

PROSPECTUS

# GULF OF MEXICO REPORT CARD INITIATIVE

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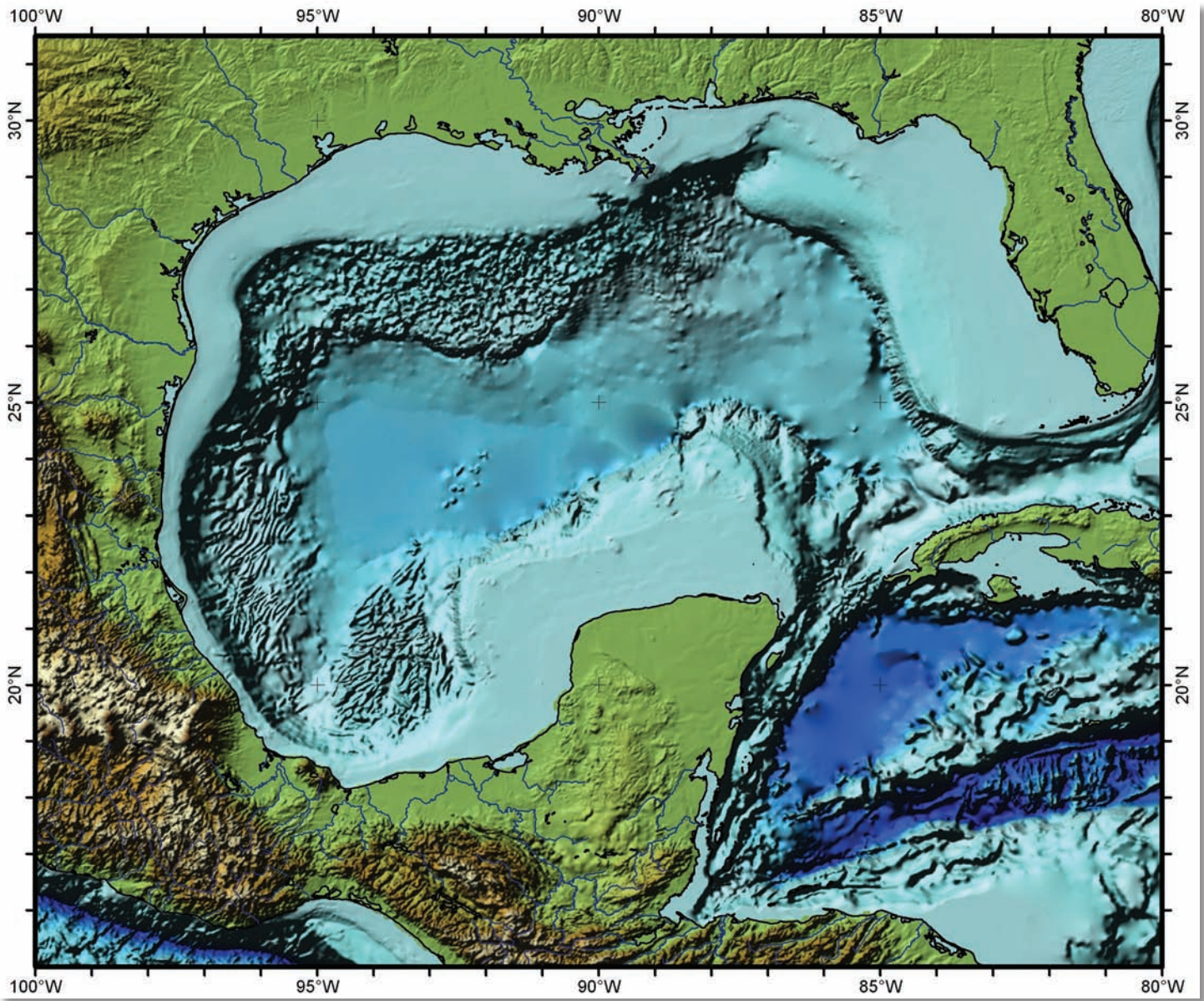
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# Vision Statement

The Harte Research Institute for Gulf of Mexico Studies of Texas A&M University-Corpus Christi, along with its partners Harwell Gentile & Associates, LC, and the University of Maryland Center for Environmental Science, proposes to develop a comprehensive framework for a Report Card on the health of the Gulf of Mexico. Our vision is to develop a graphical representation of the environmental condition of the Gulf that will be scientifically based, widely accessible, and readily understandable by policy-makers, stakeholders, scientists, and, most importantly, the American public. Such a Report Card will provide the scientific information and understanding necessary to evaluate the health of the Gulf, clearly demonstrate how well it is or is not progressing towards desired long-term goals, and inform the decision-making process on the policies and resources needed to achieve sustainability of a healthy Gulf of Mexico.

When President Obama announced by Executive Order the formation of the Gulf Coast Ecosystem Restoration Task Force, he said that within one year of the date of the order (5 October 2010) “*the Task Force shall prepare a Strategy that proposes a Gulf Coast ecosystem restoration agenda, including goals for ecosystem restoration, development of a set of performance indicators to track progress, and means of coordinating intergovernmental restoration efforts guided by shared priorities*”. Because of the scale and complexity of the Gulf, achieving a healthy and sustainable Gulf of Mexico will require an extensive, sustained National effort that addresses not only the consequences of the Deep Water Horizon oil spill and the suite of recent devastating storms such as Hurricanes *Katrina*, *Rita*, and *Ike*, but also the myriad of other impacts on the Gulf from human activities. These range from: increased nutrients and chemicals that flow into the Gulf from the watershed that drains more than half of the continental US, including America’s agricultural heartland (Figure 1); rapidly expanding development of cities and industry fueled by energy, transportation, tourism, and other major industries; harmful invasive species that have spread across the region; and the pervasive consequences of global climate change, including the specter of rapidly rising sea levels along highly vulnerable coastlines.

