideration to the management systems was done. To make a breakthrough in these situations, we formed a group named "Oki-Raku-Kai" meaning "Enjoining the Okinosu shore" for making opportunities to consider and discuss the balance between conservation and satisfying use of the created shore through marine nature activities at April 2010.

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Assessment of Mercury Contamination and Bioaccumulation in Sarasota Bay

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Mercury (Hg) is a highly toxic metal that is present in almost all aquatic environments as a result of atmospheric transport and deposition. The metal is readily bioconcentrated and biomagnified, hence elevated Hg concentrations are often observed in fish raising a significant health concern for piscivorous animals, such as small cetaceans. To better understand Hg distribution in environments and Hg bioaccumulation in biota, a field experiment was conducted in the Sarasota Bay, FL. Diffusive gradient in thin film probes were deployed to determine methylmercury (CH_3Hg^+) and inorganic mercury (Hg^{2+}) concentrations in the overlying water and in sediment porewater. Environmental samples, including water, sediment, clams (*Pinna nobilis*, *Mercenaria mercenaria*, *Venus affinis*), plankton, and seagrass (*Thalassia testudinum*), were collected from several locations in the area and analyzed for total Hg and/or CH_3Hg^+ . Total Hg levels in fish and Sarasota Bay resident bottlenose dolphins were obtained from previously published work. The Hg concentrations in water and sediment were consistent with reported background levels of Hg in uncontaminated coastal areas (less than 1.0 ng/L in water and 1.0 ng/g in wet sediment). However, Hg was bioconcentrated in the lower trophic level biota, such as plankton and seagrass and biomagnified through trophic transfer. The relative order of Hg concentrations in the samples was: overlying water < sediment porewater < sediment \approx seagrass blade and roots < zooplankton < benthic organisms (clams, snails) < fish (Pin fish, Stripped mullet) < blood and skin of resident Bottlenose dolphins. The differences of Hg levels in the samples varied from a couple of factors to several orders of magnitude. The results strongly confirm that biomagnification of Hg is occurring in the food web of Sarasota Bay. Furthermore, the present study suggests that top predators in aquatic ecosystems may encounter potential health risks associated with dietary Hg exposure even in a relatively uncontaminated coastal area.

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Shifts of the Land-based Human Activities in Circum Bohai Sea Coastal Region in the Early 21st Century—From the Perspective of Land Use Change

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Land-based human activities play critical roles in environmental and ecological changes in enclosed coastal seas, especially coastal regions where there're high population density and extensive human activities. Bohai Sea is one of the most typical enclosed marginal seas in East Asia where there're the most rapid urbanization and industrialization process and social-economic growth in the past decades on the world. At the same time, the phenomenon of environmental and ecological deterioration is very serious in Circum Bohai Sea Coastal Region (CBSCR). Therefore, it will be meaningful works and indispensable measures to study and adjust our land based activities in order to ameliorate the environment deteriorations and improve the ecology in CBSCR.

In this paper, from the perspective of land use changes, we studied the dimensions and extensions of land-based human activities as well as its spatial-temporal dynamics in CBSCR in the early 21st century. Land use data interpreted based on Landsat images in 2000 and 2005 are available. And it was reclassified into nine kinds of land use which include paddy field, dry farmland, forest, grassland, water area, urban area, rural resident, traffic and mine, and unused land. Spatial extent covers Beijing, Tianjin, Liaoning, Hebei and Shandong was chosen as the study area. Spatial-temporal patterns of land use change were studied by statistical method and GIS spatial analysis techniques.

It turned out that, dry farmland, forest, grassland and rural resident has being the top four land use type in CBSCR, however there're distinct regional divergences among the five provincial administrative districts. As for the dynamic changes of land use in the early 21st century, overall, amounts of urban area, traffic and mine, rural resident and water area have increased greatly while the other five kinds have decreased sharply. However, at the provincial level, the spatial-temporal patterns and dynamic characters were very different from each other's. In detail, fast urbanization, increase of traffic and mine, and decrease of paddy field were the common characteristics in all the five provincial districts. However, changes of dry farmland, forest, grassland and so on had much complicated spatial characters.

Basically, the land-based human activities in CBSCR had evolved toward the direction being adverse to the environmental management of the enclosed coastal sea in the early 21st century. Especially the extensive process of urbanization accompanied by sharp decrease of forest, grassland and cultivated land would greatly exacerbate the environmental and ecological deterioration trend in CBSCR.

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Trends in Chlorophyll-a Concentration and Its Relationship to an Area-weighted Water Quality Index at the Bohai Sea, China

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The Bohai Sea is one of the key mid-latitude enclosed coastal seas located at the western Pacific Ocean. Its surrounding area has experienced strong disturbance from human activities with the rapid economic development of China in past decades, e.g., urbanization, industry, agriculture and aquaculture. Large amounts of nitrogen and phosphorus as well as other pollutants have been discharged into the sea, and the aquatic ecological system has been facing a serious problem of degradation. To study the ecological change in the Bohai Sea with the background of human disturbance, Chlorophyll-a concentration (Chl-a) derived from satellite remote sensing was used to investigate the variations of sea surface chlorophyll during 2001-2007. On the basis of water quality levels and its corresponding areas in the releases of Chinese government annual report on environment status, an Area-Weighted Water Quality Index (AWWQI) was proposed to evaluate the change of water quality status of the whole Bo Sea. As nitrogen and phosphorus are the main pollutants in China coastal waters and the main factors that control the growth of phytoplankton, an Area-Weighted Nutrient (nitrogen and phosphorus) Composite Pollution Index (AWNCPI) was also established for quantitative analysis. For comparison, two enclosed seas of Baltic Sea and Hudson Bay at the high-latitude zone, and another two mid-latitude China coastal seas, the Yellow Sea and the East China Sea, were also investigated. Results show that Chl-a at the Bohai Sea increased during 2001-2007, and it was opposite to the decreasing trend which was driven by climate event- El Nino/Southern Oscillation (ENSO) at the low-latitude zone of global open oceans. The Yellow Sea, the Baltic Sea and the Hudson Bay had a similar increasing trend in Chlorophyll concentration; on the contrary, Chl-a at the East China Sea decreased during the same period. However, the trends in Chl-a of all the three China coastal seas were in good agreement with the indices of AWWQI and AWNCPI, i.e., AWWQI and AWNCPI increased at the Bohai Sea and the Yellow Sea, and decreased at the East China Sea. The results suggest that land-source nutrient pollutants caused the increasing trend of Chl-a at the Bohai Sea, and thus management on land-source pollutants discharge is still the essential task in the controlling and improving the aquatic ecological status at the Bohai Sea.

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Impacts of Human Fishing Pressure and Waterfowl Predation on the Standing Stock of Bivalves at an Estuarine Tidal Flat in the Seto Inland Sea, Japan

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Human fishing pressure and waterfowl predation on bivalves are expected to occur a considerable influence on the substance cycle in the tidal flat ecosystem. In the present study, how the gathering shellfish “Shiwohigari” at the early summer and the predation of wintering pintail community affect on the biomass of bivalves was investigated in an estuarine tidal flat of the Inland Sea, Japan.

In the estuary (ca. 25 ha), 4,092 people visited for the gathering shellfish from April to June. They caught 520 - 12,340 g of short-neck clam (*Ruditapes philippinarum*) respectively, so that the amount of catch per person was estimated 3,990 g on the average (n=70). It could be estimated from the research that 16.3 tons of the clams were taken out from the tidal flat by the human activity. When the shell length of the collected clam is assumed to be 25 mm (2.95 g/individual), it was estimated that 5.53 millions of clams were thinned out from the habitat. These results show the human fishing pressure is considerably large.

Wintering pintails were begun to observe in late September, the number maintained ca. 300 from December to February, and then leaved in April. As only the shells of Asian mussel (*Musculista senhousia*) were found in the feces through the survey, the pintail was assumed to prey only on the mussels. The daily ingestion rate of a pintail was estimated at 1,040 g of the mussels from the digestive efficiency (72.7%), the energy content of the mussel (0.741 kcal/g) and bird energy requirements of the pintail (170 kcal/d). Total amount of the mussels preyed by the pintail community during wintering was calculated to 40.7 tons. Since the biomass of the mussel was ca. 100 tons/study area in autumn, it was estimated that the pintail community preyed on the 40% of the standing stock of mussels.

These results show that the standing stock of bivalves inhabiting in the tidal flat were greatly influenced by human activity and bird predation.

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Optimization of Nutrient Cycling and Balance of Osaka Bay for Coastal Environmental Restoration

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Osaka Bay Area metropolitan region exists, the water quality by regulating the amount of inflow loads are being improved. However, it enhanced the closed landfill area has not been resolved inflow load retention. As a result, enhanced the enclosed water has become a chronic over-nutrition.

By the way, Awaji Island of offshore in Osaka Bay and Harimanada has withered laver. In addition, the fishery has been shown that the depletion of marine resources due to lack of nutrients. Considered the problem of bias in the balance of nutrient cycling in the Bay Area region in addition to the quantitative issues as the cause of this nutrient. In particular, coastal areas have been complemented of the inflow load by the establishment of reclaimed and port structures. Nutrients do not diffusion due to this offshore, there have been differences in nutrient concentrations in coastal and offshore.

In this study, which aims to restore a proper balance of nutrient cycling in the area of Osaka Bay. In the first study, the actual condition and problems of bias and nutrients to build organized in GIS databases. Then, we designed the optimal method for sewage effluent for the purpose of optimizing the balance between nutrient cycling. We also propose a method to dilute the excess nutrients by the tidal current control of the port area. Finally, we evaluated the effect of forecast measures for the application of numerical analysis. From these findings, in Osaka Bay restore Project have shown that the plan will balance the need for nutrient cycling.

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Development of Water Quality Improvement Channel with Citizen in Amagasaki Canal, Japan

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Amagasaki Canal has been polluted because it is a sheltered water with artificial vertical structures and is affected by waste water from factories. According to restore water environment in the canal for recreation demand, design of new improvement channel and experiment for new water quality improvement system are preceded by the Amagasaki Sea Blue Project. In this study, long-term field experiment of water quality improvement techniques using bivalve and algae was examined.

We suggest new improvement system of water quality. This system is made up of Suspended Solids removing tank, Algae channel and Algae harvesting for composting by civic collaboration. Suspended Solids removing tank have a function with reduction of organic suspended solids in pumping-up sea surface water and change organic suspended solids to dissolved nutrient using bivalve biology. Algae channel have a function with assimilation of dissolved nutrient in treat water come from Suspended Solids removing tank or pumping-up sea bottom water of the canal using primary productivity of green algae and blue-green algae which grow naturally in the channel. Algae harvesting for composting is for removal of nutrients out of the system by turning removed waste sea algae into compost by citizen participation.

According to the experiment of Algae channel, DIN and PO4-P reduction function was measured by distribution of DIN and PO4-P. These max values are roughly equivalent to about 96 % of amount of DIN and PO4-P inflow to the channel and reduction function of advanced sewage treatment. These high performances only expressed in daytime. The quality of bottom water improved hypoxic condition by primary productivity of algae at daytime. Removing decomposed sea algae of 13 wetkg by local junior high-school student was conducted in August, 2010. According to the componential analysis picked algae include 414gC, 65gN and 9gP. These value are roughly equivalent to 28 % of amount of DIN and PO4-P inflow to the channel. Moreover, we conducted environmental education to elementary school student and junior high-school student. At last, we tried to design for improvement channel based on the findings of the study. Consequently, we found only twenty-nine 60m-channels are required for total industrial effluent water to meet environmental standards for PO4-P.

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Water Quality Monitoring and Its Relationship to Riparian Buffer Zones

Edwin B. James

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Purpose: A comprehensive volunteer water monitoring effort can expand the knowledge base of the scientific community by filling important gaps in data collection and potentially identify the value and effect of riparian buffer zones on water quality. These citizen science efforts can be used to inform future protective actions on waterways, and encourage broad community engagement in conservation efforts.

The scope of the Nanticoke Watershed Alliance's water monitoring efforts includes four years of data collection throughout the Nanticoke River watershed, including 38 river sites and six agriculture sites. The monitoring procedures have received EPA approval and over 60 volunteers have been trained and collect samples according to this rigorous protocol. Our program augments the state water monitoring effort, which includes only two sites on the river.

Methods: Citizen volunteers monitor water clarity, dissolved oxygen, salinity, bacteria, and nutrients bi-weekly using meters, secchi disks, and laboratory samples. In addition, constant public outreach occurs through the use of "river report cards," a farmer filter strip incentive program, and public-focused programs based on river access and awareness.

Results: At present the Nanticoke River is the healthiest major river in the Chesapeake Bay watershed. Throughout the lifespan of the Creekwatcher program on the Nanticoke we have seen increased interest and awareness in the health of the river.

Conclusions: Water monitoring efforts are intended to ascertain progress, or the lack thereof, and to encourage conservation activity at the individual, organization, and government level. Riparian buffers are wide and abundant throughout most of the Nanticoke system. Water Quality Monitoring activity points to their effectiveness as natural filters and encourages their continued conservation in the future.

Recommendations: A vibrant water monitoring effort, if rigorously applied, will increase conservation efforts, highlight the importance of riparian buffers on water quality, and focus resources on conservation resulting in healthier water and the land protection afforded by functioning and robust buffers.

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Eutrophication and Partial Recovery of a Shallow Embayment of the Tidal Potomac River

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Enhanced nutrient loading has resulted in widespread eutrophication of inland and coastal waterbodies. Shallow water macrophyte communities in many locations have been displaced by phytoplankton dominated systems. The tidal freshwater portion of the Potomac River received extensive loads of wastewater nutrients through much of the 20th century culminating in major blooms of cyanobacteria and almost total loss of submersed aquatic vegetation (SAV). Beginning in the late 1970's, loads of the limiting nutrient phosphorus underwent dramatic reductions which decreased loadings by more than 98% by the early 1980's. Long-term trends in water quality, phytoplankton, and SAV in Gunston Cove, a shallow embayment of the tidal freshwater Potomac River receiving treated wastewater, have been monitored on a consistent semimonthly basis since 1983. Additional monitoring data is available for periods back to the mid 1960's allowing construction of a data record spanning the time from intense loading and eutrophication through the nutrient load reductions of the late 1970's and early 1980's and continuing to the present.

Response to nutrient loading was not immediate, partially because even at reduced levels nutrients were not really limiting. But following a substantial lag period, nutrient concentrations and phytoplankton populations began a steady decline and water clarity has demonstrated marked improvement. After remaining constant at about 40 cm for nearly two decades, average summer Secchi depth has increased to over 70 cm. In September 2009 Secchi depth exceeded 100 cm for the first time in the study. In the same period, average summer chlorophyll a declined from 100 ug/L to about 40 ug/L. In recent years SAV has spread over larger portions of the embayment consistent with model predictions of macrophyte recovery. The state of the Cove could now be characterized as partially recovered, with SAV returning to shallower inner areas of the cove, but not able to successfully colonize the somewhat deeper mid to outer cove. Results demonstrate the role of time lags in ecosystem response and the importance of long-term monitoring in understanding ecosystem recovery.

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Temporal Variation in Water Quality at a Fixed Monitor on the Tidal Potomac River

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Recent advances in water quality monitoring have facilitated “continuous monitoring”—the acquisition of basic water quality variables at short intervals over extended periods. We focus our analysis on a monitor on the tidal Occoquan River at the Belmont Bay development in Woodbridge, Virginia. The tidal Occoquan is a tributary of the tidal Potomac River, a subestuary of the Chesapeake Bay. The study site is located 120 km upriver from the Potomac’s confluence with the Chesapeake Bay and 37 km below the head of tide of the Potomac, well within the tidal freshwater zone. At the study site tides are semidiel with an amplitude of about 0.6 m. River inflow from the flowing Occoquan is episodic regulated by a dam just above the head of tide.

Temperature, conductivity, dissolved oxygen, and pH were collected at 15 minute intervals during the 2010 growing season using a YSI 6600 extended deployment sonde connected via cell phone to a YSI maintained web site. Sondes were exchanged at monthly intervals with freshly calibrated sensors and ingoing and outcoming sondes were crosscalibrated at each exchange. Additional water quality variables such as Secchi depth, light extinction coefficient, chlorophyll a, and total suspended solids were measured from grab samples at the monthly sonde exchanges. Correlative data on tides, river inflow, air temperature, photosynthetically active radiation were also available.

Results of time series analysis indicate that, on a short term basis, specific conductance exhibited a semidiel pattern. This was shown to be related to tide stage with highest values observed at high tide and minima at low tide. On the other hand, dissolved oxygen, pH, and temperature exhibited a strong diel pattern which was clearly related to the daily light and temperature cycle. At some times, a weak semidiel pattern was also observed in DO and pH. This semidiel component in DO and pH may have been related to enhanced flushing of water from SAV beds which lined the channel just upstream of the monitor. Chlorophyll values were relatively low at the study site raising the possibility that daily DO and pH cycling may be dominated by photosynthetic activity in the adjacent SAV beds rather than phytoplankton in the open water.

Over longer time scales, average daily dissolved oxygen and pH exhibited a general increase in early summer reaching a maximum in early July and declining through the remainder of the summer. Specific conductance remained very low in the spring and early summer, but gradually started to increase in late July with a more rapid increase during the month of September. Freshwater inflows to the tidal area were minimal during June through the end of September allowing brackish water from downriver to start penetrating the tidal Occoquan. A major freshwater input event at the end of September carrying over into early October flushed the brackish water from the area restoring low specific conductance conditions. In the wake of the flow event there was also a marked increase in both pH and dissolved oxygen which needs further study.

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Leveraging and Tracking Private and Public Sector Funding to Protect and Restore Enclosed Inland Seas

Tim Jones

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There's an old adage that applies to successful watershed protection: "put your money where your mouth is!" The success of any watershed management program ultimately depends on community involvement, but it also depends on secure finances. This presentation will discuss how to engage community members and organizations in a way that is directly linked to environmental improvement: financial and in-kind contributions. In increasingly difficult economic times, the audience will learn about the interdependence of community involvement, fundraising and environmental protection, and how these efforts have resulted in the protection and restoration of over 1 million acres of habitat, and reduction in pollution in enclosed seas of the U.S.

Several examples will be presented, such as "friend raisers" that recruit future financial contributors through volunteer opportunities, to illustrate how the US EPA's National Estuary Programs have leveraged approximately \$160 million in base funds to obtain \$2.3 billion from private, local, state, and federal partnerships.

The audience will be invited to share their fundraising stories and to discuss the challenges and rewards of working with communities to raise the critically needed funds for environmental protection. The discussion will also include the idea of using fund-raising results as an indicator of effective community involvement.

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Regulating Air Pollution to Improve Water Quality: An Overview of IMO's Emission Control Area Program

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Air emissions from marine vessels are significant contributors to pollution in many coastal regions around the world. Marine vessel exhaust emissions are potentially hazardous to human health and the environment, and can lead to nutrient overload in aquatic ecosystems. These emissions are especially problematic in ports and enclosed waterways, where marine vessels as well as associated onshore equipment operate nearly continuously in close proximity to each other.

One of the biggest challenges facing policymakers responsible for regulating air pollution from large marine vessels is balancing valuable maritime shipping interests with environmental concerns. Achieving consistent regulation of shipping is difficult because of the global movement of people and goods through many sovereign jurisdictions. One of the ways through which the International Maritime Organization (IMO) addresses this challenge is to provide for the establishment of Emission Control Areas (ECAs) which reduce air emissions from marine vessels.

This paper will present an overview of the IMO's ECA program. The history of this program will be given, from the first ECAs more than ten years ago to the recently-approved United States/Canada ECA. In addition, the specific demonstrations required to obtain an ECA designation from the IMO will be outlined. Ultimately this paper will illustrate how a coastal sea region can improve the health of its marine environment by obtaining an ECA designation from the IMO.

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Natural Reflections: Re-Finding Our Place in Nature through Word and Song

Geoff Kaufman, with guest student performers
Professional Folksinger, New London, CT, USA

This live performance is intended to lead the audience and the participants to reconnect with the natural world from which our modern culture tends powerfully to separate us. I agree with many environmental educators that there is far too much in our contemporary culture that makes us pay attention to such things as portable communication devices without really seeing nature's own message all around us. Many of us, especially young people, spend much of their time inside their homes and classrooms "learning" from computers, DVD's, and TV's without really experiencing lessons that the world outside has to offer.

My program will combine texts from a variety of nature writers such as Henry David Thoreau, Henry Beston, Annie Dillard and Farley Mowat with songs from a variety of sources in folk and tradition which compliment or expand upon the writings. Participants in the EMECS 9 Students and Schools Partnership will be invited to join me on stage. Having students read, and possibly sing, as an integral part of such a performance cannot help but engage them to consider the issues raised in both texts and songs. My experience is that student participation has a way of connecting both the performers and members of the audience with their own personal perspectives in addressing environmental concerns. These concerns transcend immediate environmental issues; they include our relationship to the natural world, our impact upon it through our brief human history on the planet, and our need to become active participants in an effort to support a sustainable environment for all people and the communities in which they live.

It is my sincere hope that this performance will encourage all involved to look upward and outward, but also inward to realize and critique our human role on earth, including its coastal seas.

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A Comparative Study of Distribution Pattern of Two Endangered Benthic Animals on Artificial and Natural Tidal Flats

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The Ohgata tidal flat located on the east of Shikoku Island in southwestern Japan, was accidentally created by dredged materials from the nearby shallow bottom and by mountain soils in the course of the land reclamation for the Ohgata fishing port enlarging project. The particle size distribution was quite different between these two sediment types: dredged materials consisted of >90% of the silt and clay content, mountain soils consisted of >70% coarse grains (from 75mm to 75 μ m in diameter). At present, after about 15 years from the last reclamation, many animals including 15 endangered species are found in the artificial tidal flat. In particular, two endangered species, the fiddler crab *Uca arcuata* and the mud snail *Cerithidea rhizophorarum* are abundant from the mid to upper intertidal zone.

A series of studies aimed to examine distribution pattern of the two endangered species with special reference to their habitat preference in an artificial tidal flat and some nearby natural tidal flats. We investigated their density at 6 study sites (2 sites each in an artificial tidal flat and two natural tidal flats) and conducted a sediment manipulation experiment in an artificial tidal flat. Analysis of the difference in habitat preference between artificial and natural tidal flats and understanding of variation in habitat preference between these two species with different life history characteristics could contribute to the successful creation of tidal flats with higher biodiversity including some endangered species and/or rich ecological functions.

Contrasting distribution patterns of *U. arcuata* and *C. rhizophorarum* were demonstrated in our observations and experiments for four years. *U. arcuata* strongly preferred fine muddy habitats in the sediment manipulation experiment. On the other hand, *C. rhizophorarum* preferred coarse mountain soils, although its preference seems not to be strong as the crab. These species specific preferences may be caused by some ecological properties such as burrow requirement in crab, feeding efficiency or constrains in relation to particle size of sediments. In our field experiment, *U. arcuata* quickly colonized new habitats of dredged fine sediments and its density reached the ceiling after only 5 months from the start of the experiment. The density, however, has not achieved the same level to the natural situation yet. In contrast, *C. rhizophorarum* continually increased in the experimental mountain coarse soils habitat and became similar with natural situations during three years. These species specific patterns of response to a newly created habitat suggested that we should carefully pay attention not only to the density of a single target species but also to their life history characteristics, age structure and habitat preference of multiple species, when we judge ecological conditions of artificial tidal flats.

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Development of the Great Barrier Reef Annual Report Card

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The Queensland Government and the University of Maryland Center for Environmental Science are developing an annual report card that creates and tracks metrics relating to the ecological health of the Great Barrier Reef system and agricultural land management drivers. The development of the report card began in 2010 with the preparation of a baseline report incorporating metrics for land management practice technique adoption, catchment land condition, pollutant loading, and reef water quality and biotic condition metrics.

Metrics are directly related to an ambitious policy directive from the Queensland Government that encourages agricultural land holders to adopt improved land management practices on their farms. Land practice adoption targets include 80% adoption of improved practices for nutrient, chemical and soils for most agricultural enterprises, and 50% adoption of improved pasture and riparian practices by grazing enterprises. The effect of these improvements will be tracked through continued monitoring of catchment land condition, pollutant loading through riverine inputs, and water quality and reef resource condition metrics. Program targets include a 50% reduction in nutrient and pesticide loading by 2013, and a 20% reduction in sediment loading by 2020.

Innovative reporting and visualization techniques are used to communicate results from the baseline report and will be incorporated into the annual report card. Although the Reef remains in moderate condition overall, initial results suggest that improvements to land management practice adoption should continue. The results highlight that there are significant areas of concern that justify the need for accelerated action to improve water quality and build resilience of the Great Barrier Reef. These include five to nine times the natural loads of pollutants; significant loss of some freshwater wetlands; decline of seagrasses in some areas and the exceedance of water quality guidelines for pesticides in marine areas.