To capture the effects of these and many other pressures impinging on the Gulf, we have developed a conceptual framework

for a Gulf of Mexico Report Card that is unequalled in the world in its scope and potential utility. The Report Card, when fully developed, will be directed at a diversity of audiences, from the highest levels of decision-making to the most-detailed scientific investigations. This hierarchical structure, unified by a common conceptual framework, will provide the optimal basis for informing multiple audiences at the appropriate level of detail and aggregation, allowing one to dig deeper into the reasons for the various assigned grades of environmental health. Additionally, the Report Card will be spatially explicit yet scalable, providing a way to compare the successful and not-so-successful outcomes across regions, habitats, and political boundaries.

As the Report Card is populated and updated over intervening years and decades, patterns of pressures and impacts will emerge, giving guidance to what policies have accomplished or failed to accomplish their objectives. This type of feedback from scientific information into the decision-making process promises to be an invaluable tool for improved environmental management, guiding Gulf-wide research, policy, and ecosystem restoration. Indeed, because of the scale and comprehensiveness of the proposed Gulf of Mexico Report Card, we believe it has the potential to be an unprecedented advance in how the Nation manages and sustains its environmental heritage.



Figure 1. The Gulf of Mexico watershed includes portions of five countries.



# Proposed Framework

Over the past decade or so, a number of environmental report cards have been developed and presented that characterize the health of ecosystems. Our team has actively been engaged in the development and implementation of environmental health report cards for a diversity of ecosystems, ranging from Chesapeake Bay and the Florida Everglades, to Prince William Sound and the Gulf of Alaska, and across to the Great Barrier Reef.

We have recently surveyed several existing environmental report cards and assessed their conceptual foundations. Two basic approaches exist: one based on the Drivers-Pressures-State-Impacts-Response construct, aimed especially at synthesizing scientific indicators to inform decision-makers; and the other based on the ecological risk assessment framework, focused on the cause-effects relationships between environmental stressors and ecological effects, and aimed especially at the scientific and risk-assessment communities. Our team has integrated these two approaches to create a new **Drivers-Pressures-Stressors-State-Impacts-Response** (DPSSIR) conceptual framework, designed not only to reach decision-makers and stakeholders, but also to guide and focus scientific research on identifying and addressing the most important risks to the ecosystem.

In the DPSSIR conceptual framework (Figure 2), we distinguish the following elements: 1) **Drivers**—these are the fundamental forces that affect the environment, whether societal drivers, such as energy development and demographics, or natural drivers, such as climatic and oceanographic processes; 2) **Pressures**—these are the human activities and natural processes that cause environmental stressors; human activity examples include coastal development, oil and gas exploration and spills, and commercial and recreational fishing; natural processes in the Gulf include the dynamics of the Loop Current, and hurricanes and tropical storms; 3) **Stressors**—these are what the ecological system “sees”, defined as chemical, physical, or biological agents that can cause ecological effects; examples include habitat alteration, changes in the salinity regime, sea-level rise, harmful algal blooms, toxic chemicals, and excess nutrients; 4) **State**—this is the condition of the environment, which is measured in terms of Valued Ecosystem Components (VECs), i.e., those particular ecological attributes that are important to humans and/or to the functioning of the ecosystem itself; examples include fisheries populations, marine mammals, important habitats such as wetlands, seagrasses, and coral reefs, and critical or endangered species; 5) **Impacts**—this is a measure of how far the condition of the ecosystem is,