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Coastal Regulation and Its Enforcement, Case Study: India

Santosh K Ghosh -- presented by: **Unmesh Kirtikar**
Centre for Built Environment, Kolkata, India

Purpose: Many countries in Asia have long coast line and the need for coastal regulation is being felt with concern for natural disasters, climate change with sea level rise, unsustainable pattern of development causing environmental deterioration. The prohibitory and regulatory activities can enhance accountability. Indian case study is presented which provide many lessons.

Scope: Coastal zone regulation with prohibitory and permitted uses guidelines have wide scope. The coastal areas are complex with biodiversity, mangrove forests, industrial, urban and recreational activities and such regulation may prevent soil erosion, deforestation and environmental degradation. Coastal regulation can have wider scope in preparing landuse plan, vulnerability index etc.

Methods: The Ministry of Environment and Forests, Govt. of India in 2010 has amended the 1991 regulation (on the basis of Environmental Protection Act, 1986), mentioning uses, which are permitted and not permitted. It identifies land area between high tide line (HTL) in landside to 500 m between low tide line (LTL). This is coastal regulation zone (CRZ) and a concept of hazard line has been demarcated categories 1. Areas ecologically sensitive 2. Areas already developed near shoreline 3. Undisturbed area including rural area. Islands have special category. Regulation is given to State Governments to enforce. Accurate mapping is required, as demarcation is difficult. In case of creeks, if the width of creek is upto 350m, the CRZ will be 100 m from the creek, if wider than this it will be 150 m from the creek.

Results: Since 1991 there were amendments 25 times and various State Govts have expressed difficulties as India has 8200 km long coast line. Now the Govt. of India has appointed a special committee to look into.

Conclusion: Within the framework of overall coastal regulations details will give variations as the long coastline has diverse landscape. Current regulations donot include aquatic resources. The fishing community has objections. There are 3200 fishing villages. Land, water and natural resources symbiosis is needed requiring an environmental sustainability plan. Land use regulations and building rules are to be drafted for different coastal zones.

Recommendation: Preparation of an integrated planning with hazard mapping, identification of environmental area including aquatic part, protection of biodiversity mangrove, livelihood options for local people etc. is needed.

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Sustainability of Coastal Areas in Climate Change: Bengal Delta

Santosh K Ghosh -- presented by: **Unmesh Kirtikar**

Centre for Built Environment, Kolkata, India

Purpose: The changing coastal areas of Asia in the context of rapid population and economic growth and climate change has created problems. There are many megacities located in and around the coastal area. The unsustainable pattern has damaged the ecosystem with construction, pollution, erosion, sedimentation, changing of biodiversity and natural disaster. Isolated action has limited success and a holistic regional planning is required. A case study of Bengal delta of Bay of Bengal with complex biodiversity area includes world heritage sites and has many lessons.

Scope: Bengal delta, both in eastern India and Bangladesh is largest in the world. It includes Sunderban facing the bay of Bengal. It is rich in terrestrial, aquatic and avian faunal species and it has wildlife sanctuaries. The Unesco has declared it as one of the biospheres and a work heritage site. But there is unsustainable pattern of development, climate change and natural disaster have made the problems complex. A study will benefit many other coastal areas.

Methods: The Unesco's programme outlines three functions (a) conservation function preserving flora, fauna, landscape etc. (b) development function for sustainable development of social, cultural, economic and ecological aspects (c) support to logistic function – education, training and capacity building. There are large number of people. The planning and development is a holistic process achieving an equilibrium balance with the density of population and the carrying capacity of the ecosystem.

Results: Some specific programmes have been taken like restoration of mangrove forests which protect from storm and cyclone and flooding and help in aquatic production. Introduction of coastal zone regulation amended in 2010 of Govt. of India. Eco restoration including afforestation programmes wetland conservation and project tiger and biosphere, climate change protection etc.

Conclusion: The Bengal delta specially the Sunderbans is an ecosystem and its planning will be different for integrated coastal zone management. Ecosystem, spatial, development and social parameters are to be integrated with several impacts like vulnerability, natural disasters, climate change sea level rise etc.

Recommendation: A regional coastal environmental plan based on analysis of interrelation amongst physical, spatial development and environmental ecological process and human activities and social economic objectives is necessary.

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Estimation of Wet and Dry Deposition of Gaseous and Particulate Ammonia and Nitric Acid Using Buoy in Mikawa Bay, Japan and Evaluation of Its Effect on Eutrophication by Fluid Dynamic-Ecological Model

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Wet and dry deposition of ammonia-N and nitrate-N were directly observed on a buoy in Mikawa Bay, Central Japan, connecting to the Pacific Ocean and were compared with those at nearby coastal monitoring site. No significant difference of wet deposition between the buoy and the coastal site was found. However, dry deposition on the buoy was by about 30% smaller in molar base than that on the land site. Ratio of concentration of gaseous species such as NH_3 and HNO_3 to that of particulates of NH_4^+ and NO_3^- was 3.7 at the coastal site and 1.7 on the buoy also in molar base, indicating importance of gaseous species in dry deposition. Based on the 6 months observation from April to September, 2009, N-loading by wet and dry depositions were estimated as about 6% and 6~12% of the loading through river, respectively.

Hydrodynamic-ecological model (CE-QUAL-W2) simulations in Mikawa Bay for the 6 months showed the wet and dry deposition can increase Chl-a (chlorophyll-a) by about 2 mg m^{-3} which is 10% of the maximum Chl-a concentration during the simulation period. By the simulations, importance of strength of the N-loading rate was demonstrated. In that sense, it was estimated that steady but not strong loading rate of dry deposition may not lead to rapid algae blooming but may serve as a part of basic nutrient N-supply to the estuary.

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Environmental Educational Effects in the Use of New Composite Index of Water Environment

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Through the growing public interest in water environment in recent years, people have strong recognition that the evaluation of water environment using only water quality index such as BOD and COD is insufficient. Following this public opinion, Japan Society on Water Environment to which the author belongs has developed a new composite index for citizens to evaluate water environment easily, with the support from Ministry of the Environment.

The new composite index has been developed for the evaluation of water environment, especially river environment. The index consists of five evaluation factors and five individual indicators in each factor (25 indicators). The five factors are (1) natural state, (2) biological diversity, (3) water usage, (4) amenity to people and (5) regional culture on water. They are decided not only from natural scientific point of view ((1) and (2)), but also from social perspective ((3), (4) and (5)). Individual indicators include unique ones concerning sensory evaluation such as visual and tactile amenity in (4). Each evaluation criteria is described in the scores of 5 to 1. The scores of the individual indicators are averaged to obtain the evaluation score of the factor. The evaluation scores for five factors are indicated by using a pentagon chart in order to show the characteristics of the surveyed site.

The environmental educational effects were investigated in the evaluation survey of urban river environment using the new composite index by citizens. Before survey, the participants showed little concern to unprecedented indicators such as industrial use and cultural resources in (5) and incomprehensible indicators such as benthos in (2) and COD in (3). However, after survey, participant's interest in those indicators increased. Moreover, 85% of the participants represented their growing interest in the indicators to which they showed little concern.

From these results, it is suggested that the practical use of the new composite index provides a certain level of environmental educational effects to users. On the other hand, it was found that the indicators concerning sensory evaluation are unique but have some problems to be considered in the point of index stability because of wide variation in the evaluation.

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Relationships between Environmental Factors and Fishery Production in Japanese Enclosed Coastal Seas

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In order to find out key environmental factors of fishery production, historical aspects and relationships between water quality and fishery productions were investigated in major Japanese enclosed coastal seas. Water temperature, salinity, transparency, concentrations of nutrients, chlorophyll-a and dissolved oxygen (DO) were used as environmental parameter and number of catches, CPUE (Catch Per Unit Effort) and juvenile survival rate of fishes were used as fishery production index. Catches of demersal fishes, such as conger eel, flatfishes, benthic prawns and crabs showed clear positive correlation with DIN (dissolved inorganic nitrogen) concentration and negative correlation with transparency. These results suggest implications of nutrient load reduction and oligotrophication (decline of ecosystem production). Although bottom hypoxia is considered as one of the controlling factors of demersal fish production, there were no correlations with bottom DO concentration. However, concentration of bottom DIP (dissolved inorganic phosphorus) showed clear negative correlation with those fishes. As DIP is released from bottom sediment during occurrence of hypoxia, this correlation seems to indicate influence of hypoxia in summer.

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Evaluation of Tidal Flat Restoration Effect in the Coastal Unused Reclaimed Area by Promoting Tidal Exchange with Public Involvement in Ago Bay, Mie Prefecture, Japan

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Ago Bay is located in Ise-Shima National Park, Mie prefecture, Japan. This bay is famous for cradle of pearl culture and it has been continued for more than 100 years. However, recently in Ago Bay, nutrient loads increased due to domestic loads and pearl culture. At the same time, natural purification capacities also decreased due to the land reclamation. Accordingly, excess nutrient loads accumulated into the bay bottom, causing red tides and hypoxia to occur every year. It is considered that one of the major causes of these phenomena is a stagnation of the material circulation between sea and land by reclamation of coastal shallow area including tidal flats and sea glass beds. The reclaimed coastal areas were estimated by the multi-spectrum aerial picture analysis. In detail, for more than 50 years ago, approximately 70% of tidal flats and shallow areas were reclaimed for constructing rice fields around the Bay. But now these reclaimed areas were given up cultivation and changed to fallow fields and unused wetlands. Therefore, for the environmental restoration of Ago Bay, it is necessary to enhance the biological productivity and natural purification capacity which these areas provided, and to recover a smooth material circulation around the shallow area. In this study, attempts were made to enhance the biological productivity, by promoting tidal exchange between an unused reclaimed area and outer sea through the open of the floodgate on a dyke with public involvement.

1) Present State of Unused Reclaimed Area

More than 100 years ago, there were about 269 ha of tidal flats in Ago Bay occupying about 10% of the sea surface area. The total reclaimed areas are about 185ha, however most of these areas were given up cultivation and changed the hypertrophic unused wetland. Such areas are up to about 154ha. The sediments of unused wetlands are too muddy and contain high organic matters, because the dykes which were constructed for reclamation, lead to accumulation of the nutrient and organic matter run off from the land. In these wetlands, the abundance and diversity of benthos are quite poor.

2) Effects of Tidal Flat Restoration

Tidal flat restoration was carried out from Apr. 2010 by opening the floodgates on the concrete dike, which was constructed for reclamation. The restoration site is about 2ha and located in the inner part of the bay (Ishibuchi in Shima city). Clam stocking, seagrass planting, and environmental education were carried out with public involvement. Improvements were evaluated by monitoring sediment quality, benthic abundance and species diversity every season. Before the restoration, only 6 species of macro faunas (*Chironomidae*, *Hediste diadroma*), which lives in brackish water, were found. After the opening of the floodgate, the macro faunas was changed from brackish to saltwater and the number of species gradually increased. After 6 months, 22 kinds of juvenile fish (*Goby*, *Lateolabrax japonicus* and *Mugil cephalus*), migratory macro faunas (*Hemigrapsus penicillatus*, *Batillaria zonalis*) and small clams were found in the restoration tidal flat. At the same time, the COD and AVS in sediment decreased too. These results indicate that the sediment status in the restoration site were gradually changed to the aerobic condition by promoting the decomposition of the hypertrophic sediment through the tidal exchange. Further enhancement of the biological productivity will be expected through continuous tidal exchange near the future. This method would lead to wise use of the coastal environment and to enhance the biological productivity around the unused reclaimed areas.

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Long-term Changes of Nutrients in River Water Flowing into the Osaka Bay, Japan

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The amounts of loadings of nutrients that flow into the Seto Inland Sea have been calculated by using unit loads for point and nonpoint sources by the Ministry of Environment, Japan. As unit loads on pollutant sources are values gained by limited researches, there is large difference between unit and actual load. Therefore, the pollutant loadings calculated by using a unit load procedure will include a large error as a necessary consequence. In addition, any changes of chemical forms are not able to evaluate by this method. To confirm the changes of loadings and forms of nutrient based on actual measurement, we studied the concentrations and forms of nitrogen and phosphorus in river water flowing into the Osaka bay, Japan, where is the most polluted enclosed sea in the Seto Inland Sea.

The data of continuous monitoring plan conducted by Hyogo and Osaka Prefecture since 1970's were collected and arranged as a set of nitrogen and phosphorus. The thirty three rivers, which consist of the first and the second class rivers, were selected in descending order of discharge and annual average concentration of nutrients were calculated.

The concentrations of nitrogen and phosphorus in most rivers indicated a decreasing trend as a whole. Some non-polluted rivers have maintained lower concentrations of nutrients for a long term. The decreasing trend of nutrients in most rivers fitted together changes of loadings reported by the Ministry of Environment every five years. The average concentrations of nitrogen and phosphorus for five years between 2004 and 2009 reduced 30 to 50 % than those in the 1970's, and the concentration of phosphorus were cut down more than that of nitrogen. Ammonium nitrogen remarkably decreased. Meanwhile, the ratio of nitrate nitrogen increased and occupied the largest part of inorganic nitrogen. Nitrite nitrogen was not detected. The change of inorganic nitrogen reflected a development of sewage system in each river watershed, that is, the percentages of treatment on domestic effluent is more than 90 % in Osaka and Hyogo Prefecture. Precipitation in Osaka and Kobe city faced to the Osaka Bay does not any trend during the period between 1970 and 2009. This suggests that the loads of nutrients from rivers in the watershed of the Osaka Bay would decrease according to the change of concentration.

These results showed that the loadings of nitrogen and phosphorus from watershed surrounding the Osaka Bay have been successfully cut by a total amount control based on the extraordinary measures law for environment conservation of the Seto Inland Sea.

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Detailed Monitoring of Nutrient Supply through Tidal Front in Seto Inland Sea, Japan

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The tidal front, which is a transition zone between the stratified area and the area vertically mixed by tidal currents, probably supplies a moderately high concentration of nutrients from the vertically mixed area to the subsurface layer of the stratified area. Thus, knowledge of these dynamics is essential to manage the coastal environment because tidal fronts are important for primary production of the stratified area. In this study, we conducted a spatio-temporal field survey from April to November 2009 to quantify and assess the nutrient supply from the narrow strait (Hoyo Strait) to the stratified area (Iyo-Nada) in Seto Inland Sea, Japan. Concomitantly, we conducted a fixed-point observation to measure the short-term fluctuation of the nutrients in the Sada Peninsula (i.e., vertically mixed area) almost everyday in 2009.

The tidal front was observed between the vertical mixed area (Hoyo Strait) and the stratified area (Iyo Nada) during a six months period (from April to October), defined as the stratified period. An analysis using the TS diagram indicated an intrusion of the mixed water (Hoyo Strait) into the middle layer (10 ~ 30 m depth) of the stratified water (Iyo-Nada). Chlorophyll *a* (Chl-*a*) maximum was observed within the tidal front area on the middle layer. In the Hoyo Strait, vertical mean concentration of NO₃+NO₂-N increased from 2.2 μmol L⁻¹ on April to 4.3 μmol L⁻¹ in August. Subsequently, a clear correlation was observed between the vertical mean concentration of NO₃+NO₂-N in the Hoyo Strait and the mean standing stocks of Chl-*a* in the middle layer of Iyo-Nada during the stratified period ($r^2 = 0.836$, $n = 8$, $p < 0.01$). Thus, the nutrient supply from the Hoyo Strait seems to be an important nutrient sources for the primary production of Iyo-Nada. The results of the short-term fluctuation of the nutrients in Sada Peninsula will be reported in the presentation.

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An Economic Approach to Appraise the Restoration of Coastal Resources by Water Reuse

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The conference paper aims to demonstrate that water reuse and exchange of water entitlements between farmers and cities can play a vital role in the reduction of wastewater pollution of enclosed coastal seas. Such schemes can confer benefits to farmers and municipalities, while also creating benefits for the natural environment.

One of the main sources of pollution of enclosed coastal seas are the excessive loads of nutrients. Drastic examples can be found at the Baltic and the Mediterranean Seas with occasionally extreme algae levels causing losses for the fish industry, impairment of aquatic ecosystems and degradation of recreation values. Reclaimed wastewater use in agriculture is a promising way to solve nutrient-related problems as the effluents from treatment plants are recycled for irrigation purposes and the nutrients are used rather than being discharged to water bodies. The ecologically minimal flow of rivers can be restored and the overuse of groundwater can be ceased. Farmers enjoy better reliability of water, save costs in fertilizing and in water pumping, and get additional incomes. Cities can benefit if freshwater resources from aquifers, rivers or reservoirs are made available for potable uses by farmers' willingness to use reclaimed water. Expenses in developing remote resources can be reduced.

This is a part of a recently published UN Food and Agriculture Organization (FAO) study, which showed that both the farmers and cities can win by exchanging treated wastewater with freshwater: freshwater resources are reallocated to uses with considerably higher values and the farmers involved can share in the economic gains of the cities. Case studies at the Tordera River Delta and the Costa Brava in the North of Spain show that the wastewater outflows and the loads of nutrients in the Mediterranean Sea can be lowered by water reuse: www.fao.org/docrep/012/i1629e/i1629e00.htm. These cases have the potential of triple outcomes, including various environmental benefits. The terms on which the effluents are made available to farmers, and the degree to which they are subsidised, should take account of this broader balance of social costs and benefits. The study provides a methodological framework to appraise water reuse projects that can contribute, among others, to the restoration of coastal resources in a cost-effective way.

* This work is not a product of the United States Government or the United States Environmental Protection Agency, and the authors are not doing this work in any governmental capacity. The views expressed are those of the authors and do not necessarily represent those of the United States or the US EPA.

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International Conference and Summer School-Seminar “Dynamics of The Coastal Zone of Non-Tidal Seas”

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Once in two years International Conferences and Summer school-seminars “Dynamics of the Coastal Zone of Non-tidal Seas” were held in Baltiysk, Kaliningrad region, Russia. Conferences take place at the Scientific Station “Baltic Spit” of the Atlantic Branch of Shirshov’s Institute of Oceanology of Russian Academy of Sciences, Baltiysk, Kaliningrad Oblast (Province), Russian Federation. The station is located on the Vistula Spit just near the inlet of the Vistula Lagoon at the walking distance (5-7 minutes) from the lagoon and see shores.

Conferences were organized by support of Russian Foundation for Basic Researches (RFBR), P.P.Shirshov Institute of Oceanology of Russian Academy of Sciences (IORAS), Atlantic Branch of P.P.Shirshov Institute of Oceanology of Russian Academy of Sciences (AB IORAS), Working Group “Sea coasts” of the Council on Problems of World Ocean of the Russian Academy of Sciences, some projects in the framework of the EU, Project “Sustainable Development Indicators for South-Eastern Baltic” in the framework of Neighborhood (Int.-Taxis) Program “Lithuania, Poland and Kaliningrad Oblast (Russian Federation)”, Immanuel Kant’s State University of Russia (IKSUR).

The principal aim of the International Conference and Summer school-seminar “Dynamics of the Coastal Zone of Non-tidal Seas” is to give modern information about dynamics processes in the coastal zone and to afford a base for exchange of scientific results of investigations. Whole spectrum of questions (from surf zone hydrodynamics to interaction of coastal zone with open sea regions) was discussed during oral and poster presentations.

About hundred experts, specialists, young researchers, PhD-students with interest in coastal dynamics participated in this events. Invited lectures come from Russia, Poland, the Netherlands, Bulgaria, Germany, Estonia, Italy, Switzerland.

Specialists and young researchers came from more than ten countries (Russia, Ukraine, Estonia, Poland, Greece, France, Italy, Spain, Netherlands, Turkey, Switzerland and others) to participate to the International Conferences and Summer school-seminars “Dynamics of the Coastal Zone of Non-tidal Seas”, to hear a course of lectures and to present their posters during the conference. Course of lectures included three topics: “Dynamics of the coastal zone”, “Dynamics of estuaries and lagoons” and “Dynamics of interaction between coastal zone and the open sea”.

In addition to the lectures a number of poster presentations (three minutes for each poster) were presented during every of three thematic poster sessions. Scientific Committee selected two best posters for each topic. Authors of best posters received incentive prizes from Scientific and Organizing Committees.

A limited set of fellowships is usually available for young scientists from Russia and other European countries. Conference Proceedings with extended abstracts with illustrative material in English and Russian are published before the conferences and distributed among participants.

Cultural events included barbecue (first day) and closing buffet dinner (last day) in the Station "Baltic Spit" garden, musicales, football and volleyball matches for all participants of these conferences.

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Determining the Ecological Value of Shell Mound Reef Habitats Following Decommissioning of Offshore Platform Sites

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In 1996, Chevron removed four offshore oil and gas platforms in the Santa Barbara Channel off the coast of Santa Barbara, California. The four platforms, Heidi, Hope, Hazel, and Hilda, (or collectively the 4H platforms) were installed between 1958 and 1965 and provided oil and gas production until their decommissioning. As part of decommissioning the above water structures (topsides) and legs (jackets) were removed at the sea floor. At each of the 4H sites, the underlying drill cutting mounds were left behind. These mounds are covered with several meters of "shell hash" from bivalve shells dislodged from the platform jacket and natural sedimentation that has accumulated in the 30+ years following cessation of drilling activities. These resulting "shell mounds" remain on the natural soft bottom and provide a rare complex hard bottom habitat within the Santa Barbara Channel area. To date few studies have focused on the shell mound habitats relative to the surrounding soft bottom habitats. This study was designed to evaluate the shell mound habitat and soft bottom areas and included a nearby deep natural rocky reef reference location.

A multi-season fish trapping study using standard commercial fish traps was conducted to address the ecological value of the shell mounds sites. Data were collected from the 4H shell mound sites, two soft bottom reference sites, and a deep natural reef location over a two year period. The general study design was a paired sampling of sites within a depth gradient (i.e., deep and shallow) on roughly a quarterly basis. The assemblage of fish and invertebrates observed in the fish traps from the mounds include several species of rockfishes (genus *Sebastes*), ling cod, rock crabs, whelks and bat stars that are typical of hard bottom communities in the Santa Barbara Channel. Results indicate that the shell mounds have more fish and invertebrates and a more diverse benthic community than the soft-bottom reference areas. These data supports the conclusion that the fish habitat value of the shell mounds is greater than that of the surrounding soft bottom habitat.

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PLANS: PLankton And Nutrient Studies for the Chesapeake Bay, a NOAA B-WET Program

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PLankton And Nutrient Studies for the Chesapeake Bay (**PLANS**) is a NOAA B-WET sponsored program designed to provide hands-on experiences for Calvert County Public High School students by investigating nutrient enrichment/limitation and phytoplankton dynamics in the Chesapeake Bay. The goal of the program is to teach students the sources of nutrients, the relationship of nutrients to phytoplankton population dynamics and the role that man plays in managing the Chesapeake Bay. This project has partnered Advanced Placement, Honors, and Ninth Grade Environmental Science teachers and students with Bay scientists and educators. A teachers' workshop was held to introduce teachers to the program, followed by classroom, field and web-based activities for the students. The teachers are encouraged to use information provided on the **PLANS** website (www.plansforthebay.org/index.html) including activities adapted from the National Geographic Society FieldScope site. The specific student activities include viewing live plankton, understanding the basics of the plankton food web, establishing the types and sources of nutrients, setting up nutrient limitation bioassays and learning field techniques for the collection of plankton and water quality data. The conclusion to the students' experiences is the **PLANS** Summit for the Chesapeake Bay, a meeting at which the students present the findings of their experiments, fieldwork and photographs of their plankton to parents, teachers, scientists, and the public. During year-2 of the program a station will be established in the Chesapeake Bay that becomes part of the NOAA citizens-based Phytoplankton Monitoring Network. Samples taken from this site will be examined taxonomically by a subset of the AP and Honors students and the data reported to NOAA. The **PLANS** program enables high school students and teachers to work directly with Chesapeake Bay scientists and educators on some of the major issues facing the health of the estuary.

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Investing in Innovative Technologies for Chesapeake Bay Restoration

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Historically, the Chesapeake Bay has been one of the most productive estuaries in the world, providing tremendous habitat for fish and wildlife, as well as unparalleled economic and recreational opportunity. The past few years have been ones of leadership, innovation, enhanced coordination and accountability, marked by actions that will advance progress in restoring the Chesapeake Bay. Despite important restoration steps by federal, state, local and private partners and the benefit of our world-renowned science, sobering reports of Bay water quality conditions remind us of the significant challenges ahead. To combat these challenges Bay watershed states have developed strategies to reduce nutrient loads using accepted methods for pollution reduction, yet gaps remain and States are looking for new ideas to reduce nutrients. Maryland's Innovative Technology Fund was established with the goal of accelerating riverine, estuarine and coastal water quality restoration through the development of new innovative technologies to reduce nonpoint source pollution. A secondary goal is to support the development of successful businesses while creating green jobs in Maryland. At the 2007 Chesapeake Bay Program Executive Council meeting, the State of Maryland and the Environmental Protection Agency agreed to promote investments in technologies that could accelerate Bay restoration efforts. Maryland is using this fund to develop new technologies, and improve approaches to implementing existing best management practices, that reduce nitrogen, phosphorus and sediment. The Innovative Technology Fund includes two tracks: one addresses the need for additional research and development, and the second supports fledging companies in industry and technology related to Bay restoration and protection. Both tracks leverage government and private sector funding. A number of projects have been supported under the Innovative Technology Fund that have developed best management practices to support restoration and pollution prevention within agriculture, urban stormwater, air deposition and natural filters. By supporting innovation, the State demonstrates their commitment to investing in research and development as a way to improve efficiency and maximize return on investment. The Innovative Technology Fund framework is currently under review to increase available funds and partnerships as well as expand the scope of best management practices eligible for funding. This presentation will cover the project selection process, supported projects, lessons learned and challenges to implementing the Innovative Technology Fund.

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Sediment Mobility as an Indicator of Vulnerability to Climate Change on a Mediterranean Beach: A Modelling Approach with Several Sediment Transport Formulae

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In a context of climate change, we will present the methodology of the modeling approach to analyze the sensitivity of a Mediterranean beach to forcing conditions changes. This paper discusses the abilities of numerical models to predict the nearshore evolution and to set-up vulnerability indicators of sandy beaches against the climate change predictions for 2030.

The objectives which we want to reach during this study are multiple. First, we are going to set up a procedure of linking of three codes (the waves, the flow field and the bed evolution models (Telamac)) to be able to simulate realistic climates. This procedure is validated from the point of view of the hydrodynamics and morpho-dynamic evolution (Larroudé, 2008). This technique of simulation will then use to compare and studied the contribution of the various formulae of sedimentary transport (as in Camenen and Larroudé, 2003) on the site of Sète (Languedoc-Roussillon, France). Located in a microtidal, swell-dominated coastal environment, this beach is a linear beach of about 2.5 km length with double straight bar system. The mean significant offshore wave height is about 0.5 m increasing to 3–6 m during storms, (Certain and Barousseau, 2006). We improve this methodology to simulate the Rising-Apex-Waning of a two specific storm event (Robin et al., 2010). We also present a comparison of the velocity at these different periods of the storm. We will present simple indicator methods to analyze the vulnerability of a sandy beach based on the results of simulations for different scenarios. The first method is based on the method described in Idier et al. (2006). In the present study, we calculate the maximum grain size potentially mobilized but with a simpler approach, based on analysis in different point on several cross shore profile

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SAGE: Systems Approach to Geomorphological Engineering Innovative Approach to Coastal Landscape Transformation

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The U.S. Army Corps of Engineers initiative “SAGE,” stands for Systems Approach to Geomorphological Engineering. The purpose of this initiative is to develop and pursue a comprehensive view and utilize an integrated methodology to determine the role of the ecosystem(s) in slowing/preventing/mitigating impacts to coastal communities from the consequences of climate change. This concept will take a more holistic approach in exploring the idea of hybrid engineering (i.e., linking ‘hard’ infrastructure with soft ‘ecosystem-based’ approaches) to develop innovative techniques to seek solutions and minimize impact from changing climate trends.

This landscape transformation initiative looks at capturing various elements of the “living shoreline” ingenuity by looking at processes and appropriate actions to minimize impacts to coastal communities and shorelines, while also maximizing economic benefits. The U.S. Army Corps of Engineers is interested in exploring the ecological and economic benefits of coastal protection by utilizing our natural ecosystems, rather than just building hard infrastructure to protect coastal communities and shoreline.

This initiative is initially being developed in partnership between the Army Corps of Engineers and various components of the National Oceanic and Atmospheric Administration. However, there are early plans to work with the academic community, various non-governmental organizations and other federal partners to ensure we are taking the appropriate steps moving forward. We envision sharing broad applications of these processes internationally.

Innovative approaches are critical and necessary as our coastal communities and shorelines are facing escalating risks from powerful storms, climate change trends, sea-level rise, storm surge, and changing precipitation patterns that can have dramatic economic losses to those impacted communities and our country. While the threats of these events may be inevitable, our ability to best minimize the impact by utilizing a blend of the natural ecosystem and hard infrastructure is important to explore best practices and appropriate solutions to ensure the resiliency of our coastal communities and shorelines.

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Evolution of *Sato-Umi* Frame during the Recent International Meetings in the Context of Sustainable Coastal Management

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The concept of *Sato-Umi* and related activities originated in Japan are gradually gaining ground not only in Japan in particular of more or less polluted enclosed coastal seas, where ecosystem and living resources were deteriorated. *Sato-Umi* is aiming at well-balanced sustainable management of coastal seas not only in water quality but also in ecosystem and ecosystem services. Although original definition of *Sato-Umi* was given by Yanagi in 1998 focused on the importance of biological production and diversity under human interaction, varieties of discussion on *Sato-Umi* frame have been developed after that both in domestic and international meetings. Major points of discussion so far done were on the relationship between the concept of *Sato-Umi* and already proposed related concepts such as ecosystem based management (EBM), community based management (CBM) and integrated coastal management (ICM). In the present study, discussions on *Sato-Umi* were reviewed from the view point of international context. The first presentation on *Sato-Umi* by the present author in the international meeting was made in 2005 at the PEMSEA meeting held in Korea, where strong interest in *Sato-Umi* was given by Asian participants. In 2006, at EMECS7 held in Cean, France, concept of *Sato-Umi* and related local activities were introduced by Yanagi and Matsuda, respectively, with other case studies in Japan. At the reviewing session of EMECS7, *Sato-Umi* was highly evaluated as symbiosis among human communities and coastal area. In 2008, at EMECS8 held in Shanghai, China, specialized *Sato-Umi* Session was held and case studies in many countries were introduced and discussed. In 2009, at East Asian Seas Congress which was held in Manila, Philippines by PEMSEA, International *Sato-Umi* Workshop was successfully organized in the frame of indigenous approaches to habitat protection and restoration. In October, 2010, Convention of Biodiversity (CBD) COP10 was held in Nagoya, Japan when International *Sato-Umi* Workshop was held as an official side event of COP10 in relation to biodiversity. During these discussions, originality of *Sato-Umi* became more clear as bottom-up type of local initiative with special reference to the maximization of ecosystem services and integrated coastal and river basin management.

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Aftereffects of Hypoxia Exposure on *Ruditapes philippinarum* in Omaehama Beach, Japan

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The objective of this study is to examine the aftereffects of hypoxia exposure on the suspension feeding activities of *Ruditapes philippinarum* and recovery of that. Hypoxic condition which usually means a dissolved oxygen concentration of less than 2-3 mg/L has occurred from every late spring until late summer in eutrophied Osaka bay, Japan. *Omaehama beach* has remained one of the few natural coasts in the northern part of Osaka bay and plays the water purification functions because a lot of suspension-feeding bivalves such as *R. philippinarum* inhabit in shallow coastal areas (< DL-2 m in depth). A large amount of hollow shells of *R. philippinarum* were washed ashore of Omaehama beach after hypoxia occurrence. We could notice that the monthly variation of cohort group and the rate of *R. philippinarum* loss in Omaehama beach depended on the hypoxia exposure duration and the DO concentration of hypoxic water. There are very few descriptions of the after effects of hypoxic conditions on the suspension feeding activities of *R. philippinarum*, while a number of reports describe catastrophic mortality of benthic clams was caused by hypoxic waters in the eutrophicated bays.

We conducted monthly investigation of *R. philippinarum* density along with measurement of DO, temperature and salinity at Omaehama beach in 2008. Moreover, exposure experiments of *R. philippinarum* to hypoxic water were carried out to measure the suspending feeding activity using the diatom *Skeletonema costatum*. In recovery experiments, hypoxia exposed *R. philippinarum* were put in the water with oxygen enough and feeding activity was measured every few days. Consequently, once *R. philippinarum* was exposed the hypoxic condition, the suspension feeding activities was reduced and recovered it after 60 days. In case of anoxic condition (DO=0.0-0.5mg/L), the number of *R. philippinarum* dying increased and the activity could never recovered.

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Advancing Watershed Restoration at the Local Level through the Chesapeake Bay TMDL

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With the Chesapeake Bay TMDL now in place (as of December 2010), Maryland is tasked with achieving ambitious goals on a strict timeline. Realizing that State initiatives alone will not achieve our implementation goals, Maryland has put in place programs and strategies that target valuable resources at the local level. Aimed at increasing capacity and accelerating large-scale restoration initiatives, the unique partnerships of the Watershed Assistance Collaborative have already given many communities a boost in tackling these goals.

The Watershed Assistance Collaborative (Collaborative) is a federal, state, and nonprofit partnership that includes Maryland's State Agencies, the Chesapeake Bay Trust, University of Maryland Extension, the University of Maryland Environmental Finance Center, NOAA and the EPA. Since its inception in the spring of 2009, the Collaborative has fit very well into the overall goals and restoration strategies that Maryland Department of Natural Resources & the State are working toward for the Chesapeake Bay TMDL and the state level Watershed Implementation Plan. More specifically, the Collaborative offers the tools, support, and technical assistance to help local governments and communities plan, target and implement on-the-ground projects, as well as build the capacity to implement best management practices and environmental policies that relate to improved water quality.

In order to meet the challenge of Chesapeake Bay restoration, every local government, every business and every citizen will have a significant role to play. To date, the Collaborative has awarded over \$350,000 for planning and design projects, facilitated stakeholder outreach meetings, delivered detailed Financing Strategies for future implementation options for the partners, and has provided on-the-ground technical assistance to help local government entities and community groups coordinate project implementation, outreach, and leverage additional funding opportunities. Two examples of successful local watershed organizations that utilized the Collaborative and how they have expanded their restoration and outreach efforts will be discussed.

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Communicating the Health of Maryland's Coastal Bays – Involving Citizens with Science

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In the Maryland Coastal Bays watershed several products are collaboratively produced to communicate the health of the Coastal Bays to several audiences. Produced on different timescales, these reports are variously addressed to laymen, scientists, managers, and elected officials. A highly technical ecosystem health report is prepared on a 5-year scale. Concomitantly, a 'public friendly' State of the Bays Report is also produced. Beginning with 2008, in collaboration with several partners and the Mid-Atlantic Tributary Assessment Coalition, Maryland DNR, Maryland Coastal Bays Program, and Assateague Island National Seashore have produced an annual report card to the citizens of the watershed. This format – an abbreviated synthesis on a timescale relevant to politicians and tourists as well as residents - functions to keep the health of the Bays continuously in the public eye. The report card presents the progress of water quality and living resources indicators, combining data generated by State and federal agencies, and volunteer private citizen monitoring groups. It evaluates sub-basins within the Coastal Bays system, tells stories of successful partnerships and accomplishments, and recommends individual actions and opportunities for citizens and visitors. Data and methods underpinning the report card are made available through a dedicated webpage.

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Monitoring of Mercury Concentration in Fish in the Vicinity of Natural Gas Production Platform in the Gulf of Thailand

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Thailand has developed the offshore natural gas exploration and production in the Gulf of Thailand since 1979. Prior to the installation of the wellhead and processing platforms, the environmental impact assessment reported the above world baseline level of mercury in the deeper layer of seabed. With this warning, the environmental effects of mercury in the vicinity of natural gas production platforms have been conducted since 1990. The present paper reported merely the monitoring of mercury in fish in the Erawan production platform, the oldest platform that has been operated since 1980. The methodology included the sampling and analysis of fish both in the immediate vicinity of the platform and at reference location which is at Pranburi coastal area. The samplings covered 8 years during 1993-2008. The results of 1993 study showed significant elevated mercury concentration in fish. The average mercury concentration was 0.556 µg/g (wet weight basis) and 41.6 % of fish had mercury more than 0.5 µg/g, the safety concentration recommended by the FAO. This was an alarming sign. Thai government authority asked the company holding the concession in this zone to make a prompt correction measure, and a long term monitoring program was funded by the government. The company later set up a hydro-cyclone device for separating mercury from the produced water before discharging it into the sea. In addition, the zero discharging practice was also adopted by using a deep-well injection. Monitoring results in the following years up to 2008 found a gradual decrease of mercury concentration in fish near to the baseline level of 0.200 µg/g. The percentages of fish having mercury concentration exceeded the safety limit of 0.5 µg/g were also decreasing.

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Designing the Salt Marshes of 2100: Climate Adaptation in the Chesapeake Bay

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In partnership with US Fish and Wildlife Service (USFWS), US Army Corps of Engineers (USACE) and other key partners, The Conservation Fund (Fund) and Audubon Maryland-DC are creating an adaptation strategy to address the forecast impacts of sea level rise on the tidal marshes of Blackwater NWR and adjacent areas of Dorchester County, MD. The objective will be the creation of a decision-tool and mapping identifying high priority, currently upland areas suitable for salt marsh migration and re-establishment. The strategy will also identify areas for increased protection and restoration of current marshes to slow the rate of loss to open water.

The Chesapeake is one of the Nation's most vulnerable areas to the impact of climate change. Not only do studies forecast its sea level to rise steadily in the coming decades, but the Chesapeake's land areas are subsiding due to rebound from the last glacial age, a natural phenomenon that amplifies relative sea level rise on top of climate change and accompanying storm surge. With 11,684 miles of coastline along the main stem and tidal tributaries, the entire Chesapeake Bay region has a significant amount of highly productive wetland ecosystems at increased risk. The region's salt marsh birds include the globally vulnerable Saltmarsh Sparrow, which breeds only in the high marsh zone of salt marshes and consequently, may be the bird species most at-risk of extinction due to climate change in the United States.

The Blackwater NWR and the surrounding area have already lost thousands of acres of land during the past 50 years. These losses result from sea level rise, land subsidence, erosion, ditching for mosquito control, hydrologic changes from development, and invasive species such as nutria. The relative sea level at the Refuge has risen approximately one foot in the last century, nearly twice the global average. The Scientific and Technical Workgroup of the Maryland Commission on Climate Change indicates that sea level could rise from 0.6 to 1.3 feet by the middle of this century, but accelerated melting could produce a relative sea level rise at the end of the century of between 2.7 feet and 3.4 feet. Low-lying areas such as the Blackwater NWR will be dominated by open water by 2050

The project partnership led by the Fund is developing spatially explicit strategies to guide land protection that will allow wetland migration and restoration of existing wetlands to increase resilience to sea level rise. The project has the following four components:

- 1) A strategic assessment of the current condition and predicted sea level rise impacts in existing marshes and adjacent uplands that are potential marsh migration corridors.
- 2) A comprehensive strategy for Refuge restoration and sea level rise adaptation
- 3) A communication strategy to build support for implementation actions among partners and the public.
- 4) Pursue implementation projects consistent with the plan.

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Field Survey and Satellite Validation of Water Quality Parameters of Rivers in the Surroundings of Santo Domingo Metropolitan Area, Dominican Republic

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About one third of the population of the Dominican Republic is concentrated in Santo Domingo Metropolitan area (SDMA). Ozama, Isabela and Haina rivers are the three main rivers in the surroundings of SDMA. Ozama River is considered the 4th most important in Dominican Republic because of its flow. Ozama and Haina rivers flow crossing SDMA at the East and West, respectively, before emptying into the Caribbean Sea. Isabela River is one of the main tributaries of Ozama River and it runs in the North part of SDMA.

Water quality monitoring of rivers and coastal areas requires a great amount of effort and monetary investment. Satellite imagery covers a broad area and requires neither great amount of money nor effort. Remote sensing through satellite imagery is a technique that can be used to understand the macro situation of the environmental pollution of rivers and their influence in coastal areas. Therefore, the purpose of this research is to perform field surveys of the water quality in the above mentioned rivers and coastal areas and to validate the data using satellite imagery in order to create a model that could be used any time to determine the water quality of the rivers and coastal areas mentioned.

In situ monitoring of the representative locations of Ozama, Isabela and Haina rivers, including the mouth of Ozama and Haina was performed from a vessel using a portable water quality meter (TOA-DKK WQ24). Dissolved oxygen (DO), pH, conductivity, turbidity, temperature, total dissolved solids (TDS), salinity, sea water specific gravity and chlorophyll a were determined. Water samples were also taken and filtered through a fiberglass filter (Whatman GF/F) to determine the amount of suspended solids (SS). A correlation between the amount of SS and color spectra of water was determined and it was used to validate the data with the satellite imagery.

Along the banks of the rivers there are a great number of sewage pipe ends as well as several ravines that converge in the rivers, all of them discharging their flow of domestic and industrial wastewater as well as garbage. Results show that SS, turbidity and chlorophyll a values are very high in these places and DO values are very low. Chlorophyll a values for the most polluted locations are higher than 40 µg/l and 25 µg/l for the Haina and Ozama-Isabela rivers, respectively, showing conditions of hypereutrophication. A significant correlation (0.72) was observed between the color spectra of water and ALOS band 1 (blue band), which shows the possibility of the use of remote sensing to determine the macro situation of pollution in the rivers and coastal areas

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The Estimations of Nutrient Cycles of Artificial Tidal Flat in Tokyo Bay

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Tidal flats are important fields for coastal environments. Because of the loss of tidal flats, a marine environment in coastal area in Tokyo Bay was abruptly deteriorated. The amount of catch of fish was considerably decreased last several decades. The impacts of tidal flats on marine environment are dependent upon the characteristics of each tidal flat. We carried out field investigations in order to know the ability of water quality purification by each tidal flat. The study field is the tidal flat in Tokyo Port Wild Birds Park. This tidal flat has two channels, which connect to adjacent sea in Tokyo Bay. We carried out the measurements of tidal velocity, the concentration of nutrients such as Nitrogen and Phosphorus, Chlorophyll-a, turbidity, etc. for two tidal cycles in Summer, 2005 to 2010 and in Winter, 2009 to 2010. Then we estimated the nutrient fluxes pass through the channels from the tidal flat to adjacent sea. From the field measurements of nutrient fluxes, it is found that the tidal flat has the functions of a net source of Phosphorus and a net sink of Nitrogen and Chlorophyll-a. In order to know the mechanism of the function conducted in the tidal flat, we carried out the sampling of benthos and bottom sediments and counting the individual numbers of water birds in the tidal flat. Furthermore, we estimated the Nitrogen flux from the sediments to atmosphere by denitrification and anammox by means of revised isotope paring technique.

From the field studies, we found following conclusions. (1) From the field measurements of nutrient fluxes pass through the channels, the tidal flat has the function of a net source of Phosphorus and a net sink of Nitrogen and Chlorophyll-a. (2) Predominant species of water birds in the tidal flat is cormorant. The excretion of water birds is a source of Phosphorus, but the nutrient flux by the birds is not so large compare to nutrient flux of the channels. (3) The nutrient flux between bottom sediment and water column in the flat is quite large. (4) The main factor of a net sink of Nitrogen in the tidal flat is denitrification and anammox.

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Spatial and Temporal Distribution of Total Carbonic Acid in the Seto Inland Sea

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The concentration of atmospheric CO₂ has been rising by human activities and the effect for sea environment has been studied. Consequently, it is reported that ocean makes a role as a sink of the CO₂. On the other hand, the coastal sea into which river water and effluent flow from coastal area is very complicated compared with open sea. As there are little findings on an interaction between atmospheric CO₂ and coastal sea, we measured total alkalinity (TA) in the Seto Inland Sea, which is the index of all carbonic acid and an important parameter to understand the dynamics of the carbonate system in sea environment.

Water samples of surface and bottom layer were collected in three surveys, July and November 2010 and January 2011 in the Seto Inland Sea. The TA by a titration method using 0.01mol/L HCl, pH by a pH meter, and Salinity by a salinometer were measured, respectively.

The TA, Salinity and pH in surface sea waters were 691-2240μmol/kg, 7.63-34.27 and 7.89-8.87 in three surveys. The lower concentrations of TA were observed in the eastern part of Osaka Bay and Hiroshima Bay. As large rivers flow into the inner part of Osaka Bay and Hiroshima Bay, the concentration of TA was affected by fresh water. In addition to river water, biological production which is a very important process to produce CO₂ in eutrophic sea area such as Osaka Bay and Hiroshima Bay, should be considered. Other sea areas showed higher concentrations of TA than two bays. The TA in the Sea of Iyo, which is the western sea area, was higher concentrate compared with other sea area.

The seasonal variation was observed in each sea area. The TA showed the lower concentration in July, and became higher in January. The effect of river water and biological production would relate to the seasonal variation.

The TA indicated a linear relationship with salinity in the surface seawater. The equation of regression line was $TA = 54.93 \times \text{Salinity} + 401.2$ ($R^2=0.946$, $n=90$). As a lot of data on salinity were accumulated in the Seto Inland Sea, the concentration of the TA in past time will be calculated by the TA-S equation. It is necessary to raise the precision of equation.

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The Runoff Characteristic of Nutrients from Kako River in Hyogo Prefecture, Japan

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The eutrophication in the Seto Inland Sea, which is the largest enclosed coastal sea in Japan, has been serious problem. To reduce the amount of loadings of nitrogen and phosphorus to the Seto Inland Sea, many measures have been taken for about forty years. As a result, the concentrations of nitrogen and phosphorus in the Seto Inland Sea have decreased. Then, a number of the red tide occurrence largely decreased than 1970's. On the other hand, seaweed culture, which is one of major fishery in the Seto Inland Sea, is getting worse. The similar serious problem happens in the Sea of Harima, where is located in the eastern part of the Seto Inland Sea. To solve the seemingly paradoxical problems, which are conservation of water environment and sustainment of fishery production including seaweed culture, it is necessary to seek new measures to manage the amount of nutrients flowing into the Sea of Harima. Therefore, we conducted an investigation at the downstream of the Kako river, which is the largest river in the watershed of the Sea of Harima, to get correct loadings of nutrients as possible.

Daily water sampling was conducted at the Ikejiri station in the downstream of the Kako River from April to December 2010. The total phosphorus (TP), total nitrogen (TN), and other parameters were measured. The flow rate was used data observed at the Kakogawa weir office of the Ministry of Land, Infrastructure and Transport.

The concentration of TP was 0.041-0.903mg/L (ave.:0.104mg/L), TN 0.67-4.77mg/L (ave.:1.08mg/L). The daily average flow rate fluctuated 2.59-2100m³/s (ave.:52m³/s) for nine months. The total amount of TP and TN are 340ton (1.22ton/day) and 2,100ton (7.80ton/day) from April to December. The loadings of TP and TN showed the largest value in May. Especially, the loadings of TP was 156ton on 24 May, in the case of runoff, and occupied about 47% to 340ton. The loadings of TP and TN were 300ton and 1,700ton within 10% in order with a lot of flow rate.

The L-Q equations of TP and TN were $L(\text{TP})=0.065Q^{1.13}$ and $L(\text{TN})=0.828Q^{1.08}$, respectively. The coefficients of equation for TP and TN were more than 1. These result indicated that the type of runoff of TP and TN was classified into "washout type" in which the concentration of TP and TN increased in proportion to an increasing of flow. The loadings of the TP and TN from Kako River largely fluctuated every month. These results show that investigations during many rain events are important to evaluate annual loadings of TP and TN in addition to a regular sampling.

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Relation between the Decreased Mussels Biomass and Water Quality at Amagasaki Port, Osaka Bay, in 2010

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The invasive mussels attach to the surface of port breakwall at Amagasaki port, Osaka Bay. Generally, in summer season, these mussels drop out to the bottom and cause the decreasing water dissolved oxygen and become sediment worse. We have investigated about the fluctuation of attached biomass and dropped biomass since 2006. It was demonstrated that high temperature and low salinity occurs in July when the mussels attach, the mussels receive the influence and the mussels cause to drop out to the bottom. Therefore, the investigation was came in order to grasp water special quality.

The container was placed on the surface breakwater to measure a volume of dropped mussels at some stations of Amagasaki port. The volume of dropped mussels was 24 ~ 30 wet kg/m/day in July and August 2006, 2007. The volume was very few 0.1 wet kg/m/day in same season 2010, this corresponds to 1/300 of the ordinary year.