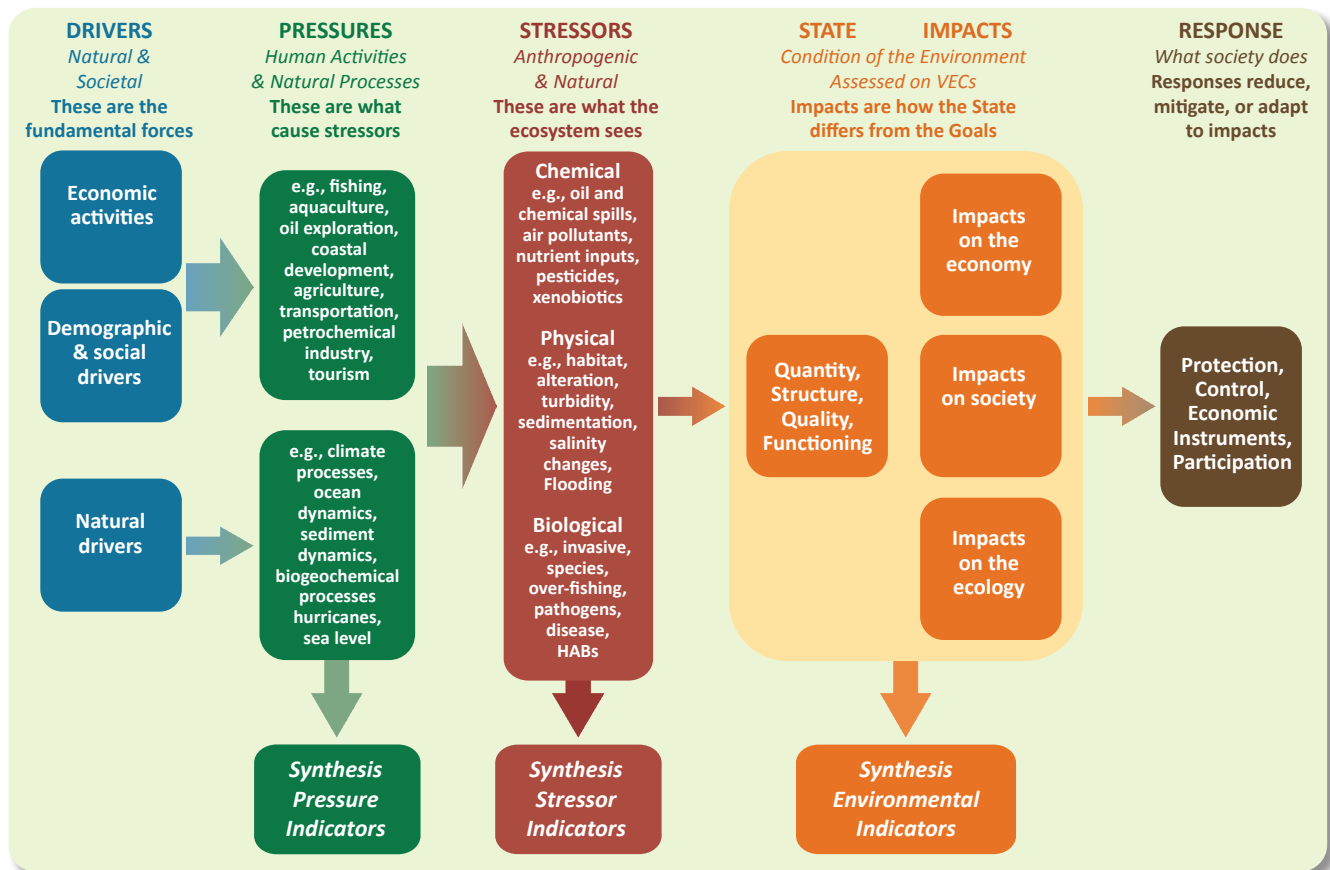


Figure 2. The DPSSIR Conceptual Framework. This new integrated framework provides the foundation for a science-based, policy-relevant, environmental health report card commensurate with the scale and complexity of the Gulf of Mexico.

in terms of the VECs, from a desired condition, such as the condition that existed before an oil spill occurred, or the desired environmental goal for ecological recovery and sustainability; and 6) **Response**—this is what society does to reduce, mitigate, or adapt to stressors; often response actions are aimed at reducing the Pressures on the environment, such as through pollution controls, regulations to improve the safety of ships or oil platforms, or land-use and water-conservation measures.

The DPSSIR conceptual framework is comprehensive, providing the scientific foundation and structure to organize and report information across the broad spectrum of needs for regional-scale environmental management, as well as reaching the breadth of audiences with interests in the health of the Gulf of Mexico. Figure 3 illustrates how different layers in the DPSSIR conceptual framework address targeted audiences. The highest level, aimed at decision-making officials and the general public, focuses on Pressures, State, and Responses, with emphasis on the State, i.e., the bottom-line conclusions about the health of the environment. Policy- and decision-makers and stakeholders, shown at the second level, would be presented with report card indicators for Pressures, State, Impacts, and Response, with the emphasis on the latter, i.e., what to do about environmental problems. More hands-on environmental managers, such as managers in state-level environmental agencies, would focus on Pressures and Impacts, but also with interest in the Stressors and State of the environment. And, finally, scientists focus particularly on Stressor-State-Impacts relationships, within the context of the Drivers and Pressures.

This structure allows, for example, an elected official to ask why the health of her/his state is as it is, and being provided with the appropriate information from the more detailed, lower layers that indicate what Pressures and Stressors are of primary concern, and what may be appropriate Responses to mitigate the Pressures of concern. At the other end of the spectrum, this conceptual framework can help scientists identify uncertainties in those aspects that matter the most to the health of the ecosystem, and then allocate resources towards those studies that will best reduce uncertainties and improve critical understanding of the ecosystem. Moreover, the hierarchical nature of the DPSSIR framework (Figure 3) provides the structure for most effectively aggregating and combining data to create synthetic indicators as one moves up the tiers, as well as to organize and communicate information most effectively to stakeholders and the public.

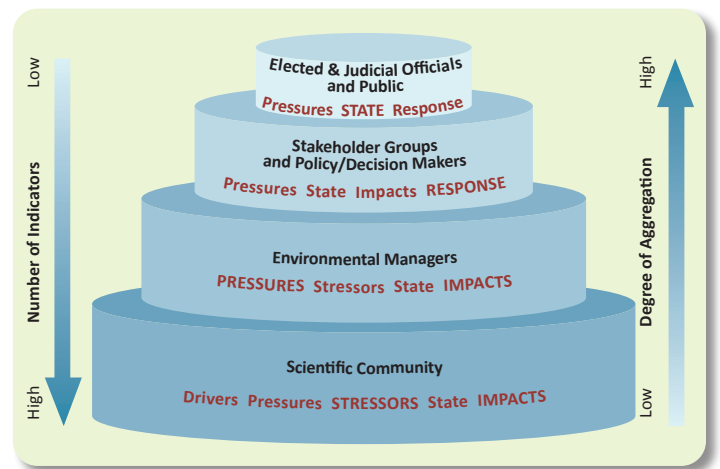


Figure 3. Hierarchical Structure of the Gulf of Mexico Report Card. This reporting structure captures and integrates the information relevant to each layer of a diverse set of audiences.