The relation between the decrease mussels biomass and water quality test was examined here. The result of vertical measurement temperature and salinity, the water temperature in July 2010 was 3°C higher than the ordinary year, salinity in this season was 10 psu lower than the ordinary year at the depth DL0 ~ -1m where the mussels attached primary. Because, the variability characteristics of air temperature, amount of insolation, rainfall were different in summer season 2010, it was considered water quality near the breakwall was changed to high temperature and low salinity. Especially, Amagasaki port is located in the large river estuaries Yodogawa, this port is the sensitive environment to the discharge of river water. According to the reported previously, when temperature reaches more than 26 °C, salinity contains less than 20 psu, the mussels decrease in strength of adhesion and drop out the bottom. Therefore, it was suggested the reason of decreasing mussels biomass was to occur high temperature and low salinity in July, the mussels were suppressed growth, the dropout period was accelerated earlier than the ordinary season.

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Bringing the Coast into the Partnership for Ecosystem Restoration in South Florida

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Beginning in the early 1990s, a multi-lateral partnership of state and federal agencies and local tribes formed around the goal to restore the Florida Everglades. This partnership is embodied in the South Florida Ecosystem Restoration Task Force and the Comprehensive Everglades Restoration Project (CERP). Over time, the geographic scope has expanded to encompass downstream estuaries and coastal marine ecosystems; however monitoring and assessment activities remain focused on the freshwater Everglades. The coastal marine ecosystem is not yet included in regular reports on the status of the regional ecosystems produced by the Task Force.

The goal of the NOAA-supported South Florida Marine and Estuarine Goal Setting for South Florida (MARES) project is fill this gap and include the coastal ecosystems in regional ecosystem assessments. The necessary scientific knowledge and data exist, in large part. What is missing are synthetic products based on this information, i.e. the conceptual ecosystem models and quantitative indicators, that form the basis for system-level assessments. The MARES project engages scientists, managers, policymakers, academics and environment organizations in a collaborative effort to develop these tools.

The MARES project has adopted a Driver-Pressure-State-Ecosystem Services-Response (DPSEER) framework for developing integrated conceptual ecosystem models. The DPSEER framework explicitly represents the interdependence between human dimensions of the ecosystem and environmental attributes. Linking conditions in the ecosystem to “ecosystem services”, rather than the more general “impacts,” allows human-use values, activities, and impacts to be modeled explicitly. The DPSEER models identify key attributes of the coastal environment that then form the basis for defining quantitative ecosystem indicators. The ultimate goal of the MARES project is to develop a report card for the coastal marine ecosystem comparable to the report card already in use for the Everglades.

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A Comparative Study of Shellfish Assemblage Patterns between an Artificial and a Natural Sandy Tidal Flat

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The Maripia sandy seashore located in Tokushima City, southwestern Japan, was created in March 2007 to compensate for the loss of the adjacent natural seashore to land reclamation. Because the main objective for creating this seashore was to provide a habitat for the endangered tiger beetle *Cicindela lewisi* inhabiting the natural shoreline and vegetation, there is less ecological information on the intertidal benthic species. We conducted seasonal quantitative sampling of intertidal shellfish (mollusks and crabs) from May 2008 to October 2010 to investigate the differences in assemblage structure and recruitment pattern between the artificial and natural habitats.

The seawater quality, sediment particle size distribution, and topographical characteristics were almost similar between the 2 habitats. The number of species was almost always lower in the artificial habitat, and the dominant species composition differed between the 2 habitats. In particular, a mud snail *Batillaria cumingi*, which was the most dominant species in the natural habitat, was not observed in the artificial habitat during the 3 years of survey. Moreover, in the artificial habitat, the species rank-abundance pattern was unstable compared to that in the case of the natural habitat, and the recruitment pattern of the dominant bivalve differed between the 2 habitats, suggesting that the ecological conditions of the artificial habitat were different from that of the natural one even after 43 months of its creation.

However, the shellfish assemblage of the artificial habitat appeared to be rich during our study period. The 2 exclusively dominant clams drastically declined by the end of 2009, and the density of some species gradually increased with an increase in the biodiversity index.

From our findings, we infer that the assemblage structure of the artificial habitat was not enough to compensate for the lost natural habitat in the current situation. Because several physical characteristics were common between the 2 habitats, biological factors such as variation in recruitment amount and modes of recruitment (planktonic or direct development) seem to play a crucial role in the observed differences. Continuous survey is therefore needed for a better ecological understanding of the artificial tidal flat.

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Small Coasts, Large Issues - Can Communities Protect Their Coasts?

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How can coastal communities protect their environment while maintaining economic activities that use marine resources sustainably? This question can be addressed by investigating either national or regional approaches in marine policy that successfully promote the sustainable use of coastal ecosystem services. It can also be answered through the analysis of case studies on local coastal management schemes, which describe the innovative hands-on approaches of coastal communities to conserve or restore their environment. These community-based management schemes are often culturally sensitive and bottom-up, due to the nature of their operational structure, which is either grassroots or indigenous. The greater challenge has amounted to arguing the continued relevance of the 'community' brand of coastal management in the face of increasing vocal (and fashionable) alternatives that try to make sense of the unity and diversity of coastal living and environment. However, both studies on policy approaches and those of community case studies can only offer limited answers to the question, providing perspectives that are either too area specific or artificial. This paper will discuss ways to advance sustainable coastal management locally and globally. To look locally, it proceeds through a discussion of the way Satoumi is utilized to mainstream the idea of conserving biodiversity and sustainable use of coastal and marine resources to the work of production sectors, mainly fishers communities, and argues the benefits of the Satoumi approach in comparison to other contemporary coastal management schemes, such as Marine Spatial Planning. To look globally, it argues the need for a comprehensive understanding of global coastal governance outlook and introduces newly establish marine initiative, the NF-UBC Nereus Program. The paper concludes that both the local and global matter: Sustainable use of ocean resources requires both innovative local, bottom-up management approaches as well as global-scale coordinated scientific research efforts and large-scale management responses.

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Relationships between Food Web Structure of Benthic Community and Origin of Sedimentary Organic Matter in Tidal Flats of Two River Mouths in Shikoku Island, Japan

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Many studies were conducted to analyze food web and estimate the origin of sediment using carbon and nitrogen stable isotope ratios in estuarine ecosystems. Since the environmental factors are changeable and various spatially and temporally, characteristics of sediment in tidal flats are not uniform. It is assumed that spatial distribution of sediment characteristics influences food web structure, and food web structure may be different among the different sediment characteristics.

The objective of this study is to analyze food web structure and estimate the origin of sediment using carbon and nitrogen stable isotope ratios in two tidal flats of river mouth. We collected macrobenthos and potential food sources in tidal flats and surrounding reed marshes in the Yoshino and Katsuura Rivers, Tokushima Prefecture of the Shikoku Island, Japan. Carbon and nitrogen stable isotope ratios were measured for macrobenthos and sediments collected at 50 and 32 stations in the Yoshino and Katsuura estuarine tidal flats, respectively.

Carbon stable isotope ratios of sediments were distributed with spatial characteristics in the two tidal flats. Contribution of terrestrial organic matter was lower in the downstream section of the tidal flat comparing with in the upstream section. It is thought that sediment in many stations consisted of terrestrial organic matter, that is mostly originated from reed. Although benthic consumers were distributed in the stations with sediment from terrestrial organic matter, they did not assimilate terrestrial organic matter as their food sources. Moreover, benthic consumers have selectively assimilated food sources that are supplied from water column. Reed marshes play a role as habitat and food sources are indirectly supplied through the reed marshes, indicating that reed is not useful for benthic consumers as a food source.

Sediment groups were distinguished according to the physical characteristics of sediment by cluster analysis for particle size composition and difference in elevation. As a result, carbon stable isotope ratio of sediment and contribution of terrestrial organic matter showed statistically significant difference among the sediment groups. However, macrobenthos mainly assimilated MPOM and benthic diatoms as their food sources even in the station of sediment groups with rich terrestrial organic matter.

It was implied that the difference in sediment characteristics hardly corresponded to food web structure of benthic community.

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Direct Intervention to Improve Hypoxic Conditions: A Baltimore Harbor Pilot Study

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The purpose of this Pilot Study was to deploy mixing and aeration to an area of Baltimore Harbor and to monitor the improvements provided. The project area is seasonally affected by anoxic conditions caused by increased nutrient loading as well as other factors. The information gathered could then be used to establish how these systems interact in 'real world' conditions. The ultimate goal of the pilot study is to establish design parameters of mixing and aeration systems which could assist in restoration efforts in Baltimore Harbor, Chesapeake Bay and around the world.

The first step in executing the pilot study involved establishing a location that reflected the conditions being encountered in the harbor. Hypoxic and anoxic conditions are defined as waters with dissolved oxygen (DO) of below 2 mg/l and 0.2 mg/l, respectively. These conditions significantly limit the water body's ability to sustain aquatic life, thus limiting productive areas, and can also result in fish kills.

Prior monitoring information near the project site was reviewed. This information included DO, temperature, and salinity. Additionally background monitoring was conducted by the team. Once the background conditions were understood, design of the pilot system began. This first included predictive modeling to describe the natural system and then evaluate how additive oxygen and mixing would change the dynamics at the site.

The devices chosen included a solar powered mixing system, the SolarBee[®] and a pipe diffuser system with oxygen delivered by land based compressor. Both were carefully selected based on the site and testing was carried out to establish how each affected oxygen transfer within the system and for differing power settings. Sampling was conducted on-water using sensors to measure DO, salinity, pH, and temperature.

The final report from the pilot study is being completed and seeks to establish the following:

- How much aeration and or mixing will it take to effectively increase the DO in an area located within a tidally influenced dead zone, such as exist in Baltimore Harbor?
- What are the dimensions of the volume of water so affected?
- How long will it take the aeration system to increase DO levels within the affected area to an equilibrium condition?
- How long will it take the prior low DO levels to return if mixing and aeration are ceased, and are there any lasting improvements once mixing and aeration have changed the ambient conditions?
- If aeration and mixing are varied, what corresponding water quality improvements will be seen?
- What is the capital and operating cost on a unit basis? What is the appropriate way to measure and express performance of such systems?

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A Comprehensive Regional Effort to Enhance Integrated Coastal Management in the Mediterranean and the Black Sea Countries: The PEGASO Project of EU FP7

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The start of regional cooperation among the riparian states for managing the Mediterranean (Mediterranean Action Plan - MAP) dates back to 1975. After 15 years of operation, MAP included integrated coastal management (ICM) into its sphere of activities and in the second phase of MAP starting with 1995, ICM became a priority target for the program. A milestone for the Mediterranean ICM was the approval of the Integrated Coastal Zone Management Protocol for the Mediterranean in early 2008. The Protocol, which is the first international legislation worldwide promoting ICM, has recently concluded the ratification process and will soon be in force. Despite this pioneering regional development, perhaps all Mediterranean states are still at certain distances from successful ICM implementation.

Regional cooperation for managing the Black Sea and its coastal areas is more recent compared to the Mediterranean. The seeds for this effort were put in place by the four-year long (1993-96) GEF funded project (Black Sea Environmental Program) that produced the approval of the Strategic Action Plan (SAP) for the Black Sea (31 October 1996) by the riparian states. Integrated coastal zone management was one of the issues addressed by the SAP.

The European Union started significant initiatives in ICM most notably after the mid 1990s. Experience gained from several projects carried out in the European states produced the ICM Recommendations in early 2000s. Since then, ICM has been a major area for exploration by various EU programs.

At the preparatory phase of the Seventh Framework Programme (2007-2013) of EU, a special project was envisaged for promoting ICM in the Mediterranean and the Black Sea states with special emphasis to the non-EU member countries. The PEGASO project was selected at the start of 2010 after an open call for proposals.

The four-year long PEGASO project is a concerted effort by 25 prominent Mediterranean, Black Sea and European institutions that have wide experience in ICM. The PEGASO consortium includes intergovernmental and EU institutions, international and national NGOs, universities and research centers. The project commenced with 01 February 2010.

This paper describes the goals and the work packages of the PEGASO project.

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Conceptualization of Climate Change and Its Implications for Coastal Management in the Southern Baltic

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Very productive coastal ecosystems are usually multi-use and multi-stakeholder areas. It is expected that during the 21st century the global sea level will rise at a greater rate than anytime before. Polish coast is almost entirely covered by low-lying sandy beaches, very sensitive to climate change. This is why it is essential to include climate change into the future planning and long-term coastal management. While this is pretty obvious to researchers, it might not be so to the people responsible for decision making. We believe that it is of extreme importance to investigate how the authorities, environmental planners, teachers as well as the coastal societies perceive climate change and how much they really know about it. In order to investigate this hypothesis, we have developed a dedicated questionnaire in cooperation with the University of Linköping. Its primary goals were to identify (i) how the responders perceive major problems, (ii) what are their declared concerns about the environmental issues, (iii) what they recognize as foundations for the sustainable development and finally (iv) what are their information sources. The analysis of the last factor was also used as a proxy to help to understand how, if at all, scientific information is transferred from research institutes through education and public opinion to the decision makers. We have also used content analysis to investigate the management measures applied in the coastal areas and the Polish territorial waters. We studied the relations between the regulations and other policy drivers, including synergistic and antagonistic institutions. Our analysis reveals that problems related to climate change are not considered important. There is a common consensus that global warming causes problems but it is rather a hypothetical statement not reflected in operational goals. The objectives are usually limited to short term social and economic issues. The state of the natural environment is considered very important but this importance is often limited to fisheries, recreation and other direct uses of natural resources. The relation between the state of the environment and climate change seems not obvious to the respondents. Interestingly, current problems are expected to persist and to be equally urging in the future. Although we looked for the regional context, the global perspective prevails in the respondents' minds, and they disregard the scenarios relevant to Northern Europe. Most of the individual and institutional actors agreed that the importance of climate change will increase over time. However, the current situation seems more severe to some respondents than what others believe it will be in 100 years. We conclude that there is a gap between scientific research, policy making and public concerns. This results from the information bias: the latest discoveries rarely influence common thinking. An appropriate information strategy and lifelong education could definitely increase the social awareness of climate change issues. This awareness is essential for actions and decisions optimally based on inventory of possible policy options and their costs and benefits analysis.

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Federal Activities to Support the Determination of Links between Environmental Conditions and the Health of Marine Organisms and Humans

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Marine animal health is affected by stressors including man-made pollution and disease. The National Institute of Standards and Technology (NIST) works closely with the National Oceanic and Atmospheric Administration (NOAA) in evaluating marine-life exposure to man-made toxicants and by archiving specimens for retrospective analysis. These activities allow for assessments of marine animal exposure to stressors that impact their health and provide the opportunity for retrospective analysis of marine mammal tissues. This work supports local, regional, and national-scale management of marine animal populations in U.S. waters near- and off-shore. The information provided by NIST enables informed decision making about which stressors lead to the greatest harm, and to what scale these factors exist and whether they can be alleviated. Methods for assessing contaminants and disease are continually improving. The availability of banked samples from marine species allows for assessment of past levels of contamination, disease, and physiological markers of health and potentially the examination of links to human health indicators. Resource management actions based on information provided by NIST will help to protect and conserve environmental resources now and well into the future.

Blood is progressively being used in health studies for exposure assessment as it can be collected less invasively than tissue biopsies. As such, NIST's most recent effort has focused on the development of methods for the determination of reliable measurements of trace elements and organic pollutants in marine animal blood. Methods have additionally been developed for the determination of "pollutants of emerging concern" in blood, including brominated flame retardants and perfluorinated substances. These have only recently been recognized as potentially toxic to marine life. NIST assists NOAA by developing standardized collection protocols for samples to be used for the assessment of marine animal health. These protocols are being used for assessing the health of bottlenose dolphins, beluga whales, and loggerhead sea turtles. Relationships of pollutant concentrations among various tissues of bottlenose dolphins and sea turtles have been examined to determine if non-lethally collected samples can be used for exposure assessment. Other studies have examined the physiological pathways leading to poor cardiac health in pygmy sperm whales and toxic mechanisms of perfluorinated compounds in northern fur seals and California sea lions.

NIST is also developing NMR-based metabolomics for use as an advanced tool for environmental modeling and risk assessment. A recent example of this work is the examination of metabolites that increase in quantity in the Atlantic blue crab, *Callinectes sapidus*, when under environmental stress such as exposure to a pathogen or pollutant. This work allows for the ecosystem-scale examination and discovery of metabolism-related compounds that correlate with different biological conditions. Understanding these correlations is necessary to reach a more comprehensive understanding of the impacts of pollution or physical environmental change on marine, environmental and human health.

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Standards to Support Sustainable Sediment Management

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Helping to establish the scientific basis for measurement and monitoring of particular substances in the environment that may negatively impact our climate and environmental quality and health is an essential focus of the National Institute of Standards and Technology's (NIST) 40 year lead in environmental stewardship. During this time, NIST have developed Standard Reference Materials (SRMs) for the determination of inorganic and organic contaminants in environmental matrices including marine and animal tissues, air particulate, botanical, soil, and marine sediment materials. Many of these SRMs have been developed specifically to address the regulations and needs of the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration (NOAA). For example, the development of the first marine sediment and mussel tissue SRMs for organic contaminants was initiated to support NOAA marine monitoring programs initiated in the late 1980s where sediments and mussels were used as indicators of coastline health and quality. At this time, NIST issued the first marine sediment SRM for determination of organic contaminants which was prepared from sediment collected in the harbor at Baltimore, Maryland. This material, SRM 1941, found widespread use within the marine sediment community and, as a result, this material has been renewed twice since its original issue.

NIST continues to develop marine sediments to support marine monitoring and sediment management worldwide. These materials serve as the basis for validating accuracy and comparability of contaminant measurements. For the SRMs intended for inorganic analysis, values are typically provided for elements with emphasis on the heavy metal contaminants. Recent efforts have focused on the development of materials for speciated metals (e.g., hexavalent chromium in soil). For the SRMs intended for organic contaminant analysis, materials are characterized primarily for persistent pollutants including polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and chlorinated pesticides. Recent activities have focused on assigning values for new classes of compounds such as brominated flame retardants. The most recent organic contaminant marine sediment was developed to meet the needs for a sediment matrix containing a wide range of different concentrations of contaminants. This material, SRM 1944, was prepared from sediment collected in New York/New Jersey waterways. The material has concentrations of organic contaminants about 10 to 20 times higher than the materials prepared from the Baltimore Harbor. It was developed in part to meet the needs of laboratories involved in the testing of materials dredged from waterways and harbors to determine appropriate disposal methods.

NIST sediment materials also support intercomparison exercises for the determination of organic contaminants in marine sediment that NIST coordinates. These have been on-going since the beginning of NOAA's National Status and Trends Program in 1987. These intercomparison exercises have become an excellent tool for assessing the quality and comparability of analytical measurements among the marine environmental measurement community. We are drawing from this experience to coordinate both materials and an exercise for laboratories involved in post oil spill analyses of samples from the Gulf of Mexico for petroleum hydrocarbons as part of Gulf monitoring and restoration efforts.

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Partnering with Watershed Organizations to Produce Tributary-specific Report Cards

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Following the release of the first Chesapeake Bay report card in 2006, environmental report cards have increasingly gained popularity and recognition as a public-friendly and scientifically sound method for reporting the health of a waterway. Recently, a number of watershed organizations in the Mid-Atlantic region have begun producing their own tributary-specific report cards. In 2009, the Mid-Atlantic Tributary Assessment Coalition (MTAC) was formed to foster collaboration among participating watershed organizations and to fully develop the potential of region-specific environmental report cards. This is done in several ways: (1) by reaching consensus on realistic and meaningful ecosystem health indicators, including selection of appropriate indicators and analysis of historical and current data to determine justifiable ecological threshold levels; (2) standardization of monitoring and sampling protocols, data analysis methods, and science communication techniques; and (3) support of a broader communication strategy for dissemination of individual tributary report cards. A protocol document covering the standardization of monitoring procedures and data analysis for the six core indicators chosen by the group (dissolved oxygen, water clarity, chlorophyll a, total nitrogen, total phosphorus, and aquatic grasses), and the basics for conceptualizing and producing a report card for tidal regions was completed in early 2011, with a similar document for non-tidal regions to follow.

MTAC members represent a diverse range of ecosystems, economic and social groups, and professional backgrounds, but the group would like to expand further to incorporate more members. Currently, members include WATERKEEPERS®, 501(c)(3) nonprofit organizations, scientists, and citizen volunteers. The types of systems represented include rivers, coastal bays, a lake, and Baltimore's Inner Harbor. The original goal of the group was to add an additional one to two members per year, but in the first two months of 2011 alone, four new groups have begun participating. Discussions have also been held amongst the group about how to standardize the collection and analysis of bacteria data, so that it may be used as an indicator in their report cards. As momentum continues to grow for MTAC, which is open to any group that wants to join whether they are currently producing a report card or not, expansion to include groups in the greater Mid-Atlantic will allow for increased collaboration and knowledge-sharing pertinent to the region.

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Study on the Changes of Coastal Zone: Chittagong to Cox's Bazar along the Bay of Bengal

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A twenty-five years long study was conducted on the changes of coastal zones from Chittagong to Cox's Bazar along the Bay of Bengal. The changes of water flow and the flora and fauna of the estuaries of four major rivers viz. Karnaphul, Halda, Sangu and Matamuhuri, which are flowing down from the adjacent Chittagong hill Tracts (CHT) and Arakan Lusai Hills, were studied. Hydroelectric dam on the Karnafuli River damaged 700 km² hill forests, caused mass migration of tribal people.

Human pressure, deforestations, pollution, upstream dams, flatland cultivation practices, shrimp culture, and unplanned infrastructures are the major causes of the changes of coastal zones and of the adjacent hills. Destruction of mangroves of Chokoria Sundarban and Cox,s Bazar are the results of shrimp culture. 91% of the perennial streams of the Chittagong and CHT have lost their dry season flows and a serious water crisis has been prevailing now. Discharge of effluents from the shrimp hatcheries, digging of shrimp ponds and hill-cuttings have caused erosion. The sea current has already damaged 3.4 km sea beach from Kolatoti to Himchari in Cox's Bazar, the world's longest beach.

The study reveals that, 34 species of tropical rainforest plants including *Podocarpus nerifolia* and *Enteda phaseoloids* are facing extinction. Animals e.g. cats, bear, porcupine, wild boars, pythons and anteater etc. are rarely available. Among the marine and coastal zone species Red crabs, jelly fish, sharks, and dolphins are rare but these were the major species before 1980. Great migration of *Hilsha ilisha* towards Myanmar is observed but marine *Hilsha* used to breed in the fresh waters of the Ganges, Brahmaputa and Meghna's meeting point Chandpur to Gualanda about 150-200 km inside Bangladesh. The Halda fresh water fish breeding zone has been shifted 14 km east due to salinity intrusion of the Bay of Bengal.

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Gulf of Mexico Regional Sediment Management Master Plan

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Issues surrounding sediment management, both natural movement and dredged sediments, have significant impact on the ability to restore and sustain coastal habitats. The Gulf of Mexico Alliance has recognized that sediment resources are integral to and a critical resource necessary in accomplishing many conservation and restoration initiatives and objectives in the Gulf. The Gulf Regional Sediment Management Master Plan (GRSMMP) was initiated as a result for managing this valuable resource and verifies the need for a comprehensive understanding of regional sediment systems and processes. The effort involves a range of state and federal agencies as well as NGO representatives. The plan provides guidelines using the understanding of sediment dynamics (inputs, outputs, movement) to manage sediment resources towards accomplishing environmental restoration, conservation, and preservation while enhancing abilities to make informed, cooperative management decisions.

The first step in the development of such a plan is to identify the technical framework that provides an understanding of the foundation associated with regional sediment management (RSM) processes. These processes are critical for establishing management guidelines that balance sediment dynamics and available sediment resources with sediment needs. Sediment management must occur on a regional scale unencumbered by agency, state, or national boundaries. Guidelines and recommendations resulting from this effort will aid the Gulf States in more effective management of sediment resources, recognizing they are a part of a regional system involving natural processes and manmade activities.

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Putting Resources to the Level Where the Work Gets Done: Accelerating Restoration in Maryland

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After 25 years of dedicated effort to restore the Chesapeake Bay, it is clear that Maryland and our partners are not achieving our goal. While improvements have been realized in some areas, there is growing evidence that conditions may be worsening in other areas. A different approach is needed if we are to be successful. To that end, State leaders in Maryland have taken bold steps in their efforts to restore the Chesapeake Bay and Atlantic Coastal Bays.

In 2007 the State of Maryland identified new ways to enhance their land conservation programs, using targeting, to maximize available funding by setting priorities for which new lands were to be acquired. They followed suit in 2008 with the passage of the Chesapeake and Atlantic Coastal Bays Trust Fund (Trust Fund), laying the foundation for an ambitious strategy for restoring and protecting the bays and their tributaries.

The Trust Fund is a unique source of funding dedicated to the reduction of nonpoint source pollution and is a cornerstone to achieving Maryland's portion of the Chesapeake Bay TMDL. Funds are prioritized through geographic targeting based on potential nutrient load into the mainstem of the Bay, strength of local government and partner support, ability to leverage maximum funding, and the potential to demonstrate a measurable difference in a relatively short amount of time. This targeting strategy as well as a new accountability tool in development will be discussed in further detail.

As a case study, the Little Patuxent Restoration Partnership will be discussed. Howard County, MD, and local stakeholder group, Columbia Association, have together received over \$2.9M from the Trust Fund to implement a targeted, multi-practice, restoration effort involving the implementation of dozens of stormwater management projects, a citizen outreach and education program, and an intense monitoring program. This intense restoration effort has attracted additional partners to the project, leveraged local, state, and federal funds, and accelerated the implementation of their watershed plan.

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An Exploratory Investigation of Nutrient Bioextraction Opportunities in Long Island Sound

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The EPA Long Island Sound Study has been investigating the potential application of seaweed and shellfish cultivation and harvest specifically for nutrient mitigation in the nearshore estuarine environments of the Sound. A workshop was convened in December 2009 to bring international experts in seaweed and shellfish cultivation, integrated multi-trophic aquaculture (IMTA), resource economics, and coastal modeling together with local partners to discuss the potential benefits of these technologies to the Sound and other urban, estuarine environments. A combination of (i) watershed; (ii) water quality; (iii) ecosystem and farm-scale models explicitly considering shellfish growth; (iv) economic assessment; and (v) pilot-scale implementation approaches, are being used to evaluate the potential effectiveness of nutrient bioextraction in the highly urban western Sound and to inform policy decisions in this ecosystem. NOAA researchers are planning to assess the environmental effects of a standard mussel aquaculture raft installed in the lower Bronx River by a commercial shellfish farmer and local youth development organization. Results will be used in a project funded by the EPA REServ Program where an international team of scientists will model the bioextraction potential of shellfish in Long Island Sound and characterize the ecosystem services that would be provided by this approach. Bioextraction currently is being considered for incorporation into the revision of the LIS Total Maximum Daily Load (TMDL) for nitrogen. Nitrogen trading as an element to attaining water quality objectives can be considered in the strategies that are developed to implement the TMDL. Bioextraction is not seen as a replacement for nutrient control from watershed sources, but as part of an overall ecosystem strategy to attain water quality standards. Preliminary results suggest that bioextraction is a promising and cost effective complement to traditional land-based nutrient management measures.

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Chesapeake Bay: A Case Study of Citizen Science and Executive Order 13508

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Efforts to restore the Chesapeake Bay watershed have had mixed results over the years. The recent Executive Order (E.O.) 13508 directs federal agencies to coordinate federal Chesapeake Bay restoration projects to reinvigorate the overall Bay clean-up process. E.O. 13508 requires the federal government to increase citizen stewardship throughout the Chesapeake Bay watershed in an effort to engage the public in assisting with the watershed restoration work. One way to increase citizen stewardship in the Chesapeake Bay watershed is through greater federal government engagement with existing citizen science organizations that provide water quality monitoring data for Chesapeake Bay restoration projects. On-going Chesapeake Bay citizen science water quality monitoring projects represent cost-effective solutions that continue to produce large data sets suitable for use by scientists overseeing Bay restoration efforts. At the same time, these volunteer organizations provide a means to increase citizen stewardship in the Chesapeake Bay through hands-on, scientifically-monitored volunteer opportunities to interested individuals regardless of their educational background. Interviews with selected citizen science water quality monitoring groups in Virginia, Maryland, Delaware, and Pennsylvania, revealed areas for citizen stewardship collaboration within E.O. 13508, namely federal sponsorship of a centralized data clearinghouse for data collected by citizen science water quality monitoring organizations for broader dissemination of the data sets, streamlining the federal grant process to improve access to federal funds to citizen science organizations for the acquisition of additional field tools needed for water quality monitoring, and collaborating with citizen science organizations to increase citizen stewardship within the context of the federal government's efforts to comply with E.O. 13508.

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Development of Sustainable Aquaculture as a Model of Satoumi and GAPURA to Improve Productivity of Marginal Brackishwater Pond in the Northern Coastal Area of Karawang, West Java, Indonesia

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A sustainable model of aquaculture by applying an integrated multi tropic aquaculture using Tilapia, Giant Black Tiger Prawn, seaweed Gracillaria and Green muscle was developed to improve the productivity of the marginal brackishwater pond in the northern coastal area of Karawang, West Java. This program was designed to implement the Sato Umi and Indonesian Gapura concept to recommend an appropriate model for sustainable coastal management. The 4 (fourth) treatment of the experimental pond with 3 replications was designed to understand the productivity performance as well as their ecosystem stability (water quality). The result shows that the productivity of pond containing 4 commodities i.e. Tilapia, Giant Black Tiger Prawn, seaweed Gracillaria and Green muscle was the most productive and their water quality was stable (DIN=1.21; DIP=0.15; Sulfide=0.02; Iron=0.39), followed by pond containing Tilapia, Giant Black Tiger Prawn and seaweed Gracillaria with water quality (DIN=2.09; DIP=0.74; Sulfide=0.03; Iron=0.53), Tilapia and Giant Black Tiger pond with water quality (DIN=2.15; DIP=0.21; Sulfide=0.03; Iron=0.21), and Tilapia only pond with water quality (DIN=1.09; DIP=0.33; Sulfide=0.03; Iron=0.12).

To recover the marginal pond in the northern coastal area of Karawang, an integrated sustainable aquaculture model by using multi tropic aquaculture was recommended to be developed within this area to improve their productivity and minimize the organic waste as used in an intensive aquaculture through bio recycle system.

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Post-Aswan Dam Sedimentation Rate of Lagoons of the Nile Delta, Egypt

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This study uses short sediment cores and high-resolution (1-cm sampling interval) radiometric analysis (^{210}Pb and ^{137}Cs) to trace sedimentation rates in Nile Delta lagoons, particularly since completion of the Aswan High Dam in 1964. A declining trend in ^{210}Pb is clearly identified in about 10 cm of the upper-core sediments in the cores M-1 and E-1, accompanied by two spikes of ^{137}Cs in B-4. These findings, together with sediment records from other short cores (B-1, B-2 and B-3), illustrate post-dam sedimentation rates ranging from 0.7 mm a^{-1} to 2.7 mm a^{-1} in the lagoons. Our findings that contrast with those found previously with low-resolution sampling, are the first to report post-dam sedimentation rates and associated chronology. The lower sedimentation rates in the lagoons are a consequence of a dramatic reduction in riverine sediment load to the coastal area as a result of the damming. Although widespread erosion occurs along the open estuarine coast, the lagoon setting remains calmer than it was before the dam due to coastal diking and freshwater regulation in the delta plain in the past decades. This provides the possibility of continuously preserved radiometric records in the less-bioturbated lagoon sediments. Our findings would shed light on the environmental conservation and socioeconomic development in the Nile Delta region.

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Characteristics of Periphytic Algae on Concrete Contained Amino Acid

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Coastal structures such as breakwaters and coastal dikes are built to prevent coastal erosion and storm surge damage. Such artificial structures fulfill the function for years, but recent years the coastal are added new function to contribute to environmental conservation. Here the contribution is acceleration to form ecological chain from periphytic algae, which is the bottom of the marine food chain. A lot of approach is launched in various regions and achieves the certain effect. But few blocks contain pure material which has the physiological function like amino acids. Thus the blocks including amino acid, Arginine, was prepared and ascertained the efficacy of acceleration to form marine periphytic algae in actual water area.

The block was installed into 3.5m depth of the sea in Kojima fishery harbor, Osaka. Then growth of algae on the block was periodically monitored and shown as the time course of chlorophyll a.

The periphytic algae on the blocks contained Arginine after one and half year occupied the surface more than algae on the ordinary block. Especially adhesion of crustose coralline algae on the Arginine block was less than ordinary block in terms of organism species. In addition, the time course of chlorophyll a appeared that growth rate of periphytic algae on the Arginine block was faster than ordinary block. Besides the growth rate of brown seaweed was also faster.

With all these results, this actual sea area test demonstrated that this block contained Arginine filled the role of the basis of marine food chain. In another front, behavior of amino acids in the block was estimated. Slow release of Arginine from the block to water was detected in Laboratory. Combination of further investigation of amino acid behavior in the block and actual tests is considered to provide the more efficient concrete block to environmental conservation.

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The Scope of Liability for Damages to Private Party Claimants for Accidental Discharges of Oil and Hazardous Substances under United States Law

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Two of the worst environmental disasters in American history involving accidental discharges of oil into the sea have put the spotlight on the matter of liability for damages to private-party claimants under United States Law. A good legal regime of liability for damages is essential to provide compensation to those affected by such accidents and to deter conduct that may cause such discharges in the future. The two incidents in question are the wreck of the oil tanker Exxon Valdez in Prince William Sound, Alaska, in 1989 and the Deepwater Horizon oil discharge into the Gulf of Mexico offshore Louisiana in 2010.

This paper will analyze current United States law on the topic of liability for damages and compare this law with relevant international law liability regimes that are in effect in most of the world. The Deepwater Horizon oil discharge will be presented as a case study of the law in operation. Particular attention will be given to the question of damages for what is termed “pure economic losses”, that is economic damages that are incurred without any accompanying damage to any property interest owned by claimants. Examples of such pure economic losses are losses of profits by fishermen who cannot fish because of contaminated fishing grounds and hotel and restaurant owners who lose money when the discharge causes people to cancel vacation plans.

Finally, suggestions will be made to improve the working of United States law and international law.

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University & Municipal Partnerships in Sustainability – A Model for Success

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For the past four years, Washington College's Center for Environment & Society has engaged in a variety of sustainability initiatives on campus and in partnership with the Town of Chestertown. These efforts include recycling, energy savings, urban greening and climate initiatives. The purpose of the partnership is to enable work that might be difficult for one partner to achieve on its own, leveraging scarce resources and expanding the positive impacts. This partnership has allied scientists, citizens, elected officials, and students of varying ages, and it has provided a model for conceptualizing, planning, financing and effecting change at the community level. Since its inception, the program has grown to include additional towns and the surrounding county. The latest phase of the work is designed to further expand its impact, providing easily accessible tools that can be used by elected officials, government employees and concerned citizens to promote change in their own communities.

This paper explores the successes and failures of this partnership program, outlining the steps taken, its concrete results, and the program's overall effectiveness. The utility of tools such as GIS also are discussed. The paper concludes with a projection for future work and suggestions for how this model might be used elsewhere.

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Biological Diversity Policy and Consideration of Marine Protected Areas on Small Island Coasts -Tsushima Island and the Goto Islands

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The 10th Conference of the Parties to the Convention on Biological Diversity (CBD/COP10) in 2010 was held in Japan. The light shed by these international discussions provided an opportunity for some new thinking and developments in the fields of fisheries environment and coastal environmental policy. Biodiversity protection, sustainable use and natural resource management in the vicinity of outlying islands in particular are being seriously considered, and ways of promoting improvements on outlying islands are being reconsidered on the local policy level as well. Consequently, policy readjustment that links the local and international communities in the field of protecting fishery environments will be crucial.

Marine protected areas were a much-discussed issue at COP10, and in response field surveys and interview surveys regarding drift trash were conducted along the coasts of Nagasaki prefecture's Goto Islands with reference to the national park area in Tsushima City being promoted by local governments. On Tsushima Island, survey members participated in the process of drawing up local policy.

In September 2010, a "Marine Protected Area Promotion Committee" was launched, and with a fisherman acting as chair, a concentrated effort has begun to create policy that will promote both sustainable fisheries and nature conservation. In the Goto Islands (Fukue Is.) regular surveys of drift trash on ocean beaches are continuing on the local level, and mechanisms for citizen participation in national park management are being created. The physical conditions of topography and currents support a unique habitat that gives rise to rich fishing grounds. The other side of the coin is that these same conditions render the area vulnerable to damage from drift trash. The former process of negotiations between countries on the trans-boundary issue of marine trash has slowed down progress, but a process under the international convention may show new promise. Japan's Ministry of the Environment has a national strategy for marine biodiversity, but policy harmonization between this ministry and the national administration for fisheries will be needed to deal with fishery environments. Especially needed for outlying islands is a locally based comprehensive marine & coastal environment policy that is adapted to their natural and social conditions.

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Exploring Characteristics of Beach Environments and Issues of Coastal Management through Analysis of Drift PET Bottles along the Shores of Fukuoka/Hakata Bay, Japan

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Despite new legal measures to deal with drift trash on ocean beaches, the problem continues to dramatically worsen. Efforts confined to the local level are approaching their limit, and everywhere a feeling of resignation is invading as the situation reaches impasse. Thus, it is essential to pursue programming that maintains the continuous interest of local citizens and waste management authorities and leads them to adopt original strategic countermeasures. To do this, it is best to break away from the former focus on trash collection and pursue a line that involves local citizens in a process that leads from field surveys to countermeasure creation while connecting locally-based knowledge with oceanography, etc. Marine area management responsibilities fractured among various sectors has obstructed effective measures heretofore; we now need cooperation among them not reactively, but pro-actively in the form of scientific data-based management.

Hakata Bay has been a port city since ancient times; material and humans have long been carried to and from here by ocean currents and seasonal winds. These natural phenomena have now placed it squarely on the route of marine drift trash. The watersheds of the rivers flowing into Hakata Bay have also been urbanized, meaning wind-scattered trash and apparently illegally discarded wastes have also become trash sources. Drift trash originating from in and outside Japan lies intermingled along the Fukuoka/Hakata Bay coastline; its topography provides a good example for considering not only the issue of foreign trash but also the responsibilities and duties of local citizens. This study examined the mechanism of drift trash movement in this area by monitoring drift trash PET bottles for country of origin (starting in 2008, twice a year in September after the typhoon season and March after seasonal winter winds, with about 100 PET bottles collected at each of 6 sites) and interviewing people and authorities involved.

The results of the monitoring survey showed three patterns of drift trash PET bottles on the Fukuoka/Hakata Bay shoreline. We consistently collected (1) mostly domestic bottles in upper Hakata Bay, (2) fewer than 10% foreign-made bottles on south-facing beaches at the harbor mouth, (3) 20% - 40% foreign-made bottles at the harbor mouth (in Fukuoka Bay from the Itoshima peninsula to Shika Is.). The number 3 pattern was also observed outside the bay on beaches facing north towards Japan Sea, but these are sandy beaches strongly affected by winter seasonal winds.

We learned from interviews that large volumes of drift trash are found particularly after the summer flooding season at the estuary of the Tataru River at the head of the bay, and on the beaches opposite this rivermouth on the bay side of the Itoshima peninsula. The monitoring survey is carried out every September just after the season when floods are common, and thus can be considered as reflecting the influx of trash from rivers. Also, the harbor mouth is in a rural area where there is less trash originating from the city. Most of the bottles found at the rivermouth are domestic, having been carried down from the urban areas at the head of Hakata Bay. These bottles continue not only to float out of the bay, but also to impact fishing communities, swimming beaches and nationally designated park areas within city limits. Hakata and Karadomari are harbor areas where foreign vessels have historically berthed, and the particularly large proportion of foreign-made bottles is an interesting historical link.

Because of the divisions among the management authorities for various marine areas, a bay-wide examination such as this has been difficult for the City of Fukuoka government, and so far no strategic plan of action based on a synthesis of information has been attempted. From here on we would like to take the differences in external forces affecting this coast that have attracted attention so far as a "hypothesis" to explain the sources of drift trash and "verify" it together with citizens and authorities through a process of information gathering and observation of the interplay of external factors such as coastal and river currents, winds, etc. and shoreline topography.

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Progress of Citizen Participation and Multi-sectorial Collaboration as the Driving Forces of Integrated Coastal Zone Management in Japan

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Social and legal systems for coastal management in Japan have been fragmented since Japan began its modernization over a century ago. The demands of each field and industrial sector resulted in systems being formulated to achieve optimal results in each individual field or sector, and the initial stage involved integrating domestic and imported western ideas step by step. Starting in the late 1990s, following the Global Summit and the revolution in environmental thinking, citizen participation was promoted in Japan based on amendments to the River Law and Seacoast Act.

In the process of participation, numerous conferences and informal discussion meetings are held everywhere and at every stage. At these meetings, ideas about a 'lack of true common sense' have been expressed by non-governmental sectors. Incorporating the citizen sector as a newcomer to the decision-making process brought about the reconstruction of a new decision-making scheme. Under the former scheme, it was hard to break through barriers of governmental sectionalism to achieve integrated coastal zone management.

The citizen sector is relatively free from pecuniary interests and other ties, so citizens can think about issues in a way that transcends the current dictates of common sense. A case in Japan is introduced: a project to "set back" a sea wall at the river mouth where Nakatsu tidal flat is located, in Oita prefecture fronting the Seto Inland Sea in western Japan. This site is habitat to many endangered species such as the Japanese horseshoe crab.

In the current commonsense view, setting back a sea wall is a kind of taboo for the governmental land management system, even though other countries have chosen this method. In addition, river mouth management is complicated by the jurisdictions held by a variety of administrative departments, for example, departments of seacoasts, ports, protective forests, parks, rivers and fisheries. These administrators find it impossible to compromise if it means losing any of their territorial area, even on a small scale.

At Nakatsu, tidal flat ecosystem conservation activities that started in the 1970s evolved from a protest campaign to consensus building. A multi-sectorial conference decided to select the set back plan in order to conserve endangered species habitat and biodiversity at the river mouth. And, it is very significant that this choice was rational and in fact the optimum for wave and flood disaster prevention. This site provides natural and ecological services to small scale fisheries by local people and environmental educational activities as well.

Even its natural salt marsh and sand bars play multiple roles in conserving human habitat. The set back plan was proposed by a conservation group, and local people agreed to it. Local residents know about this phenomenon based on their experience, but they had not spoken out about older, traditional ways of habitation on this coast. With scientific data and specialists' advice, the local government decided on this rather unusual plan. On the international level, the 1st Asia and Pacific Water Summit was held in Oita in 2007. The Nakatsu example was introduced as a case of good practice of Japanese citizen participation and decision-making systems. In 2010, Nakatsu tidal flat was awarded the International Wetland Prize.

These promotion activities have highlighted the importance of integrated coastal zone management, and are encouraging national and local governments to form a new scheme. Specifically, the Nakatsu case pointed out the following; 1) Citizen participation can be the trigger to overcoming overly compartmentalized management. 2) Multi-sectorial collaboration to decide local affairs activates local knowledge and a sense of local residents' responsibility. 3) For coastal zone administrators, both legal systems and scientific data are essential in order to decide on more rational and ecological methodologies.

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Development of Sustainable Ecosystem Management in Thai Context: Case Study of Five Islands in Thailand

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Thai continent territory consists of 913 islands including 368 islands on the Gulf of Thailand and 545 in the Andaman Sea. These islands have various sizes from the largest area, such as Phuket Island, with 543 sq km, to the smallest area with less than 1 sq km. Differences of island characteristics are not only in terms of size but also landscape, natural resources, distance from mainland, accessibility, and local life styles. On some islands forest preservation areas and agricultural lands have been converted for recreations for sight-seeing places and residential areas that cause environmental impacts. As time went on, ecosystem management in the island focused on economic growth but lacked of efficiency management on environmental aspects. As a result many islands natural resources are deteriorated and adverse environment impacts occurred in many areas. It can be said that many tourism activities affect to environmental pollutions in the area such as noise and air pollution in the area due to from rising number of vehicles, solid waste problem from local people and tourists, deterioration of fisheries resources from wastewater problem.

This research is focused on development of thinking process upon sustainable ecosystem management in Thai context. Few islands will be selected for comparative semi-closed ecosystem studies. Integration of GIS, remote sensing and GPS were employed to identify and analyze some of these characteristics and problems including suitable and unsuitable land use change, land and housing development and tourisms . Field surveys were conducted to collect social and life style of the local people. Questionnaires were distributed to obtain economic situations in the past and present. The simulation method of ecosystems was also employed in this study. Moreover, this research addressed the application of ecological footprints and ecosystem management schemes under a principle of carrying capacity concept. Sustainable development is a main aim of this research. Five study islands, Koh Chang, Koh Samui, Koh Lanta, Koh Yao, and Koh Libong; were selected as study areas. These study areas were analyzed for sustainable ecosystem management in Thai context. Propose from this research will be reached on development format, process, and management system upon island ecosystem in Thailand. These developments will be related with sustainable ecosystem management under carrying capacity concept. At last, this development model will be applied for using in familiar area condition.

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Alternative Stable States of Ecosystems, Tipping Points and Management of the Coastal Seas

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Traditional view on ecosystems as systems with alone steady state is replaced by the Concept of alternative stable states of ecosystems (CASSE). It's important not only for ecological science but also for environmental management. In CASSE ecosystems are complex, adaptive systems that are characterized by historical dependency, nonlinear dynamics, threshold effects, multiple basins of attraction, and limited predictability of their behavior (Levin 1999). In ecosystem transit from one state to another one there are tipping points (TP). Transit from 1st steady state to another one goes through destabilization of ecosystem; TP is a defined level of system destabilization. Before TP system can go back to 1st steady state, after TP it only can transform in new steady state. It is evident from CASSE that an environmental management cannot be taken to one best strategy of nature using; it must be the set of alternative strategies. It's very important for environmental management to evaluate: How is ecosystem far from TP?

Using long-term data on changes in some the Black sea coastal ecosystems we analyze the shifts from one to another steady states in coastline and lagoons. Main reasons of such shifts are changes in regimes of winds, precipitation and temperature as well as anthropogenic disturbance. Some cases: Case of Bakalskaya spit (Crimea, Ukraine, Black sea). The Bakalskaya sand spit having formed through merging of two accumulative spits and now stretching along the northwestern coast of the Crimea. Now we observe a loss of sand from both spits, but much more from west one with rate about 5-10 m per year. 10 year long study shows us that this process is conditioned many reasons both natural/ climatic and anthropogenic origin, and to divide the results of action of different reasons, as a rule, uneasily. Decreasing or growth of beach caused by sand balance on beach – input and output. There are three main sources of sediments input into beach: with rivers, from cliff erosion and biogenic produced in marine ecosystems, in our case - only clayey cliff erosion and mollusk shells. Part of *Bivalvia* shells was 15-30% of total mass of beach sediments. *Cerastoderma glaucum* prevailed, being 12-41% total mass of shells on the beach. *Chamelea gallina* was subdominant. We found a trend of decreasing of fresh shell part in total mass of shells. And it's one of the reasons why the beach loses its area. Decreasing of beach line area, which acts as natural mechanism of prevention of cliff erosion, leads to increasing of cliff erosion and as result to increasing of water turbidity and decreasing of sand bottom biotopes because clayey particles sediments. Of course these reasons lead to decreasing of mussel settlements on bottom, change their species composition. And shell flow on beach decreases more. The mechanism of self-acceleration of loss of beach and erosion of bank is included. These reasons are not all ones causing increasing of beach loss on Bakalskaya spit. There is strong climatic reason – increasing of west winds causes wind tide. There are also anthropogenic reasons: illegal sand mining by local peoples, high level recreation pressure leading to dune devegetation. Devegetation increases sand leaving from beaches very much accelerating wind and water erosion. Smallest sediment particles are moved by wind from devegetated dunes and beaches to sea. It also leads to destruction of bottom sand biotopes with damage to *Bivalvia* settlements. A rate of going out of shells from a beach depends also on speed of their mechanical grinding by waves and recreational activities. As shown in experiments resting on the beach people walking along beaches increase a rate of shell grinding. Its mean high recreational pressure can lead to increasing of loss of sediments (shells) from a beach not only through devegetation. Increasing of coastal erosion is increasing of sediment flow in the sea and leads to acceleration of sea level rising. Acceleration of sea level rising increases coastal erosion. Shifts of marine and coastal communities led to shifts in options for people use. Tipping point in dynamics of spit ecosystem was passed. But it is didn't taken into account by local authorities, no changes in management of recreation on the Bakalskaya spit and there is accelerating destruction - irreversible shift in degraded steady state with decreasing options for people use.

Case of the Crimean closed lagoons. Using 10-year monitoring data we can identify 5-6 steady states of their ecosystems – different taxonomic and ecological groups of primary producers, as well as animals. Different states – different options for nature use. Reasons and consequences are discussed. To have time to prepare to new strategy of nature use is determined by our possibility to evaluate level of ecosystem destabilization TP. These issues are analyzed.