# Process to Develop the Gulf of Mexico Report Card

We propose to develop the Gulf of Mexico Report Card through a systematic process that will engage scientific and management expertise and experience relevant to the Gulf. This process will build on previous success in report card development (Figure 4) by the development team, including ecosystem assessments at Prince William Sound, and report cards for Chesapeake Bay and Australia's Great Barrier Reef. We will first convene an Initial Stepping-Stone Workshop, consisting of scientists, environmental managers, and stakeholder representatives. The charge to the participants in this workshop is to decide how to divide the Gulf into manageable reporting units. Unlike many existing report cards, the one for the Gulf must include a broad diversity of ecosystem types, from deep-water bottom communities, pelagic habitats, coral reefs, seagrass communities, salt and freshwater marshes, and riverine systems to barrier islands, coastal forests, and the larger watershed. Additionally, there are quite different environmental issues across the spatial extent of the Gulf—for example, the components of South Florida's environmental report card likely will differ substantially from Mississippi's or the Yucatan's. Further, the Gulf's Report Card must also incorporate some VECs that are trans-boundary, crossing geographic or governance divisions, such as the health of important pelagic fish populations or blue whales. Consequently, the product of the Initial Stepping-Stone Workshop will be to clearly define how the Gulf of Mexico will be divided into appropriate and relevant reporting units. That workshop will also begin the process of identifying the important Pressures and Stressors impinging on the Gulf's ecosystems.

The Second Stepping-Stone Workshop will follow a few weeks later. This workshop will have additional scientific expertise, organized around those habitats and regions selected for the Report Card. Each habitat- or region-specific workgroup will develop an initial conceptual ecosystem model of the system of interest, including identifying the full suite of VECs for the system, ranking the relative importance of the Stressors that affect that habitat or region, and the Pressures causing them, as well as proposing an initial set of indicators or indices for the Report Card.

Completion of the Second Stepping-Stone Workshop will provide our team with the ideas and information needed to construct the Gulf of Mexico Report Card Framework. This Framework will be presented at the State of the Gulf of Mexico Summit to be convened on 4-8 December 2011 in Houston, Texas, by the Harte Research Institute. A summary document will be prepared for distribution at the Summit, that includes a description and rationale for the DPSSIR approach, the geographic units of the Gulf that will be assessed, and the specific set of indicators proposed to constitute the Report Card. We also intend to present selected indicators with existing data to illustrate the nature and utility of the Report Card, along with a plan for full implementation across all indicators.

Fully constructing the Gulf of Mexico Report Card will be an iterative process that will continue to unfold over several years following the Summit. In this final phase, the Harte Research Institute for Gulf of Mexico Studies will lead and integrate activities to collect and analyze

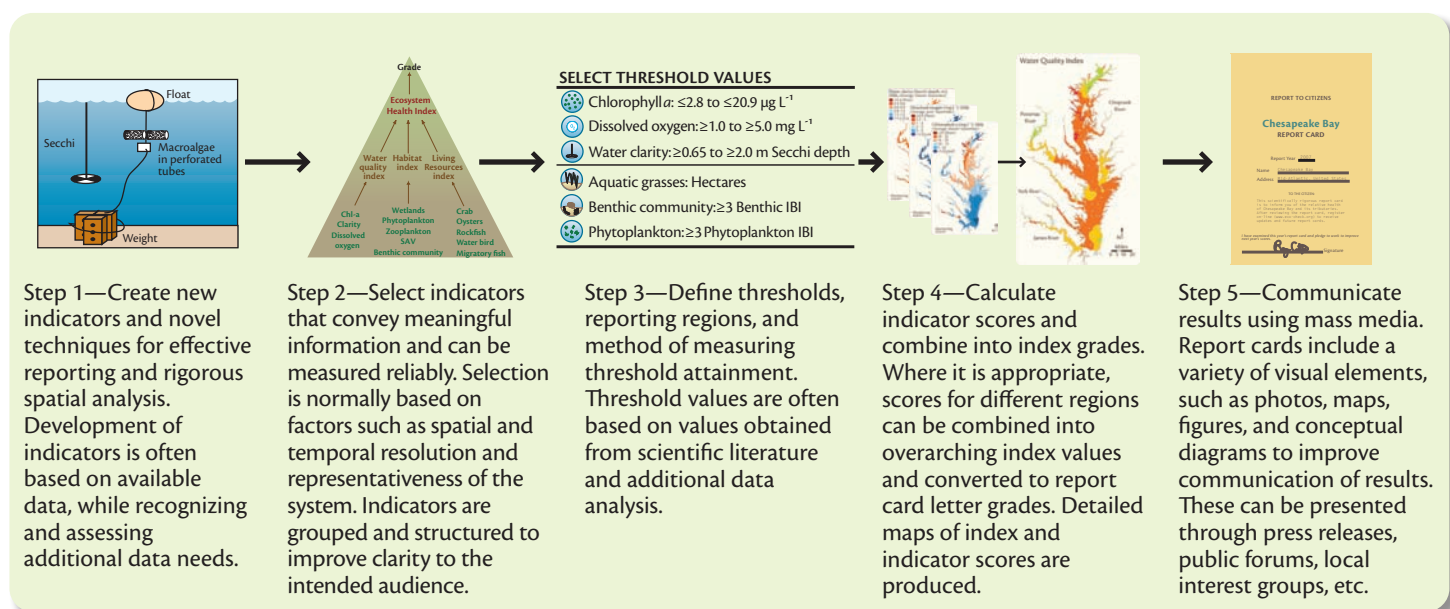


Figure 4. The five step process model for developing an environmental report card, using the Chesapeake Bay Report Card as an example.



environmental data, develop integrative metrics, with emphasis on synthesizing Pressures, Stressors, State, and Impacts indicators, and create the reporting process. We will plan for the latter to be an online-based system

for accessing the Gulf of Mexico Report Card and its associated data, recognize important trends, and readily understand the health and remaining threats to the Gulf.





# Product to Present at the Gulf of Mexico Summit

The Gulf of Mexico Ecosystem Report Card Framework will be 'rolled out' at the State of the Gulf of Mexico Summit in December 2011, a critical meeting of about 400 Gulf scientists, managers, and leaders, convened by the Harte Research Institute for Gulf of Mexico Studies. A portion of one day during the Summit will be dedicated to this presentation. This will be the first public presentation of the Report Card Framework, the framework development process of Phases I and II, and the proposed Phase III to complete the implementation and refinement of the Gulf of Mexico Report Card in 2012 and beyond. The presentation will graphically show the long-term viability and value of the Report Card, along with its practical application for measuring the health of the Gulf of Mexico and linkages to the NRDA and Restoration processes.

The Report Card presentation will reveal that this is the first such metric of this magnitude ever attempted, and that it will contain cutting-edge methodology at an unprecedented scale. Not only will the Report Card help guide research and monitoring activities, it will include policy- and regulatory-relevant metrics and analyses that



will help guide and unify restoration activities in a cost-effective manner. It will also help to evaluate the efficacy of restoration efforts within the limitations of natural variability.

Summit attendees should come away with a full understanding of the Gulf of Mexico Report Card Framework and its purpose, with ample opportunity to provide relevant feedback to the Development Team about moving forward into Phase III-Implementation.





# Composition of the Gulf of Mexico Report Card Development Team

The Gulf of Mexico Report Card development process is led by the Harte Research Institute for Gulf of Mexico Studies. The Report Card is intended to be an ongoing, central organizing theme for the activities and continuing development of the Institute. The HRI activities are led by Drs. Larry McKinney and Wes Tunnell, Executive Director and Associate Director of the Institute, respectively. Drs. McKinney and Tunnell collectively bring over 80 years of experience working in the Gulf of Mexico. Dr. McKinney had a leadership role in the Texas Parks and Wildlife Department where he led in the management of Texas coastal resources, and he worked across Gulf states with other state and federal agencies. Dr. Tunnell has worked extensively with Gulf scientists in academia and marine labs in all three countries (US, Mexico, and Cuba) surrounding the Gulf, and he has published four books on the Gulf.

Supporting the Gulf of Mexico Report Card development process are the principals of Harwell Gentile & Associates, LC, Drs. Jack Gentile and Mark Harwell. Dr. Gentile spent more than 30 years as a senior scientist in the US Environmental Protection Agency before moving to the

University of Miami's Rosenstiel School of Marine and Atmospheric Sciences. During his final decade in US EPA, Dr. Gentile led the scientific development of the US EPA ecological risk assessment framework and guidelines. The ecological risk framework has now become the central methodology for ecological assessments throughout the federal government, and is widely used by industry and environmental groups alike. Dr. Mark Harwell spent more than 25 years in academia, primarily at Cornell University and at the Rosenstiel School, where he led interdisciplinary research centers throughout his career. He led the academic component of the development of the US EPA ecological risk assessment framework, as well as guided the development and application of principles of ecosystem management through the US Man and the Biosphere Program. Drs. Gentile and Harwell helped facilitate the ecosystem management framework for the Everglades Restoration process, and they have conducted ecological risk assessments on many large-scale ecosystems, including Prince William Sound (Figure 5), Tampa Bay, Biscayne Bay, the Bay of Fundy, and Coeur d'Alene. They have led the development of stressor-effect-based conceptual ecosystem models for a number of National Estuarine Research