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Field Survey of the 2011 off the Pacific Coast of Tohoku Earthquake Tsunami Disaster in Japan

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On March 11, 2011, a large earthquake of magnitude 9.0 took place, generating a tsunami that caused a severe damage to the east coast of Japan. To comprehensively record tsunami trace heights along the coastal region, the 2011 Tohoku Earthquake Tsunami Joint Survey Group was organized. The author conducted field surveys as a part of this group in Iwate, Miyagi, Fukushima, Ibaraki and Chiba prefectures. In the presentation, the results of these surveys are reported. Inundation heights were more than 15 m in Iwate and in the north part of Miyagi, 5 to 10 m along the coast of Sendai Bay and around 5 m in Ibaraki and Chiba. Buildings, including reinforced concrete structures, were washed away and ships were stranded in land. Coastal structures such as dikes and coastal forests also suffered extensive damage.

Tsunami Shelters and Evacuation Buildings are designed against the worst case scenario that was predicted or anticipated using available scientific and historic information. For the case of Tohoku tsunami, some of the designated shelters were below the tsunami inundation level. An example of this was the case of Minamisanriku, where the tsunami reached the top of one of the Evacuation Buildings. During one of our field surveys, a local resident explained how he had to place his child in his arms so that he was not soaked by the incoming wave, while he took refuge, as instructed, on the top of the 4 story building.

In terms of the usage of hard and soft measures the debate amongst experts in Japan appears to be reaching consensus. Essentially, the idea that hard measures can protect against the loss of life has been discarded. The function of coastal structures would thus be to attempt to protect property or to help evacuation process against the more frequent but low-level events (typically with a return period of several decades to 150 years). Soft measures, on the other hand, would be used to protect lives, and be designed with more infrequent higher level events (with much longer return periods, for example 1,000 years). The cost of using hard measures for tsunami protection is often significant, and their effectiveness is not clear and seems to have been relatively low for massive tsunamis such as the March 2011 one. Future construction of hard measures should proceed after it has been established that they make sense from a cost-benefit point of view, especially considering that they will be expected to prevent damage to property and coastal infrastructure and to help evacuation process by reducing tsunami height.

The author is currently arguing for the classification of Evacuation Points in Japan into three separate categories.

Category A: This category would include hills (higher terrain) that are adjacent to the coast but continue to increase in elevation for a long distance. These would not be isolated low hills, but those that form part of larger geographical features and have a higher hinterland region. A good example would be Akanumayama in the Tarou area, already designated as an evacuation point.

Category B: This would include robust buildings that have 6 or more floors, or hills that are more than 20m in height. This category would have the inherent risk of being isolated during the worst tsunami, but would likely be safe for most events

Category C: This would include robust buildings that are over 4 floors high. This category, however, would have the risk of being overtopped during the worst tsunami events, as described earlier.

Thus, local residents would be trained to attempt to reach the highest category Evacuation Point (A), and proceed only to other locations in the case that better Evacuation Points cannot be reached. Currently, the author is in dialogue with local government authorities of Kanagawa Prefecture and Yokohama City about the implementation of such a system. However, it has become apparent that in some areas, even Category C Evacuation Buildings do not exist (for example in some dockland areas with a high concentration of low-elevation warehouses, which typically have a large workforce during the daytime but

are almost deserted at night). This represents a significant problem, and careful consideration must be given to how to deal with these areas.

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Estuarine Habitat Restoration on an Intertidal/Submerged Cap

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Capping complexities in an estuarine ecosystem are addressed with beneficial modifications to the intertidal and submerged habitats. Containment was accomplished by the construction of a two foot impervious cap consisting of several layers for protection. The intertidal and submerged areas consisted primarily of debris associated with the historical site use. The existing tidal fringing wetland was evaluated using HGM for post evaluation to determine success. As part of cap construction, the debris was removed. Over 100,000 plants of five species were removed, maintained, and incorporated into the fringed tidal wetland restoration. Beneficial modifications include the expansion of a fringing wetland system, development of a transition area and creation of oyster reef habitat. To create the fringing tidal wetland, the rip-rap armament was covered with sand to create a substrate for intertidal planting and the transition area rip-rap was covered with topsoil. The planting and development of the wetland creates a soil bioengineered system to increase protection of the cap. The exposed submerged riprap provides habitat with oyster reef development. An adaptive management plan has been developed for the project to insure the objectives are met for a functioning intertidal wetland, transition area and oyster reef.

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Mangrove Ecosystem Changes during the Holocene from Chilka Lagoon, East Coast, India

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The Chilka Lagoon is the largest open lagoon of Asia and lies on the eastern coast of India between 19°28' to 19°54' N latitudes and 85°05' to 85°38' E longitudes. It has been declared as a Ramsar Site under the convention on "Wetlands of International Importance" in 1981. It is well known for its floral and faunal diversity. During the present times it is under threat due to anthropogenic impact.

In the present study, palynological investigations of surface and core sediments have been undertaken, to decipher the mangrove dynamics and palaeoclimatic interpretations during the Holocene. Surface samples were collected from the different locations within the lagoon, in order to define the composition of modern pollen rain. The pollen spectra recovered from the surface sediments were found to be compatible with the present day vegetation in the area. Apart from this, palynological analysis of a sediment core, supported by ¹⁴C dates were undertaken. The study reveals that mangrove development was initiated in the area around 11,000 yrs B.P. Mangroves began expanding around 8,000 yrs B.P. and reached their optimum about 5,000 yrs B.P., suggesting a warm and humid phase and a concurrent rise in relative sea-level. Since then, a gradual decline in mangroves has been observed between 4,000-2,000 yrs B.P., which can be attributed to the prevalence of dry climate. Since 2,000 yrs B.P. till the present, midland taxa have been replaced the mangroves. The palynological record demonstrates changing patterns of the mangrove vegetation during the Holocene. It also suggests possible extinction of mangrove vegetation in the studied areas and/or displacement of mangroves to other geographical locales. This can be related to fluctuations in the climate and concomitant sea-level rise and fall coupled with anthropogenic activities during Late Holocene.

The present investigation strongly recommends restoration and regeneration of mangroves in and around the Chilka Lagoon, since there was a history of mangrove depletion during Late Holocene. This requires competent managerial practices to restore lost glory of mangrove history on East Coast.

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Fostering Bay Stewardship Values, Understanding and Action through Blended Indoor, Outdoor and Online Learning: A District-wide Case Study from Prince William County, Virginia

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Prince William County, Virginia is a rapidly developing suburb of Washington DC. It is home to an ethnically and economically diverse population and the Virginia's second largest school district. The first two years of a new K-12/University partnership provided "Meaningful Watershed Educational Experiences" to over 10,000 Middle and High School Students across Prince William County Schools. Their teachers were trained to deliver, in partnership with university students and faculty, MWEEs which include schoolyard stewardship projects, inquiry-driven outdoor field studies and computer-based analysis of environmental conditions Occoquan Bay sub-basin of the Chesapeake Bay. Impacts on students' watershed understanding, stewardship values and activities were assessed through pro forma and post-learning surveys. Semi-annual professional learning community meetings allowed teachers' to share and regularly improve their experience with lesson plans developed. Results support benefit to sustaining this sort of program beyond its current 3-year grant period, scaling up to include other jurisdictions, and adapting such methods to foster similar watershed stewardship in other bay and coastal sea basins.

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In the Context of Climate Variability, Assessing Trajectories from Eutrophication to Restoration Over 25 Years in the Tidal Freshwater Portion of the Potomac River Estuary

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As the second largest sub-estuary of the Chesapeake Bay and home to the United States' capital city, the Potomac River historically delivered tremendous nutrient loads to receiving waters of the Bay. This led to massive, pervasive summer algal blooms as far upstream as the tidal freshwater portion of the river. Nutrient management over the past 40 years led to remarkable decline in anthropogenic nutrient loads, despite burgeoning populations throughout the Washington DC metropolitan region. Over the period since 1984, a basin-wide phosphate detergent ban and costly nitrogen removal upgrades at the Chesapeake's largest wastewater treatment plant, Blue Plains, have created conditions for potential decline in water quality impairment. Meanwhile, inter-annual variability in hydrometeorological conditions obscure underlying trends in recovery from eutrophication even in the upper tidal freshwater zone.

The current study examines 25 years of intensive water quality monitoring in the tidal Potomac River near Gunston Cove for signs of sustained water quality improvement. Visualization methods associated with exploratory data analysis are utilized to distinguish impacts of inter-annual climate variability and nutrient management factors. Results show an overall trajectory towards improved trophic status in recent years. Nonetheless, any sustained climatic change which creates longer, drier growing seasons could create conditions which once again favor massive algal blooms. Also discussed are implications for sustained monitoring of the river; implementation of new, ultra-advanced nitrogen removal at a Blue Plains, and development of climate-corrected trends in water quality in other embayments and coastal seas.

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Innovative Web Based Communications and the Chesapeake Bay

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The Chesapeake Bay Program is a unique regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983. The Chesapeake Bay Program partners include the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; the Environmental Protection Agency, representing the federal government; and participating citizen advisory groups.

The Chesapeake Bay Program has maintained a web presence for well over a decade. In that time we have evolved the site both to keep up with the changing landscape of technology and too in an effort to find innovative ways to communicate our diverse scientific messages to broad and ever expanding audiences. The Chesapeake Bay Program website communicates scientific, educational, interpretive and technical information to an incredibly diverse audience ranging from the concerned citizen, to teachers and students, to research scientists, to government agencies to watershed organizations. Communicating effectively to such a diverse range of audiences requires a unique blend of well crafted content, interpretive charts and infographics, up to the minute news, interactive tools and resources and increasingly, the integration of social media and other avenues that encourage active engagement.

The next iteration of the Chesapeake Bay Program web site (launching summer 2011) leverages the latest technologies, both from a backend perspective and in terms of innovative communications methodologies. In redeveloping the site we engaged in a comprehensive discovery process to better understand the needs of our diverse audiences and to develop innovative approaches to communicate the complex science behind the restoration efforts. This led to a redevelopment of the web site information architecture which focused on clearly defining the issues affecting the Chesapeake Bay watershed and explaining how the Chesapeake Bay Program partnership was leading the way to protect and restore this national treasure. With www.chesapeakebay.net we've been able to successfully communicate complex scientific information, such as the importance of underwater grasses or how stormwater impacts rivers and streams and in an easily digested, effective manner online.

In this session, we'll talk about successes, failures and lessons learned in our attempts to communicate Chesapeake science, restoration and to facilitate engagement among stakeholders in the Chesapeake region. We will discuss our discovery process and how that helped us to redevelop the information architecture. Additionally we will talk about the technical approach we choose to developing the site and how that approach will allow us to more efficiently communicate the Chesapeake stories and messages.

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Nut & Bolts: Integrating Social Media into Your Web Site

Guy Stephens

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Social media can take many forms from simple forums, blogs, wikis, podcasts, photo sharing and social bookmarking to dedicated social networks like Facebook and Google. While social networks like these are great tools in and of themselves, they also present opportunities to leverage them to enhance your organizations website. This segment of the panel will discuss specific ways how you and your organization can leverage social media in to enhance your website - whether it is using Flickr to showcase photos on your site or using comments from Facebook there are many options and ways to leverage these resources.

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Questions of Sustainability in a Large-scale Tidal Wetland Restoration in Chesapeake Bay

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As part of the Poplar Island Environmental Restoration Project there is a plan to create approximately 300 hectares of tidal marsh, primarily using material dredged from shipping channels in upper Chesapeake Bay. Unlike the sandy material used in many coastal marsh restoration projects, this material is fine-grained and high in nutrients. Of the first two wetlands completed, one was constructed with the upper Bay material (Cell 3D, planted in 2005), the other with local sand (Cell 4D, planted in 2002). Vegetation and sediment monitoring efforts have revealed striking differences between the two *Spartina alterniflora* marshes, including sparser vegetation and higher recruitment of new plant species in Cell 4D, and lodging, intense muskrat grazing, leaf freckling and high rates of fungal infection in Cell 3D. Biomass production and allocation also differ markedly between these two cells with higher belowground biomass and root:shoot ratios in Cell 4D and much higher aboveground biomass in Cell 3D. Furthermore, extensive die-backs have occurred in Cell 3D but not in Cell 4D.

We hypothesize that the observed differences, including biomass allocation, are due to differences in nutrient content of the upper Bay material vs. sand. Preliminary sediment accretion measurements indicate that the impact of diebacks and low root:shoot ratios is negative, and since external inorganic sediment inputs will be limited in this system by design, belowground production is especially important for vertical accretion. Local sea-level rise is currently 3.2 mm y^{-1} in Chesapeake Bay and expected to at least double over the next century. Given the goal of creating self-sustaining marshes, healthy vegetation leading to adequate vertical accretion is essential. Currently, we are exploring the potential benefits of soil amendments to overcome the effects of high sediment nutrient concentrations on *S. alterniflora*.

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Changes in Dominant Species of Seagrass Bed off Iwakuni, Seto Inland Sea, Japan

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In the area off Iwakuni, Yamaguchi, Seto Inland Sea, seagrass bed consist of two species, *Zostera marina* L. & *Z. japonica*. The following elements are important for the formation of seagrass bed 1) There must be the source of seed supply. 2) Seeds must be flown into the sandy bottom area. 3) The the sandy bottom must be suitable for the growth of *Z. marina* L. or *Z. japonica*. Consequently, to study the cause of changes in dominant species of seagrass after Typhoon No.18 in 2004, the distribution of seagrass off Iwakuni, Yamaguchi and changes in the sandy bottom of the seagrass bed were investigated.

In order to clarify the distribution of seagrass, 1 line was established off Ozu, Iwakuni and distribution range, shoot density, water temperature and disperse coefficient were investigated every 2 months to a year during the period from June 1997 to December 2010. Moreover, in order to study changes in sediment, it was collected and grain constituent was analyzed by JIS A 1204.

From 2005 to 2007, distribution range of *Z. marina* L. had decreased by every attack by typhoon and after 2008, it had repeated the life cycle in which the distribution range did not recover to the level prior to Typhoon No.18 in 2004 even though there had been no typhoon attack and disappeared at a low ebb. On the other hand, distribution range of *Z. japonica* could not be confirmed before Typhoon No.18 in 2004, however it had increased when distribution range of *Z. marina* L. began to decrease after Typhoon No.5 in 2007. Although distribution range of *Z. japonica* varies from season to season, it had changed between 200 to 350 meters.

From 1997 to 2010, no drastic change in downwelling photosynthetic photon flux density (PPFD) and eelgrass community light compensation (I_e) was observed, moreover PPFD was above I_e . Consequently, it can be concluded that the amount of light off OZU seagrass was sufficient for *Z. marina* L. It can also be concluded that particle diameter in sediment had not changed much, therefore, there was no drastic change in the sandy bottom of the seagrass bed.

Although, there was no change in the condition in the sandy bottom of the seagrass bed such as light and in sediment off OZU from 1997 to 2010, after Typhoon No.5 in 2007, *Z. japonica* has become dominant than *Z. marina* L..

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Maryland Bay Restoration Fund (aka The Flush Tax)

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The Maryland Bay Restoration Fund was established in State legislation in 2004. Immediately dubbed “the flush tax” in the press, the law established two separate users’ fees and directed that the revenue from each be placed in two separate dedicated funds. The first, paid by the users of wastewater treatment plants, is \$2.50 per month, which is dedicated for the upgrading of wastewater treatment plants to remove nitrogen and phosphorus from their discharges to State waters. The second, paid by users of onsite sewage disposal systems (septic systems), is \$30 per year, which is dedicated 60% for upgrading onsite sewage disposal systems to remove nitrogen and 40% for planting cover crops on agricultural fields to prevent nitrogen from leeching into the groundwater.

Since 2004, the Fund has received over \$431 million that has been invested in upgrading the State’s major wastewater treatment plants (\$352 million), upgrading onsite sewage disposal systems (\$42 million) and planting cover crops on Maryland’s farms (\$37 million).

Maryland’s 67 major wastewater treatment plants produce 95% of the treated sewage discharged in the State. Twenty two plants have been upgraded and are in operation. Another 17 facilities are under construction, 14 are in design and the remaining 14 are in planning. When completed in 2017 the upgrades will result in an additional 8 million pounds per year nitrogen loading reduction to Chesapeake Bay, which is over 1/3 of the nutrient reduction needed to achieve Bay water quality goals. Over 3,000 septic systems have been upgraded to cut nitrogen loading by 36,000 pounds per year and in 2011, over 400,000 acres of cropland were planted in cover crops, reducing another 2.4 million pounds per year.

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Community Participation in Research on Seagrass Ecosystem in Krabi Province, Thailand

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Universities and research institutions in Thailand are opening up to the real problems at local communities. They are embarking on various community outreach and engagement activities involving local school students as research assistants. The present paper provides a case study on research collaboration between the Marine Biodiversity Research Group of Ramkhamhaeng University (MBRG-RU) and a local community at Koh Pu, Krabi Province in southern Thailand. The main objective was to examine seagrass community changes, especially population dynamics of an economically important gastropod *Strombus canarium*. The research plan was developed as working partnerships between the local community and the university research group in order to involve local people in planning their future of sustainable uses of seagrass associated organisms and to raise public awareness on conservation of coastal resources. The MBRG-RU provided a research fund, equipment and training a group of local school students on monitoring methods of seagrass ecosystem. The students surveyed and collected samples according to the planned schedule every month. The researchers worked and discussed with the students quarterly for data analyses. The study in details, such as identification of seagrass associated organisms and analyzing environmental parameters by using sophisticated instruments, was carried out at the MBRG-RU laboratory. The research project was strongly supported by their parents and local community leaders and the research data were used by local people for giving them the information about status and trends of their harvested species. We recommend that one important role for universities in Thailand is to empower local people for managing natural resources and environment therefore research and teaching activities should be integrated in a way that leads to a mutual learning process among all stakeholders concerned. Universities and research institutes have opportunities to conduct research relevant to local community needs and to provide service learning for local school students. Local schools and universities should offer credits for students for working on research projects as part of their curriculum. We should emphasize on enhancing local capabilities and networks among various local stakeholders through small long-term research projects. Financial sustainability for research is very important to facilitate further participation of local communities.

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Preserving the Ecological and Recreational Values of Florida Waterways

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Coastal communities face the challenge of balancing the use and protection of their waterway resources. Over the past four decades, Florida's coasts were transformed as population growth and demand for shorefront property led to the creation of residential canal developments. Thousands of miles of channels and basins were dredged as a by-product of this urbanization process, and boaters soon followed: Florida has the most registered boats in the U.S., with just under 1 million. A result is that navigable waterways and aquatic resources are being stressed by increasing boat traffic and canal-side activities.

Recognizing their common goal to preserve the recreational and ecological value of southwest Florida waterways, the Florida Department of Environmental Protection, the West Coast Inland Navigation District, which serves four counties that contain 8% of Florida's population and 12% of its registered boats, and the University of Florida Sea Grant College Program signed a Memorandum of Agreement. The signatories agreed to develop a science-based Regional Waterway Management System (RWMS): a new approach to waterway planning and permitting based on carefully mapped channel depths, a census of actual boat populations, and the spatial extent of aquatic resources. The GIS-based RWMS provides a comprehensive, regional overview of channel conditions and the geographic distribution and severity of existing impediments to safe navigation and resource protection. RWMS information and analyses result in regional-scale permitting to accommodate water-dependent uses while minimizing environmental impacts and reducing public expenditures. It is the basis for counties, the WCIND, and the state to move boating channels from a series of ad hoc user "trails" to a defined boating transportation infrastructure that serves to separate boats from sensitive marine habitats.

Since its inception, this state-approved approach to waterway planning and permitting has resulted in two innovative state administrative rules and has saved taxpayers over \$3 million dollars. The state rule for one county authorizes zones to exclude vessels with combustion engines in areas of scarred seagrass to mitigate maintenance dredging activities in aquatic preserves. This approach helps to achieve an appropriate balance between waterway use and resource protection.

The adoption of the RWMS by the State of Florida and implementation of the state administrative code demonstrate the ability of sound science to guide state waterway management activities. Benefits include: (1) state policy based on "best available science," (2) better efficiency and effectiveness in waterway maintenance, (3) savings in dollars and staff time, and (4) better public policy through holistic, ecologically based decision-making that is predictable, fair, and cost effective.

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A Review of Nutrient Concentrations in the Eastern Seto Inland Sea, Japan

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The water quality of the Seto Inland Sea has changed in the recent decade compared with that of the 1970s and 1980s. Although the reason is unknown, dissolved inorganic nitrogen concentrations have decreased significantly after the year 2000. Commensurate with changes in nutrient levels, the fisheries yield of species such as sardine, short-neck clam, and Nori (*Porphyra*) have also declined. One hypothesis for the gradual decrease of nutrient concentrations is due to a law enacted by the Environmental Agency, and various other efforts to improve water quality. Nevertheless, an explanation for the recent decrease of nutrient concentrations has not yet to be provided. We conducted hydrographic observations of physiological conditions, nutrient and chlorophyll *a* concentrations, and compared our results with the various previous environmental monitoring data at Harima-Nada, including connecting Shido Bay, the eastern part of the Seto Inland Sea. We found that nutrient concentrations of the bottom ocean layer during summer periods after 2000 were quite low compared to the years before 1990. Nutrient concentrations in the surface seawater did not increase when mixing occurred compared to those of the stratified season. In this study, we discuss the reasons for the recent decreases in nutrient concentrations within the context of the following: (1) decrease of nutrient loading from riverine sources, (2) decrease of recent rainfall amount and change of the manner of rainfall, and (3) decrease of the upward nutrient flux across the overlying water-sediment interface. Our results can provide valuable information for consideration in the management of nutrient concentrations of the enclosed sea.

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An Approach to Reduce the Garbage at the Bottom of the Seto Inland Sea through Two Activities: Collecting Garbage at the Sea Bed and Raising Public Awareness of the Consequences of Inappropriate Waste Management

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Based on our estimation, over 13,000 tons of garbage is piled up at the bottom of the Seto Inland Sea. Most of that garbage is carried to the sea through the rivers which flow into it. How did that garbage get to be in the rivers? The answer is that it was mainly put there by the people who live in the cities, towns, and villages, surrounding the Seto Inland Sea. The Seto Inland Sea bed is now covered with a lot of garbage. This prevents life to flourish there and is slowly destroying in the sea. The problem is becoming more and more serious partly because it is so difficult to remove the garbage, but mainly because the general public is unaware of the serious consequences to use their local waterways as dumping sites. In order that the Seto Inland Sea is to be preserved, we have to raise public awareness of this serious problem. We are trying to tackle this problem in two ways. First, we helped remove the garbage from the sea bed by using small trawling fishing nets attached to fishing boats. Actually we did this action four times over last year. Our second plan of action is to make the public aware that they are giving a very negative effect on the local fishing economy each time they throw their rubbish into the rivers. I hope these two ways will lead to a large reduction of the garbage piled up on the bottom of the Seto Inland Sea.

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Addressing Critical Environmental Issues Facing the Maritime Industry

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The Maritime Environmental Resource Center (MERC) was created by the University of Maryland Center for Environmental Science and Maryland Port Administration, with additional support from the US Maritime Administration, National Oceanic and Atmospheric Administration, and American Bureau of Shipping, to provide test facilities, expertise, information, and decision tools to address key environmental issues facing the international maritime industry. The primary focus is to evaluate the mechanical and biological efficacy, costs, and logistical aspects of ballast water treatment systems and to assess the economic impacts of ballast water regulations and management approaches. Invasions of coastal habitats by non-native aquatic species are increasingly common worldwide, are known to cause extensive ecological and economic damage, and have the potential to create human health concerns.

MERC has four main objectives:

- Provide technology developers/vendors with facilities and expertise for pilot-scale and shipboard evaluations of treatment systems;
- Provide regulatory agencies and classification societies with standardized, rigorous, and independent data on treatment system performance;
- Provide ship builders and shipping lines with information and decision tools to select the most appropriate ballast water treatment options; and
- Remove as much uncertainty as possible from emerging markets for treatment systems in order to accelerate the adoption of innovative technologies.

While the initial and primary focus of MERC is on ballast water treatment systems, the Center has the expertise, facilities, academic independence, and scientific integrity that will allow for testing and assessment of additional technologies and innovations related to Green Shipping, including hull fouling invasive species, port and vessel air emissions and alternative fuels, and gray and oily water treatments.

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Real-Time Environmental Monitoring of the Patuxent River

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Real-time, quality-controlled environmental data is key to both improving predictions of climate change and large-scale weather events, and for accurate forecasting and instantaneous information on weather and water quality changes that impact coastal ecosystems and communities. It is because of this need that the Chesapeake Biological Laboratory (CBL) has maintained weather and water quality data observing equipment at both the mouth of the Patuxent River on CBL campus and on the mid-Patuxent River.

Water quality data is gathered using multiparameter instruments capable of measuring temperature, salinity/conductivity, turbidity, chlorophyll fluorescence and dissolved oxygen. One water quality instrument package is positioned on the CBL Research Pier at the mouth of the Patuxent River (where daily water temperature and salinity measurements have been recorded since the 1930's) and the associated weather station is positioned just onshore. This station measures wind direction and speed, temperature, humidity, barometric pressure, rainfall, UV radiation, soil moisture and temperature and leaf wetness. The other instrument package is located on a pontoon buoy system on the mid Patuxent River. The mobile buoy also contains a weather station, which measures wind direction and speed, temperature, humidity, barometric pressure, and rainfall. The water quality and weather data from both stations is then sent to our lab using radio telemetry, archived and displayed on the web through our own website, through Maryland DNR's Eyes on the Bay Program, and through the broader U.S. Integrated Ocean Observing System, where diverse groups ranging from local watermen to academic researchers have access to the information.

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Chesapeake Bay Program Monitoring Realignment: Reprogramming to Address Senior Management Partnership Priorities

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A comprehensive review of the U.S. Environmental Protection Agency's Chesapeake Bay Program (CBP) Partnership's Bay and Basin water quality monitoring programs was conducted from 2007 through 2009. The process involved the CBP Scientific and Technical Advisory Committee coordinating a workshop series with Senior and Program Managers representing the jurisdictions and agencies across the watershed. Managers recognized a need for a wide-range of information but requested programmatic optimization focusing the limited Federal and Match funding resources on a narrow set of objectives:

- To support monitoring needed for accountability in tracking Clean Water Act 303d listing and delisting analyses in Chesapeake Bay and its tidal tributaries, and
- Simultaneously, to support the assessment of management action effectiveness in the watershed.

The CBP Management Board used a stakeholder developed and ranked disinvestment-reinvestment-consequences matrix to evaluate trade-offs supporting decision options of the CBP Bay and Basin Monitoring Program realignment.

Since 2009, implementation of the Chesapeake Bay Program monitoring realignment decisions has occurred sustaining Chesapeake Bay Tidal Long-term Water Quality Monitoring Program needs of the partnership with acknowledged gaps. Management Board decisions further supported updates to the Basin monitoring programming that focused on areas with watershed targeting efforts for best management practices. Targeting management actions relied on modeling efforts identifying high nutrient and sediment yield regions impacting Chesapeake Bay water quality. Priority watersheds were small watersheds slated for focused and increased management action implementation efforts. Enhanced monitoring needs were identified to focus on addressing priority watershed monitoring needs. CBP Workgroups worked with stakeholders to identify additional monitoring sites needed to address key gaps in land use representativeness for watershed assessments while also improving calibration needs of the Chesapeake Bay Watershed Model as funding becomes available. Site recommendations were made to better address accountability of management actions and their effectiveness from the existing Basin monitoring network.

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Integrating Clean Water Act Requirements with Ecosystem Based Management Approaches in the Long Island Sound

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Eutrophication is among the most serious threats worldwide to the function and services supported by coastal ecosystems (Boesch et al., 2001). Attempts to reverse coastal eutrophication have centered on reducing land-based sources of nutrients, such as fertilizer applications, wastewater treatment plant dischargers, and air emissions. Both regulatory and non-regulatory approaches to assign source control responsibility are aided by the perception of all parties that allocations are fair and equitable, using resources wisely to maximum environmental benefit. Balancing legal requirements for attaining water quality standards with the costs of attainment, who pays, and for whose benefit are primary challenges to arriving at equitable and implementable solutions.

In addition, historical alterations in habitat quality, food webs, and community structure in coastal systems can alter nutrient processing, thus modifying the ecosystem response to reduced nutrient loads (Duarte et al., 2009). A systems approach that integrates watershed load reduction programs with enhanced nutrient processing in coastal systems may prove more effective at restoring ecosystem services at less cost than load reduction programs alone, helping to arrive at cost-effective, affordable, and equitable solutions.

The United States Environmental Protection Agency is working with five catchment states to revise a Total Maximum Daily Load that was developed by the states of Connecticut and New York (CTDEP and NYSDEC, 2000) for nitrogen discharges to attain water quality standards for dissolved oxygen in Long Island Sound. Over the past decade investments of more than \$1 billion have been made to upgrade wastewater treatment plants in Connecticut and New York to remove nitrogen and to better manage nonpoint sources. Additional investments in watershed infrastructure and management practices of more than \$1 billion are possible. As part of the TMDL revision, equitable allocations for the states of Massachusetts, New Hampshire, and Vermont will also be evaluated. The presentation will focus on the challenges to arriving and implementing equitable allocations for nutrient control among both land-based source controls and the application of nutrient bio harvesting (defined here as removing nutrients from an aquatic ecosystem through the harvest of enhanced biological production, including but not limited to the aquaculture of suspension-feeding shellfish and/or algae) for the Long Island Sound ecosystem. Elements to a systems approach to Long Island Sound that integrates watershed load reduction programs with enhanced nutrient processing to attain water quality standards, restore designated uses, and restore ecosystem services will be emphasized.

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Relation between Depositional Environment and Scallop Culture at Subarctic Lake, Japan

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Lake Saroma is located in the subarctic zone and connected with the Sea of Okhotsk through two channels. This lake has an area of 150km² with an average depth of 9m, maximum depth of about 20m, and is the biggest lagoon in Japan. In addition, average salinity is 33psu as high as the coastal sea. In summer, water temperature rises up to a maximum 22°C. While in winter, Lake Saroma freezes up at all area and is receiving drift ice from the Sea of Okhotsk. In spite of the above described seasonally this lake has great economical influence in Japan. 53% of the total area (80 km²) is occupied by scallop culture. Average scallops production amounts to 6500 tons per year. Bivalves like scallop are filter-feeding organisms, and are playing a significant role of the material cycling. However, water quality problems such as hypoxic events do occur in summer and it affects growth of the scallops. Based on this background knowledge, we examined the physico-chemical properties in sediments based on organic carbon, nitrogen and phosphorus. We tried to understand the depositional environment in Lake Saroma. Finally, our study shows necessity of having scallops culture based on physico-chemical properties to stabilize the scallop culture.

We collected sediment samples for the upper 0-1 cm with Ekman-Birge type bottom sampler from sixty stations over the whole area of Lake Saroma on September in 2005 and analyzed Chlorophyll a (Chl a), organic carbon (Org-C), organic nitrogen (Org-N), total phosphorus (TP), stable isotope ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$), total aluminum (TAI) and total silicate (TSi). Results shows that, Chl a, Org-C, Org-N and TP has an average of 73±86 µg/g, 18±12 mg/g, 2.0±1.3 mg/g and 0.5±0.2 mg/g, respectively. Org-C showed exceeded 30 mg/g at a few stations, this is similar to other bays in Japan (Tokyo Bay and Osaka Bay) and such regions are known as eutrophied area. Horizontal distribution of Org-C, Org-N and TP showed larger value at regions of deeper bathymetry. Chl a/Total-pigments showed larger value at shallow regions. So, this feature tends to conclude that the benthic-microalgae were more active at shallow areas and more organic matters accumulated at deep areas. Org-C, Org-N and TP exhibited relatively high value beneath the scallop farming areas. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ has an average of -21.4±1.3 ‰ and 4.2±0.9 ‰, respectively. TAI and TSi indicated an average of 65.4±6.6 mg/g and 308±28 mg/g, respectively. We suggests that TAI can be used as an index to understand percentage of supplied amounts of terrestrial materials from river since showing higher value at terrestrial side and lower value toward the sea side. While TSi showed higher value along the Sea of Okhotsk side, matching with the Chl a/Total-pigments horizontal patterns. TSi was increased with an increase of biogenic silicates from shell of benthic-microalgae. Based on the all chemical properties, we categorized sediments in Lake Saroma as four, estuarine side, central side, first channel side and shallow side. One result sheds light to the fact that, Lake Saroma is influenced by several complex intertwining factors such as depth, rivers, near by the sea and the scallop culture facility.

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Assessing Natural Resource Condition of Assateague Island National Seashore

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As part of a nationwide effort by the National Park Service in the USA to assess natural resource conditions in 270 national parks, Assateague Island National Seashore was assessed using a framework that provides a structure for integrating natural resource data for sustainable management goals. A habitat framework was applied where significant habitats within and adjacent to the National Seashore were identified, along with appropriate metrics (5–10 per habitat) and ecologically relevant metric thresholds. Data were measured against these thresholds and then the habitats were ranked from healthy to degraded. This framework allowed assessment of the natural resources of the coastal habitats from adjacent watersheds and barrier island lagoons to the island itself and adjacent coastal ocean. It also provided a method for including metrics and habitats that are priorities for management, such as the federally listed seabeach amaranth and piping plover, which inhabit the early-successional overwash areas on the island. Another management priority is the mitigation of island erosion which occurs as a result of two jetties at the northern end of the island that interrupt sediment transport. A sand bypass project aims to alleviate this erosion, and the metric of beach shoreline rate of change was applied to the beach and intertidal habitat to track progress towards this management goal. Other habitats assessed include forest and shrubland, salt marsh, bayside mudflats, inland wetlands, and Atlantic subtidal. Other metrics used in the assessment include horse abundance, seagrass area, salt marsh erosion, and exotic plants.

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Implementing a Hazard Resilience Tool: The Coastal Community Resilience Index

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The Coastal Community Resilience Index seeks to increase risk awareness among local communities of their susceptibility to natural hazard events. Developed in partnership with the Gulf of Mexico Alliance, the CRI is delivered through interactive sessions with community decision-makers and facilitated by trained facilitators from Sea Grant Extension, Cooperative Extension, National Estuarine Research Reserves, and other partners. Now in the implementation phase, the CRI will be delivered to at least five communities in the five Gulf of Mexico states, with each community completing the CRI at one-year intervals. Tool effectiveness will be measured through qualitative and quantitative data in the initial three-year implementation and evaluation period. The CRI is a snapshot in time, assisting communities in assessing their natural hazard preparedness and planning. The recipient audience can include floodplain managers, land-use planners, local elected officials, natural resource managers, and emergency managers, and is applicable at the city and county or parish level. The CRI can be coupled with existing training programs as an entree to introduce other natural hazard planning topics, such as sea level rise and climate change to coastal communities. The end outcome is for communities to take actions to address the weaknesses they identify utilizing the CRI, and community decision-makers that are more informed on their community's level of risk, ultimately increasing their capability of responding to disasters. The CRI development, delivery and adaptation model can be readily transferred to all U.S. coastal communities, and is easily adapted for natural hazards more applicable to inland communities.

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Fostering Flats Conservation and Stewardship in the Bahamas

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At the interface of land and sea, flats and their associated shallow environments provide a range of ecosystem services including stabilization of sediments, nutrient cycling, and providing habitat for a diversity of fish and invertebrates. Flats ecosystems in The Bahamas support one of the most productive fisheries in the world. Anglers travel to The Bahamas to fish the crystal clear waters of the flats for bonefish (*Albula vulpes*) and other species. A recent study of the importance of recreational flats fishing revealed that flats fishing generates \$141 million of economic value to the Bahamian economy annually with direct angler expenditures for flats fishing activities supporting the equivalent of 2500 Bahamian jobs.

Unfortunately, nearshore flats also tend to be the focal point of coastal development which often entails clearing sites of all vegetation, altering shoreline areas, and dredging to accommodate marinas, harbors, and high density residential or resort development. This type of development and its associated human activities result in habitat destruction, declines in biodiversity, and loss of critical ecosystem services. Given their ecological and economic importance, the conservation and protection of flats ecosystems is imperative to the future of The Bahamas.

To foster increased awareness about the importance of coastal flats habitats and the responsibility for their conservation, the Fisheries Conservation Foundation (FCF), Bonefish and Tarpon Trust (BTT), and Bahamas National Trust (BNT) have come together to form the Bahamian Flats Fishing Alliance (BFFA), a unique multilateral partnership. The goals of the BFFA are to a) provide scientific assistance and advice to efforts within the Bahamian fishing industry to organize a national association of guides and lodge owners to lead conservation efforts; b) conduct collaborative research and education/outreach projects addressing management and conservation issues of the flats environment and its fisheries; c) develop and implement an effective campaign to communicate the findings of such efforts to relevant policy-makers, resource managers, and the public; d) assist decision-makers in developing scientifically sound strategies to address relevant fisheries and coastal resource issues; and e) encourage public support for such strategies.

Accomplishments of the BFFA to date include conducting an economic study on the impact of flats fishing to the economy of The Bahamas, holding the first Bahamas Bonefish Conference, and fostering formation of a Bahamian Flats Fishing Guide Association (BFFGA). To better understand bonefish biology and ecology, identify key linkages in flats ecosystems, and assess the role of natural and anthropogenic disturbances on these inshore habitats scientists affiliated with BFFA member organizations and the Cape Eleuthera Institute (CEI) are using an integrated research approach to determine when and where bonefish spawn, assess the potential impacts of global climate change, identify the best ways to catch and release bonefish to maximize their survival, and study what habitats are critical for which life stages and how they impact bonefish growth, maturation, and longevity. The relationship with the BFFGA is an essential component of BFFA's work. By collaborating with the fly fishing guides, they become part of the data gathering process and are invested partners in research and conservation.

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Support Project of Total Pollutant Load Control System Introduction

T. Yamada, H. Hashimoto and Y. Muroishi -- presented by **Ryuji Tomisaka**

Office of Environmental Management of Enclosed Coastal Seas, Water Environment Management Division, Environmental Management Bureau, Ministry of the Environment, Japan

Pollution was produced throughout Japan's period of high-level economic growth in the 1960s, and this became a major societal issue. With the concentration of population and industry in coastal regions, large quantities of pollutants and substances that cause eutrophication flowed into the ocean, and damage to fishing operations due to "red tides" occurred in addition to environmental pollution from oil spills. To mitigate this situation, the Water Pollution Control Law and various other laws and systems for pollutant control were established, and construction of sewer systems, waste water treating facilities and so on was promoted.

One of these measures was the implementation of a Total Pollutant Load Control System (TPLCS) based on the Water Pollution Control Law and the Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea. The TPLCS are designed to reduce the total pollutant load of pollutants flowing into enclosed coastal seas, into which large quantities of water from domestic and industrial activities flow due to the concentration of population and industry in these areas, and for which it would be difficult to achieve and maintain a desirable water quality with effluent regulations based on emission concentrations alone. In Japan, the TPLCS was introduced to Tokyo Bay, Ise Bay and the Seto Inland Sea, and efforts have been promoted to improve the water environment in these water regions.

Moreover, in other countries that are now experiencing dramatic economic growth, eutrophication of water regions due to the generation of large quantities of pollutants is becoming a serious problem in some areas, as it was previously in Japan. TPLCS are thought to be effective in dealing with this problem, but in some cases the technical and institutional knowledge needed to introduce these systems is not in place.

For this reason, Japan is now making use of its accumulated experience in TPLCS to provide international assistance to various countries, primarily countries in East Asia with which it has close ties, in order to help these countries achieve sustainable economic development. Beginning in April 2009, Japan conducted joint research with China on total pollutant load reduction for nitrogen and phosphorus. This cooperation resulted in ammonia nitrogen being introduced as a new target item for total pollutant load reduction in China. Moreover, based on Japan's experience and knowledge and its joint research with China, plans are underway to prepare and release guidelines for the introduction of TPLCS.

Through these activities, Japan hopes to contribute to efforts to improve water environments in other countries that are now facing the same problem of serious eutrophication of their water regions.

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Let's Make the Sea of Amagasaki Blue! – A Project on Restoration of Osaka Bay

Katsuhiko Touzaki

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Amagasaki Port, located in the innermost part of Osaka Bay, and the Amagasaki Waterway partitioned by lock gates have particularly bad water quality in Japan. We are working on the improvement of water quality in those areas. In our research, we are examining water quality of the Amagasaki Waterway, Amagasaki Port, and Osaka Bay in cooperation with Hyogo Prefecture, utilizing an investigation ship of the Hyogo-Prefectural Amagasaki Port Administration Office. We are also doing some experiments on helping bivalves grow in the waterway and checking their ability to purify water, utilizing them as fertilizer after the experiments. We are working on the project in cooperation with local elementary and junior high schools, universities, the local government, and local residents, hoping that this project will be a leading model for environmental restoration of the Seto Inland Sea including Osaka Bay and other enclosed coastal seas around the world. In the future, we are going to rouse high school students to take action on environmental research and restoration in the Seto Inland sea and enclosed coastal seas in the world. We are hopefully going to hold a national forum of high school students.

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The Effects of Debris on Marine Mammals and Sea Turtles

Kristin Treat and ***Casey Firth***

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Marine debris is anything manmade that is found in the aquatic environment. Debris is deposited from ocean or land based sources. Ocean-based sources include vessels and other offshore rigs. Land-based sources include municipalities, construction, and individuals. Direct impacts occur when marine life is physically harmed by debris; these impacts include ingestion and entanglement. Indirect impacts occur when the marine ecosystem is altered, resulting in ecosystem degradation and an increase of invasive species. The extent of the problem associated with marine debris can be determined by conducting beach surveys of a local aquatic habitat. The research protocol was to survey three different beaches in the Oxford area of Talbot County, Maryland by using randomly selected one by three meter square quadrants in each area. Based on these beach surveys, the most prominent debris found was plastic. In addition, surveys were conducted at Easton High School to determine students' understanding of the effects of marine debris and to gauge their awareness of the problem. Based on these surveys, most students were unaware of the problems and ways to prevent marine debris from entering aquatic environments. Under the direction of Maryland Department of Natural Resources scientists and the Marine Mammal Stranding Team, student researchers also participated in the necropsy of a beached seal. This comprehensive approach to research enabled the students to make sound decisions regarding action which would help address the local marine debris issue.

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MedPartnership: A New GEF Project in the Mediterranean

Ivica Trumbic

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The Strategic Partnership for the Mediterranean Large Marine Ecosystem (MedPartnership) is the largest project ever in the Mediterranean, with funding of over 100 million US\$ including investments and co-financing, and is the first project to bring together some of the main partners working in the Mediterranean for joint implementation of actions. It is one of the largest projects in the Global Environment Facility (GEF) Large Marine Ecosystem portfolio. MedPartnership consists of two projects: Regional Project (led by United Nations Environment Programme/Mediterranean Action Plan – UNEP/MAP), and Investment Fund (led by the World Bank). The Regional Project has 4 components (management of natural resources; reduction of land based pollution; biodiversity conservation and protection; and project management including communication and replication). The Investment Fund has so far identified 11 investment projects. The Project will be carried out in the following countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Syria, Tunisia and Turkey. The Palestinian Authority also participates. Its duration is 5 years and will be completed by mid 2014.

The major environmental concerns and 101 hotspots in the Mediterranean were identified in the Transboundary Diagnostic Analysis (TDA). The actions for their remediation were identified and agreed in two Strategic Action Programs (SAPs) aimed at reducing land-based sources of marine pollution (SAP-MED) and protecting biodiversity and living resources and their habitats (SAP-BIO). In order to support the countries in the implementation of the two SAPs, as well as to support the implementation of the new Integrated Coastal Zone Management (ICZM) Protocol to the Barcelona Convention, the MedPartnership will address the need for financial resources and investments (led by the World Bank) and the assistance in policy, legislation and institutional reforms, as well as the demonstration and transfer of technical knowledge and best practices (led by UNEP/MAP) to achieve the goal of improving the environmental conditions of the Mediterranean Sea. Executing partners of the project include UNESCO/IHP, FAO, UNIDO, UNEP/MAP's regional activity centers (CP/RAC, SPA/RAC, PAP/RAC and INFO/RAC) and the programme MEDPOL. Non-governmental organizations include GWP-Med, MIO-ECSDE and WWF.

The Strategic Partnership for the Mediterranean will result in some of the following:

- A long term partnership for joint planning and financing in the Mediterranean;
- The improvement of environmental conditions in 15% of Hotspots and sensitive areas;
- More sustainable use of coastal resources through use of IW and ICZM;
- The reduction of pollution from land based sources;
- More sustainable use of fisheries resources through the adoption of an ecosystem based approach to fisheries, and improved protection of critical biodiversity;
- The replication and scaling up of investment projects and demonstrations, etc.

Results of the 2 years of MedPartnership's implementation will be presented as well as an outline of the final product of the project and its contribution to the improvement of the Mediterranean LME.

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Managing Development and Chesapeake Bay's Estuarine Fish Habitat and Fisheries

James H. Uphoff, Jr. and Margaret M. McGinty

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An understanding of potential problems from suburban development for Chesapeake Bay's estuarine fisheries is emerging. Sprawl, measured as impervious surface (IS), is associated with multiple stressors of fish habitat. Development of watersheds from rural (<5% IS; farms, forest, and wetland) to suburb (>10% IS) disrupts stream hydrology and spawning by anadromous fishes. Yellow perch egg and larval survival in estuarine nurseries is related to the amount of IS and egg viability and larval feeding appear to be affected. In several watersheds, yellow perch egg and larval viability is too low for successful compensation by reduced harvest. Dissolved oxygen (DO) in bottom waters of the Bay's brackish tidal tributaries diminishes with IS and becomes hypoxic during summer as the watershed becomes suburban; use of this habitat by blue crab and fish declines because of low DO. Contaminant burdens in white perch increase with IS, leading to human consumption advisories and the potential for detrimental reproductive effects. While generally small subestuaries have been impacted by development so far, remaining rural watersheds will become increasingly influenced by sprawl in the future. Currently, regulation of land-use and stressors associated with it is scattered among local, state, and federal agencies. Fisheries managers will need to join with these agencies to preserve rural watersheds, restore watersheds with manageable damage, and steer growth to less valuable watersheds.

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The Health Examination of Ago Bay in Japan

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The problem in water quality became obvious in coastal waters of Japan since about 1970. Some areas developed unpleasant odor and a lot of fish died in many areas where industrial waste was discharged. The monitoring of water quality in these areas started together with missions designed to this water pollution. As a result of encounter measures, the water quality recovered to acceptable level but fishery resources have not recovered to the desirable level both in quality and quantity. What is the ideal way of holistic evaluation on aquatic system not only on the water quality? We propose a "Health Examination of the sea" as a new marine environmental assessment technique to monitor and evaluate aquatic system. This assessment technique focuses on biological production and purification ability of the sea, which means that the scheme of "Health Examination of the sea" covers ecosystem stability and smoothness of material cycling in the broad sense.

Ago Bay is an enclosed coastal sea located in Mie Prefecture in Japan and very famous for cradle of pearl culture all over the world. However, since 1960's the production of the pearl industry was drastically decreased by environmental deteriorations such as harmful red tide and hypoxia. To improve these problems, control of domestic pollution load and dredging of sediment were carry out in the bay. As a result, the chemical oxygen demand (COD) in water is gradually decreased recent year, but the COD in sediment still keeps high level and the red tide and the hypoxia occurred every year in Ago Bay. We diagnose that Ago Bay is unhealthy by using the scheme of "Health Examination". Moreover, we diagnosed that the main cause of the unhealthiness of Ago Bay is domestic pollution load flowing into Ago Bay where the function of saving nutrients and taking nutrients outside the bay weakened. We proposed that the methods for the treatment of Ago Bay are the reproduction of both tidal flat and sea grass bed as well as control of nutrient cycle including the promotion of the sustainable fisheries.

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The Role of Satoumi in Implementing the Convention on Biological Diversity and Other International Commitments

Marjo Vierros and Anne McDonald

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The presentation will discuss the role of satoumi in implementing the Convention on Biological Diversity (CBD) and other biodiversity-related international agreements. Satoumi both as a concept and a management strategy provides a culturally-appropriate method for implementing CBD provisions related to coastal areas, and is similar to other coastal management approaches undertaken around the world. On a very basic level, satoumi is an expression of the CBD ecosystem approach, which is considered the primary framework for action under the CBD. Satoumi's rootedness in traditional ecological knowledge and cultural history also provides a way to implement aspects of Article 8(j) on traditional knowledge, innovations and practices. Finally, satoumi is of particular relevance to the CBD programme of work on marine and coastal biological diversity (decision VII/5). Because these topics, and particularly the ecosystem approach, are central to many biodiversity and fisheries-related regional and global agreements, satoumi also provides a tool for meeting a range of international commitments, and can be used to harmonize implementation strategies.

The presentation will also discuss proposed new directions for satoumi-related research that are in keeping with the continuously evolving needs for implementing the CBD and other international agreements. These research directions include further strengthening the congruence between satoumi and the ecosystem approach by addressing connections between adjacent habitats and species, both upstream and further offshore from the immediate coastal zone. Satoumi also has a role to play in enhancing the ability of ecosystems and coastal communities to adapt to the impacts of climate change. However, the specific methods of how satoumi-related activities can contribute towards this goal may require further research.