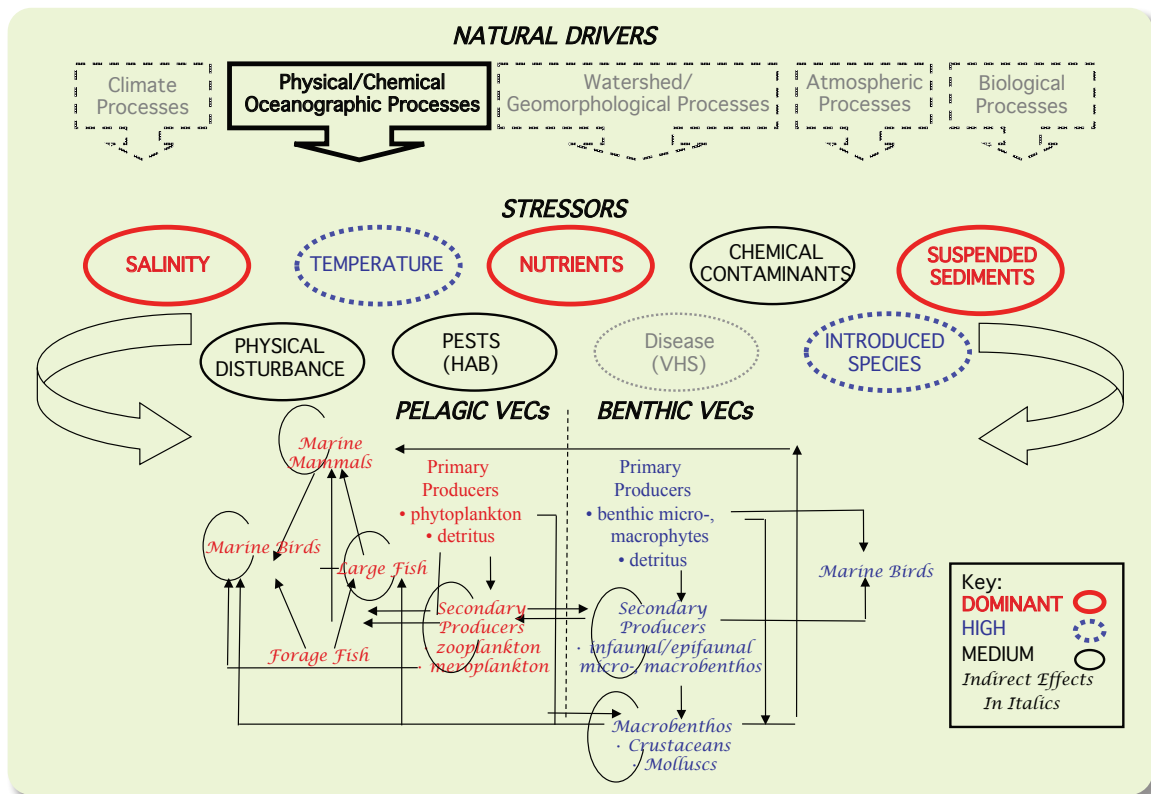


Figure 5. Example Conceptual Ecosystem Model of Prince William Sound and the Gulf of Alaska. This illustrates an ecological risk assessment-based conceptual ecosystem model, integrated with a trophodynamical conceptual model, as applied to a large-scale coastal ecosystem (from Harwell MA, Gentile JH, et al. 2010. A conceptual model of natural and anthropogenic drivers and their influence on the Prince William Sound, Alaska, ecosystem. *Human and Ecological Risk Assessment* 16(4): 672-726).



Reserves (NERRs), including, in the Gulf of Mexico, the Mission-Aransas (Texas), Grand Bay (Mississippi), and Apalachicola Bay (Florida) NERRs, and they are presently leading an effort to develop a new integrative scientific framework for Natural Resource Damage Assessments, with emphasis on ecological restoration and recovery.

The third critical component of the Report Card Development Team is the University of Maryland Center for Environmental Science, particularly Drs. Bill Dennison and Heath Kelsey. Drs. Dennison and Kelsey have unequalled experience in developing scientifically based environmental report cards, most notably the Chesapeake Bay Report Card (Figure 6). The Chesapeake Bay Report Card has been produced since 2006 and provides a detailed, timely, and geographically specific assessment of ecosystem health using data collected from state, federal, and academic partners and compiled by the EPA's Chesapeake Bay Program. Water quality and biotic indexes are created through comparison of observations to known thresholds; these indexes are subsequently integrated into an overall index of ecosystem health. The index is responsive to river flow and climate effects, which control nutrient and sediment inputs to the Bay and its tributaries.

Drs. Dennison and Kelsey have leveraged the success in Chesapeake Bay to coordinate and produce report cards at multiple scales, from the local watershed to the Great Barrier Reef. Dr. Kelsey coordinates local tributary groups

and watershed organizations to prepare report cards for their local areas in the mid-Atlantic region. Dr. Dennison has led the effort to produce the first Great Barrier Reef Report Card (Figure 7), which has required coordination of groups throughout Northeastern Australia, including scientists and stakeholders from academic, government, non-profit, and private organizations. The report card is designed to track the effects of agricultural practices (Responses) supported by the Australian and Queensland governments to land management activities (Pressures), and nutrient, sediment, and toxics inputs (Stressors), on the corals, seagrass, and water quality within the Great Barrier Reef Marine Park (State and Impacts). The report card is scheduled for release in mid-2011, and will be continued annually.

The Integration and Application Network (IAN)—which Dr. Dennison leads, and its partnership with NOAA (EcoCheck) which Dr. Kelsey leads—have developed ecosystem assessments and report cards in the United States, Australia, Chesapeake Bay (including numerous tributary report cards), Europe, the Pacific, and the Caribbean. Dr. Dennison and IAN are globally known experts in communicating science.

These three components of the Gulf of Mexico Report Card Development Team provide the complementary set of expertise, experience, and skills that is essential to developing a report card commensurate with the scale and complexity necessary for characterizing the health of the Gulf of Mexico.

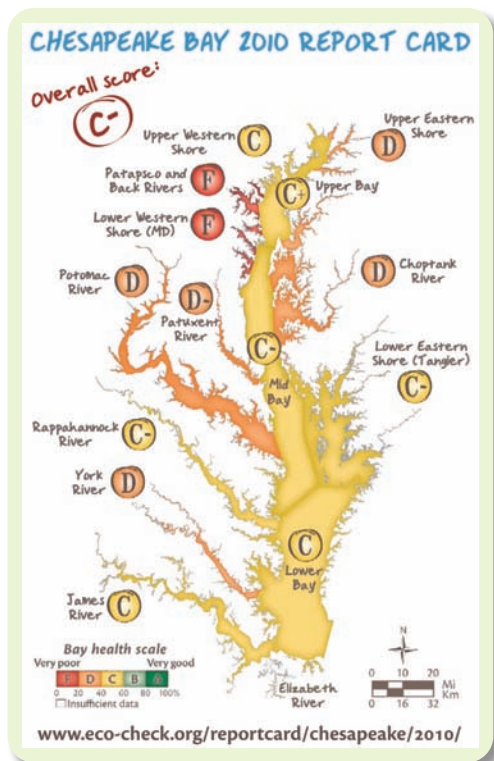


Figure 6. Results from the Chesapeake Bay Report Card are geographically specific, allowing readers to understand local ecosystem health in relation to other Chesapeake Bay areas.

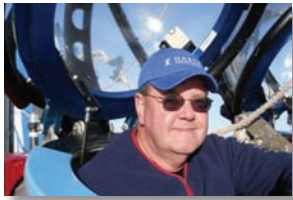


Figure 7. IAN and EcoCheck have prepared the first Great Barrier Reef Report Card, which evaluates progress toward Reef Protection Plan Program goals relating to Pressures, Stressors, State, Impacts, and Response. The report card will be released in 2011.



## Appendix—Report Card Steering and Technical Committee/Development Team

### *Larry D. McKinney, Ph.D., Committee Chair*



Dr. Larry McKinney is Executive Director of the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi, where he leads an interdisciplinary team that

integrates science, policy and socio-economic expertise to help assure an economically and environmentally sustainable Gulf of Mexico. Prior to assuming his current position, Dr. McKinney directed environmental and marine fisheries programs at the Texas Parks and Wildlife Department (TPWD). During his 23-year career there, he acted as a state trustee for natural resources and built the Natural Resource Damage Assessment (NRDA) program, served as Chair of the EPA Science Advisory Committee for the Gulf of Mexico Program, and directed oil spill response for TPWD. He also established over thirty marine protected areas of various types. He also developed an adaptive regulatory process that successfully established environmental criteria for coastal shrimp farms; led the management of invasive aquatic vegetation; and led the development of offshore aquaculture. Dr. McKinney currently acts as state lead for the Ecosystem Assessment and Integration Team of the Gulf of Mexico Alliance, and he chairs the Flower Garden Banks National Marine Sanctuary Advisory Committee and the Texas Sea Grant Science Advisory Committee. He is a member of NASA's SSC Applied Sciences Steering Committee and board member of the Texas Academy of Sciences. Dr. McKinney received his Ph.D. in Biology from Texas A&M University in 1976.

### *John W. Tunnell, Jr., Ph.D., Committee Vice-Chair*



Dr. Wes Tunnell is Associate Director of the Harte Research Institute for Gulf of Mexico Studies, Professor of Biology, Fulbright Scholar, and Regent's Professor at Texas A&M University-Corpus Christi. Dr. Tunnell is Founder and former Director of the Center for Coastal Studies (1984-2009), creator of the co-location concept

of state and federal agencies on campus, including the Natural Resources Center (1996), and he assisted in the development of the Harte Research Institute for Gulf of Mexico Studies (2001) and its building (2005). He is a broadly-trained marine ecologist/biologist focusing

primarily on coastal ecology in Texas and coral reef ecology in Mexico, and he has published widely on vertebrate fossils from the seabed, sponges, brachiopods, mollusks, coral reefs, oil spill impacts, and Gulf of Mexico biodiversity. Dr. Tunnell has trained over 60 M.S. and Ph.D. students during his career, and he has written four books on the Gulf of Mexico. He currently belongs to 10 professional organizations/societies, serves on 12 regional, national, and international advisory boards, and is Past-President of the Southern Association of Marine Labs and former Vice Chair of the U.S. National Committee of the Census of Marine Life. Dr. Tunnell is the editor of two book-series, one newsletter, and a Gulf of Mexico research and resource database, all at HRI. Dr. Tunnell received his PhD in Biology at Texas A&M University in 1976.

### *John H. Gentile, Ph.D.*



Dr. Jack Gentile is an ecologist whose primary interest is the design and implementation of watershed- and regional-scale integrated risk assessments, including examination of sustainable restoration solutions and the use of this information in ecosystem management and policy decisions. Dr. Gentile was a senior

scientist with the U.S. Environmental Protection Agency for 30 years, where he directed programs in marine ecotoxicology, ocean disposal of hazardous wastes, ocean incineration, marine water quality criteria, and the disposal of dredged materials. As a visiting scientist at Woods Hole Oceanographic Institution, Dr. Gentile developed strategies and methods for conducting ecological risk assessments in near-coastal environments. He concluded his US EPA career as Senior Science Coordinator for the Risk Assessment Forum, where he played a leading role in the development of the US EPA Framework for Ecological Risks. Dr. Gentile has published numerous scientific papers on topics ranging from toxic blue-green algae, marine ecotoxicology, water quality criteria, hazardous waste disposal, incineration at sea, the ecological effects of climate change, ecological risk assessment, and ecosystem management. He was Associate Editor for the journal *Human and Ecological Risk Assessment* and has facilitated many workshops on ecological risk assessment and cumulative risks, as well as serving as an expert witness. While Senior Research Scientist at the University of Miami's Rosenstiel School of Marine and Atmospheric Science, Dr. Gentile participated in a series of interdisciplinary studies on human interactions with the South Florida environment, including field, mesocosm, and modeling studies in Biscayne Bay and the Florida Keys National Marine Sanctuary, as well as the US Man and the Biosphere Human-Dominated Systems core project on ecological sustainability and ecosystem management



of the Everglades. Dr. Gentile, along with Dr. Harwell, has conducted several large ecological risk assessments, including on Tampa Bay, Biscayne Bay, the Coeur d'Alene River basin, and the Bay of Fundy. Working with the South Florida Water Management District, the US Army Corps of Engineers, and South Florida Ecosystem Restoration Task Force, Dr. Gentile facilitated the development of Assessment Guidance for evaluating the success of the Everglades Ecosystem Restoration, which has produced two System Status Reports that characterized the health of the South Florida Ecosystem. Recently, Dr. Gentile, working with Dr. Harwell and teams of scientists, developed a series of conceptual ecosystem models for the National Estuarine Research Reserves in Texas, Mississippi, and Florida, and for Prince William Sound and the Gulf of Alaska. He has worked extensively on characterizing the long-term residual ecological risks from the Exxon Valdez oil spill. Currently Dr. Gentile and Dr. Harwell are developing an integrative framework for conducting Natural Resource Damage Assessments.