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Effect of Oxygenation on Speciation, Behavior, and Fate of Chromium in Estuarine Sediments

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The main objective of this research is to determine the conditions that favor toxic hexavalent chromium (Cr^{VI}) formation in estuarine sediments upon oxidation of the relatively non-toxic trivalent chromium (Cr^{III}). Grab surficial sediments were collected from various locations in the Baltimore Harbor and characterized for total metals, total organic carbon (TOC), and acid volatile sulfides (AVS). Cr speciation performed using EPA methods 3051A and 3060A in conjunction with our HPLC-ICP-MS analytical technique revealed that Cr in these sediments is predominantly precipitated Cr^{III} – $\text{Cr}(\text{OH})_3(\text{s})$ and/or $\text{Cr}_x\text{Fe}_{1-x}(\text{OH})_3(\text{s})$ with concentrations varying from 68 – 1050 $\mu\text{g/g}$ dry wt. Continuously-mixed batch reaction experiments were performed to examine the influence of sediment oxygenation and mimic possible biogeochemical changes resulting from sediment resuspension during flood events, dredging activities, and bioturbation. In these batch reaction experiments, anoxic sediment suspensions were spiked with aqueous Cr^{III} and simultaneously aerated to monitor for Cr^{VI} formation. Cr^{VI} formed in 11 of the 16 sediment samples under aerobic conditions but not under anaerobic conditions. The rate of Cr^{VI} formation correlated negatively with the AVS concentration in the sediments and positively with the porewater-manganese / AVS ratio indicating that the long-term persistence of Cr^{VI} is a function of the sediment reductive capacity despite the ability of these sediments to oxidize Cr^{III} . In another set of batch reaction experiments, Cr^{VI} reoccurrence was observed following the oxygenation of Cr^{VI} -spiked anoxic sediment suspensions after the spiked Cr^{VI} was completely reduced to Cr^{III} under anaerobic conditions. The findings from this research suggest the need to monitor long-term stability of Cr^{III} under changing biogeochemical conditions in Cr contaminated sediments and soils.

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Bi-National Coastal Ecosystem Learning Center Partnership

*Shelia Brown*¹ and *LaKeshia Robertson*² -- presented by *Sharon Walker*

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A recent Gulf of Mexico Alliance successful collaborative effort is the project “Enhanced Public Awareness and Understanding of the Gulf of Mexico Alliance’s Priority Issues Through Exhibitory within Coastal Ecosystem Learning Centers (CELCs) in the Gulf.” This project has been developing interactive kiosk exhibits that educate users on the topics of water quality, nutrients, ecosystem valuation, habitat conservation and restoration, and coastal community resilience. These CELCs are in the five U.S. Gulf States and in the Mexican state of Veracruz and are specifically located at the Audubon Aquarium of the Americas, New Orleans, LA; Florida Aquarium, Tampa, FL; Texas State Aquarium, Corpus Christi, TX; Dauphin Island Sea Lab, Dauphin Island, AL; Gulf Coast Research Laboratory Marine Education Center, Ocean Springs, MS; and, Veracruz Aquarium in Veracruz, Mexico. The interactive modules in these Kiosks stimulate an interest in environmental preservation and promote a sense of personal protection of the Gulf of Mexico. The overarching intent of this initiative is to prepare youth for foreseeable challenges facing the Gulf and instill an urgent need for ecosystem remediation. Collectively, the CELCs reach over 3,000,000 people annually and their staff possesses expertise in the areas of marine and environmental science which complement hands-on engaging programs. Through the EPA Gulf of Mexico Program CELC designation, the Centers have established a partnership that brings technology and hard science concerning the Gulf of Mexico into the hands of families who can truly make a difference in the future of the Gulf: America’s Sea.

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Early Detection of Coastal Ecosystem Response to Management Actions

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The ability to detect ecosystem response to management actions is the goal of coastal monitoring programs. Moreover, the ability to detect change early is needed as a valuable assessment tool for managers. Typical methods to evaluate ecosystems include trend analyses and current status of conditions. Trend analyses require many years of data collection and often a high magnitude of change to be significant. Status analyses often rely on established thresholds levels, and a change in category, either better or worse, requires sizeable changes in concentration in relation to these thresholds. Therefore, an indicator of integrated ecosystem response that can track changes and respond in a timely fashion is a valuable tool. This presentation compares results from the Maryland Coastal Bays standard status and trend analyses to new signal of change techniques, including CUSUM and duration of dissolved oxygen criteria exceedances. The CUSUM technique allows for the detection of change from the long term mean in a variety of nutrient and water quality parameters collected monthly. Duration of DO criteria exceedances are calculated from *in situ* continuous monitoring data and allow for evaluation of habitat conditions. The combination of these two techniques shows improving conditions that have not yet been detected in standard status and trend analyses. In the case study presented, conditions in Bishopville Prong, a tidal tributary to the St. Martin River in the Maryland Coastal Bays watershed, are showing improvement based on the new methods, although the status (degraded) and trends show no change. This ability to show improvement in habitat conditions sooner is important to managers, to demonstrate to policymakers and stakeholders that management actions are producing positive effects that may not be readily observed using standard methods.

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Signaling Dissolved Oxygen Response to Eutrophication Using High Frequency Data

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Dissolved oxygen (DO) monitoring, as part of an estuarine monitoring program, should be used to signal changes that may impact living resources in the face of pressure from eutrophication. Historically, DO concentrations were investigated through routine sampling, typically once or twice per month, or short-term intensive sampling. *In situ* continuous monitoring implemented over the last decade has provided high frequency datasets that have revealed new insights on shorter temporal DO patterns. The aim of this presentation is to describe the use of high frequency DO data as a signal for coastal eutrophication in the Maryland Coastal Bays, USA. Being a shallow, unstratified system, the Coastal Bays were not thought to exhibit drastically low DO conditions, at least not to the same degree as the nearby deeper, stratified Chesapeake Bay. However, high-frequency data from *in situ* continuous monitors have revealed low DO conditions at some sites. These monitors, collecting data every 15 minutes, are deployed across stations collectively exhibiting a gradient of eutrophic conditions. Three methods of using these data to relate DO to eutrophication effects will be discussed. The first method tested the use of high-frequency data to evaluate established DO thresholds. Failure rates of established DO thresholds for the Coastal Bays were compared to failure rates for established DO criteria for various time intervals used in the Chesapeake Bay. As expected, stations exhibiting greater nutrient enrichment failed criteria more often. The second method tested the use of consecutive DO readings below established thresholds to signal degradation or recovery. Duration of DO below threshold concentrations was calculated for each station, and maximum monthly durations were then plotted against monthly percentage failure of established DO thresholds to determine a signal of improving or declining eutrophication effects. Preliminary evidence indicates that as percentage threshold failure increases, maximum duration of failure also increases. Finally, the third method tested the duration of DO below LC50 thresholds for common estuarine finfish species as a direct examination of effects on living resources. Species were chosen based on prevalence in finfish surveys and to represent a variety of low DO tolerance levels. Several stations had overall poor DO conditions for some fish species, and other stations exhibited seasonal or diel patterns of poor DO conditions. This study concludes that high frequency data from strategically-placed *in situ* continuous monitors can yield important data for use in signaling effects of management practices to control coastal eutrophication.

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Citizen Science in Baltic Sea – Experience from the Beach

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Many people believe that the Europeans are less and less interested in science which makes it difficult to base decisions on scientific knowledge and results in confusion between science, junk science and pseudoscience, a confusion dangerous for the modern society. There are fields which are evidently underrepresented in the school curriculum. This is the case of marine sciences in Poland. Poland is a relatively large country but its coastline is comparatively short. Sandy beaches are typical for the southern Baltic but many regard them as biological deserts, highly valued only for recreation and tourism. In order to demonstrate that healthy recreational waters and clean beaches are linked to the well being of the natural ecosystems, we have formulated different educational programs in close cooperation with several high schools. Students supported by their teachers and marine scientists performed relatively simple but time-consuming environmental observations. We prepared three different educational programs: one was targeted at gifted students, the other two engaged groups of students. In the first program it was the students themselves who had to plan an experiment or a field study, and we helped the students to design a methodologically easy study addressing a bona fide scientific question. The goal of the second program was to engage students in time-demanding measurements of various biological and physical data. The measurements were performed by 2 to 5 students with simple equipment available at every school. The third program was perhaps the most interesting because it allowed to obtain publishable data. With the help of students we obtained multiyear, fine scale data on the distribution of sandhopper *Talitrus saltator*, a crustacean that might be used as an indicator of the beach naturalness. After giving a short introductory lecture, we took the students to the beach for a practical demonstration how to dig holes of the specified size and depth, remove the upper sand layer and count the jumping-out sandhoppers. The program continued for 6 years and covered the whole Polish coastline. The experience gathered in all three programs was shared with the participants of the 2009 Spring School on Coastal Monitoring in Porto (Portugal) and allowed to create a proposal for a European Education Marine Monitoring Network. All three programs received positive feedback from the participants. Importantly, they gave the students the opportunity to learn how scientific knowledge may inform environmental decision making and the opportunity to experience the continuity of science: marine sciences integrate disciplines that are separate in the Polish school curriculum.

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Assessing the Ecological and Human Health Status of Baltimore's Inner Harbor

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Baltimore's Inner Harbor and its watershed is a highly urbanized area in the mid-Atlantic region of the United States. The city of Baltimore was founded in the 1700s, with the population spreading out into adjacent lands over the last three centuries and continuing to expand into suburban and exurban areas today. The Gwynns Falls drains to the Middle Branch and the Jones Falls drains to the Inner Harbor. Both streams originate in the outer suburbs and in the urban parts of these watersheds, the majority of the streams have been channelized or enclosed in storm drains.

This study assessed water quality and biotic parameters as ecological health indicators of Baltimore's Inner Harbor and its watershed. Bacteria and trash were assessed as human health indicators. Assessment of each indicator is based on methodologies validated through peer-reviewed scientific articles and years-long development of indicators for assessing the health of Chesapeake Bay via the Chesapeake Bay Program. Each indicator is compared against a threshold value and scored on a 0-100% scale, which is a gradient from Very Poor to Good health.

The study found most water quality indicators to be either poor or very poor in the Inner Harbor. Additionally, the bacteria and trash levels in the Inner Harbor were rated as poor. The watershed health was better than the Inner Harbor receiving waters, with water quality indicators and bacteria scoring from good to poor. Lack of spatial and temporal coverage of basic water quality data in the Inner Harbor was a major hindrance to accurately assessing its ecological health. Future plans to remedy these problems, such as expansion of citizen science monitoring, will be discussed.

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Connecting Students with Corals & Climate Change: Innovative Web & Classroom Materials

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How do we tap into the natural curiosity students possess? How do we illustrate their connections to coastal ecosystems? How do we get them to relate to climate change? Such hefty questions require expert knowledge from scientists, community leaders, educators, and science communicators. Thus, the Integration and Application Network at the University of Maryland Center for Environmental Science and the National Park Service Pacific Island Network Inventory and Monitoring Program partnered to create innovative web-based materials that communicate the importance of coral reefs through inquiry and observation.

The corals and climate change module developed by this partnership differs from other web educational materials in a variety of ways: a) our materials are based on data, b) the classroom activities in our module were designed by formal and informal educators in collaboration with scientists, c) throughout the module, cultural connections and traditional practices are used to engage Pacific islanders, and d) all of the web and classroom materials are vetted by teachers and reviewed by scientists. Thus, our materials are based on sound science and designed to coordinate with the science standards middle school teachers in the Pacific islands are required to use in the classroom.

Careful web design and interactive elements allow middle school students to explore the incredible biodiversity of coral reefs, collect data about coral cover with the same methods used by scientists in the National Parks, see into the future as unchecked carbon emissions increase ocean acidification and erode corals, and imagine how their daily lives would be different without coral reefs. Specifically designed to allow students to choose their experience and observe the topics that are most interesting to them, this web module uses games, videos, and animations to help students observe corals and inspire them to develop their own questions.

In addition to the resources we have developed for students, we have also created an *Access Classroom Resource* page where teachers can download the materials they need to implement the module activities. Here teachers can access the state and national teaching standards, learning objectives, and time requirements related to each activity. Providing this information enables teachers to easily incorporate some or all of the activities into their lesson plans.

Preliminary evaluation data from a focus group of science educators in the Pacific islands indicates that the content of the module is age appropriate, the classroom and outdoor activities are effectively integrated with the web pages, and teachers believe that the module can be easily implemented in the classroom. After the website goes live, and as more teachers have the opportunity to use the module, we will evaluate teachers' attitudes about the effectiveness of the module and what impact it had on their students' ability to learn about corals and climate change.

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A New Exchange Flow Formulation for the LOICZ Model and the Relative Contribution of Advection and Diffusion to Transport Time Scales

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The LOICZ biogeochemical model is widely used worldwide to estimate the residence time of water in estuaries and the role of the coastal ocean in processing carbon, nitrogen, and phosphorus as materials move between land and sea. It is shown using data from four estuaries that the model under-estimates the residence times by a factor of 3-4 for these estuaries. A new exchange flow formulation is proposed for vertically well-mixed estuaries as well as a simple analytical method to quantify the relative contribution of advection and diffusion to estuarine transport time scales.

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The Residence Times of Land-sourced Contaminants in the Great Barrier Reef Lagoon and Their Impact on Reef Recovery Following Land-use Remediation in the Watershed

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Following land-use remediation in the watersheds of the Great Barrier Reef the hoped-for recovery of corals in the central region of the reef depends on the residence time of land-sourced contaminants. That time is measured in years to decades, possibly even centuries, for fine sediment. Coral recovery thus may take decades. The exception may be the top few meters of wave-swept coral reefs surrounded by relatively deeper waters and where the fine sediment is minnowed within a year by wind waves. Ecohydrology modelling suggests that the sustainable recovery of corals may require doubling the presently proposed nutrient removal rate. The ultimate restoration of the Great Barrier Reef corals requires also addressing and mitigating climate change globally.

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A Journalist's Perspective on Social Media

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The Capital newspaper, Annapolis, MD, USA

Communications tools are always evolving and journalists -- like all professional communicators -- are beginning to embrace social media. An environmental reporter describes how journalists are using social media as a tool to communicate with sources and readers, to search for story ideas and to promote finished articles.

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Suppression of Phosphate Release from Coastal Sediments Using Granulated Coal Ash

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Deterioration of sediment quality is a serious problem in Hiroshima Bay where intensive oyster culture is conducted. Release of nutrients from sediments which are receiving feces and pseudofeces from cultured oysters hanging above are one of major causes of eutrophication of water column. Since phosphate is enhanced its release rate under anaerobic condition in warm stratified season, it should be a target to be suppressed.

Granulated coal ash (GCA), a byproduct from coal thermal electric power stations, has proven to adsorb phosphate quite well in our previous study. Then, we conducted a field experiment aiming to suppress phosphate release from sediments below oyster culture rafts, which are in organically enriched condition.

Two types of GCA were applied to the sediments of 50 m x 70 m each (Exp site A and Exp site B) covering the sediments with 20 cm depth. The GCA used Exp sites A and B were those made of pulverized coal combustion ash and pressurized fluidized bed combustion ash, respectively. After the application on 30 October 2008, monitoring of sediment and water qualities and benthic microalgae and animals was carried out for 13 months with a 3 month interval. A numerical model to quantify chemical and biological processes in the sediment was applied to estimate how phosphorus cycle was changed compared to that in the control site.

Sediment pH was significantly increased up to about 8.5 in the sediments of Exp site A and B. In the both experimental sites, organic contents of the sediments significantly decreased, and acid-volatile sulfide (AVS) which is an indicator of aerobic condition was also decreased. Phosphate concentration in the interstitial water of sediment was significantly decreased in Exp site A, which may be due to adsorption onto GCA.

The numerical model output showed that release rate of phosphate from the sediment of Exp site B was suppressed to the level of about 1 order lower ($400 \mu\text{mol}/\text{m}^3/\text{d}$) than that in the control site ($4,800 \mu\text{mol}/\text{m}^3/\text{d}$), whereas decomposition of detrital phosphorus in the experimental site is enhanced 4.8 times in the experimental site compared to the control site.

It was proven that GCA can effectively adsorb phosphate from interstitial water in organically enriched sediments and suppress release rate of phosphate from the sediments to the upper water column. Consequently, it is recommended that application of GCA to organically enriched sediments in other areas where they suffer from similar issues.

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Numerical Study on Dispersion of Turbid Overland Flow in Stratified Waters

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It is very important issue that dispersion of turbid water in coastal and land waters. There are several kinds of generation mechanism of turbid waters. This study focuses on overland flow on dry up area in particular. The turbid overland flow is induced by erosion of bottom suspended solids and transport adsorbed matter to down the stream, which is induced in intertidal zone and dam usually. These phenomena are very complex and a three-dimensional baroclinic flow model has been applied for simulating one. Usually, Sigma-coordinate system is applied to simulate these phenomena. However, we tried to apply Cartesian-coordinate system because we want to simulate hydrodynamics under the condition with stratification and steep slope.

Hydrodynamics model with dry and wet function was constructed by improvement of present quasi-3D baroclinic flow model. Conservation of suspended solid was evaluated by hindcast simulation of actual waters with both dry up area and stratified water area. As a result, water temperature of overland flow was changed by meteorological effect and was dominated a depth of inflow in stratified waters downstream. Moreover, sedimentation rate and bed fluctuation in both dry up area and stratified waters were evaluated. According to this case study, we found that the numerical model divided into various grain diameters is effective for improve reproducibility of numerical simulation.

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Effects of Desiccation and Salinity on the Outbreak of a Green Tide of *Ulva pertusa* at the Artificial Salt Marsh along the Coast of Osaka Bay, Japan

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Field surveys and laboratory experiments were conducted to examine the effect of desiccation and salinity on the outbreak of a green tide of *Ulva pertusa* at Osaka Nanko bird sanctuary. Reduction of biomass of *Ulva* spp. was observed at stations where the exposure rate to air was from 30 to 40%. In addition, the exposure rate of 30 to 40% to air showed no negative impacts on the biomass of benthic microalgae, infauna and non-motile epibenthos. Laboratory experiments revealed that photosynthetic activity of *Ulva pertusa* decreased when exposed to air for 4 to 7 hours at 25-35 °C. Salinity decreases from 30 to 25 or 20 accompanied with exposure to air drastically reduced the rate of photosynthesis of this species. These results suggest the possibility of controlling a green tide of *Ulva pertusa* without serious physico-ecological damage to benthic microalgae, infauna and non-motile epibenthos by a combination of exposure to air with low salinity.

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An Action Plan for Coral Reef Management in Thailand Following Coral Bleaching Events

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Widespread and severe coral bleaching on most reef sites in Thai waters was clearly documented in 2010. Bleaching in the Andaman Sea was more severe and extensive than in the Gulf of Thailand. The most susceptible corals were *Acropora* spp. and *Pocillopora* spp. This research aims to synthesize lessons learned concerning coral reef management in Thailand following the 2010 coral bleaching events. There were several meetings, seminars and conferences which were organized by government agencies, NGOs and universities for solving the coral bleaching problems and providing recommendations for coral reef management. An urgent action plan includes raising public awareness about coral bleaching and best practices for coral conservation, surveying on coral recovery trends at the bleached reef sites, determining appropriate measures for each critical reef such as temporary closure, limited number of divers, controlled activities, provided artificial reefs for diving and nature tours in the forests, etc., preventing land-based pollution, effectively enforcing coral reef related laws and regulations, conducting priority research themes and collaborating of all stakeholders and relevant agencies for integrated coastal management. Strategies for driving the action plan to implementation comprise submitting the status report on coral bleaching and consequent mortality to the cabinet, establishing a coral bleaching committee under the national environment board, approving the national strategic plan for coral reef management by the cabinet resolution, providing adequate funding supports from Department of National Parks, Wildlife and Plant Conservation, National Research Council of Thailand, Department of Marine and Coastal Resources, Thailand Research Fund, and corporate social responsibility projects of private companies for conservation, research, management and restoration of coral reefs. Local participation in management is very essential for reef resilience under the climate change impacts.

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An Analysis of Covariance to Determine the Effect of TPLMS in Masan Bay, Korea

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This study aims to evaluate the effects of Total Pollution Loads Management System (TPLMS) in Masan Bay, implemented to solve the pollution issues of coastal water of the Bay in 2007. The Bay had been famous for both a traditional fishery market selling flounder, sea string and other endemic fish, and a beautiful beach where local people used to enjoy sea-bathing annually until early 1970s.

The Bay experienced the rapid urbanization and economic development after early 1970s. Total population size of the watershed of 0.2 million in mid 1970s increased to one million in 2004. The development of the bay resulted in the dramatic degradation of water quality, outbreaks of fish-kill, a permanent beach-closing, the public notice of the prohibition of shellfish-gathering, and the first appearance of large scale red-tide in Korean history. Currently the bay is an exemplary area of the most deteriorating coast in Korea.

The Bay is a small and semi-enclosed bay with 17 small rivers and two sewage treatment plants in the watershed; total area amounts to about 70 square kilometers; an average depth is about 15 meters; the average tidal speed of tide in the innermost part of the Bay is only about 2~5 cm/sec; therefore, it is believed that pollutants in the Bay cannot be easily washed out.

Local and national governments invested additional 108 million USD for TPLMS projects such as river management projects, the enhancement of capacity of sewage treatment plants (STPs), and other best management practices to restore the Bay's environment since 2007.

To test the effect of TPLMS implementation, the samples of 17 rivers and 11 stations of the Bay were collected since 2005. The concentration and discharges of Chemical Oxygen Demand (COD), Total Nitrogen (TN), and Total Phosphorus (TP) of rivers and bay water were measured. The multivariate analysis of covariance (ANCOVA) using the data of measurements of both 2005-2006 (before TPLMS) and 2009-2010 (after TPLMS) samples was used to determine the impacts of TPLMS. Results of ANCOVA indicate that the implementation of TPLMS is likely to lower the concentration of COD by 2.35 mg/L. On the other hand, it is not clearly estimated that those of TP, and TN drop statistically even though those seems to be lowered.

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Characteristics of Water Quality and Phosphorus in Bottom Sediment in Strong Enclosed Sea Area

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Sin-Nishinomiya yacht harbor (YH), which is located in the inner part of the Osaka bay, is strong enclosed sea area and a recreation area for citizen. Water quality in the YH is extremely eutrophic. A red tide occurs a lot and anoxic water spreads from bottom to near surface layer during summer season. A blue tide is observed, too. However, the characteristics of water quality and bottom sediment in the YH are not known enough. Therefore, we investigated the change of water quality in the YH and examined the relationship between water and bottom sediment in laboratory at the same time.

Water samples were taken every 1m from 0m to 8m of depth between May and December 2010. Total phosphorus (TP), phosphate phosphorus (PO₄-P), total nitrogen (TN), and three kinds of inorganic nitrogen were analyzed. Dissolved oxygen (DO), water temperature and other parameters were measured with CTD. The core samples of bottom sediment were taken by a diver and used for a phosphorus release experiment in laboratory. Sea sand and steal slag as material covering bottom surface were used for the phosphorus release experiment, and the change of phosphorus concentration, DO, and other parameters in water were examined. Phosphorus in bottom sediment was analyzed by the fractionation procedure of inorganic phosphorus by Whilliams et.al (1980). The stable isotope of carbon and nitrogen in bottom sediment of the YH was measured, too.

The DO in lower layer gradually decreased from last May and anoxic water in bottom layer existed until last October in the YH. PO₄-P showed lower concentration at surface layer and became higher at bottom layer according to the decreasing of DO. The results of stable isotope in bottom sediment in the YH suggested that organic matter in sediment originated from phytoplankton but not terrestrial organic matter. This demonstrates that it is very important to control water and bottom sediment in the YH.

The results of the phosphorus release experiment using sea sand showed a decreasing of DO and a increasing of phosphorus in water. On the other hand, steal slag is very available to prevent a decreasing of DO and a release of phosphorus from bottom sediment, and the effect continued for six months at least. After experiment, CDB-P, which is iron connected phosphorus, and organic phosphorus increased in steal slag. NaOH-P (aluminum connected phosphorus) and HCl-P (calcium connected phosphorus) did not changed.

As steal slag originally contains a small amount of CDB-P and no organic phosphorus, phosphorus form changed in steal slag during the experiment. As CDB-P in steal slag did not contribute for release of phosphorus to water under anoxic condition in the case of another experiment, CDB-P may exist stably in steel slug.

To confirm availability of steal slag as covering material on polluted bottom sediment, we have started a following experiment on site.

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