### *Mark A. Harwell, Ph.D.*



Dr. Mark Harwell is an ecosystems ecologist specializing in ecological risk assessments, ecological modeling, and ecosystem management. He (with colleague Dr. Jack Gentile) was

co-leader in the development of the US EPA ecological risk assessment framework, which has been widely adopted by US EPA and throughout the federal government; they have led several large-scale ecological risk assessments, including on Biscayne Bay, Tampa Bay, Apalachicola Bay, Prince William Sound, and the Bay of Fundy. Dr. Harwell spent 25 years in academia, primarily at Cornell University and the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences; all of his academic career involved leading interdisciplinary environmental research centers. He chaired the US Man and the Biosphere Human-Dominated Systems Directorate, and led its core project to develop ecosystem management principles and apply them to the Florida Everglades, providing the framework for the South Florida Ecosystem Restoration and leading to the development of an ecosystem health report card framework. Currently, the two Partners in Harwell Gentile & Associates, LC, have developed a series of conceptual ecosystem models, including for the National Estuarine Research Reserves in Texas, Mississippi, and Florida and for Prince William Sound and the Gulf of Alaska. They have worked extensively on characterizing the long-term ecological risks from the Exxon Valdez oil spill, and are developing an integrative framework for conducting Natural Resource Damage Assessments. Dr.

Harwell served for ten years as a member of the US EPA Science Advisory Board (SAB), including three terms as Chair of the Ecological Processes and Effects Committee, and he was a leader in the ecological risks component of both the US EPA Unfinished Business Project and the US EPA SAB Reducing Risk Project. He was a member of the National Academy of Sciences panel on ecological risks in the US and Poland, as well as the NAS panel on risk communications. He served as a member of the National Academy of Sciences Board on Environmental Studies and Toxicology, and was elected a Fellow of AAAS.

### *R. Heath Kelsey, Ph.D.*



Dr. Heath Kelsey leads EcoCheck, which is a partnership between the University of Maryland Center for Environmental Science and NOAA. EcoCheck prepares and publishes the annual

Chesapeake Bay Report Card for ecosystem health. Dr. Kelsey has collaborated with many outside organizations to prepare ecosystem health report cards for systems including Australia's Great Barrier Reef, Maryland's Coastal Bays, Baltimore's Inner Harbor, and numerous local tidal and non-tidal aquatic systems. Dr. Kelsey initiated and coordinates the Mid-Atlantic Tributary Assessment Coalition, a growing group of scientists, waterkeepers, and volunteer organizations preparing report cards in the mid-Atlantic region. Through a consensus building process with this group, he facilitated the development of standard indicators, sampling methodologies, and data analysis and integration techniques for Chesapeake Bay tributary report cards. He also developed and implemented decision-making applications for beach advisory issuance at Myrtle Beach, South Carolina, integrating data from remote sensing, Ocean Observing Systems, and state and federal programmatic sources. Dr. Kelsey earned his PhD in Environmental Health Sciences at the Arnold School of Public Health at the University of South Carolina in 2006.

### *William C. Dennison, Ph.D.*



Dr. Bill Dennison is Vice President for Science Applications at the University of Maryland Center for Environmental Science (UMCES). Bill leads the Integration & Application Network (IAN), a collection of scientists interested in solving, not just studying environmental problems. He was involved for ten years with the

Healthy Waterways program in Queensland, Australia where an annual environmental report card with 47



reporting regions has been produced since 2000. He joined UMCES in 2002 and is the inaugural chair of the Science and Technical Assessment and Reporting team of the Chesapeake Bay Program. Dr. Dennison and his team of Science Integrators and Science Communicators have produced the Chesapeake Bay report card since 2006 and are involved in a suite of other regional report cards with citizen science teams and various organizations. The IAN team has been active at a variety of locations globally, and works on science communication and science integration projects with a wide variety of partners. Dr. Dennison has led the creation of conceptual models to encapsulate

current understanding of key ecological processes, anthropogenic impact zones, and critical habitats, and to communicate scientific results and to focus scientific efforts. These assessment tools have been developed and tested in a series of coastal embayment studies culminating in an Ecological Health Monitoring Program in SE Queensland, a national audit of Australian estuaries, the Great Barrier Reef Report Card, a national eutrophication assessment in the US (National Estuarine Eutrophication Assessment, 2007), Chesapeake Bay Report Card, and numerous locally derived assessment and report card projects.





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Page 5: Salt marsh in the Upper Laguna Madre along the backside of Padre Island, Texas, near Marker 37. Photographer: Jace Tunnell.

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Page 8: Oyster shell collected from restaurants and dried in sun to re-use for oyster reef restoration and rookery island habitat creation, Padre Island, Texas. Photographer: Jace Tunnell.

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