

ENVIRONMENTAL ANALYSIS OF THE GULF OF MEXICO

Margarita Caso, Irene Pisanty and
Exequiel Ezcurra, Editors (Spanish Version)

Kim Withers and Marion Nipper,
Editors (English Translation)



Harte Research Institute for Gulf of Mexico Studies
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Spanish Version Edited By

Margarito Caso, Irene Pisanty, and Exequiel Ezcurra

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PREFACE TO THE ENGLISH EDITION

International cooperation and collaboration among scientists, governments, non-governmental organizations, and the public must occur to insure the long-term sustainable use and conservation of the Gulf of Mexico. The United States and Mexico surround most of the Gulf of Mexico, but Cuba is situated where waters enter and exit from the Gulf, making it critically important also. However, even though the Gulf of Mexico is one of the most economically and ecologically productive bodies of water in the world, none of the three countries have developed an integrated strategic plan for the Gulf's future. In the U.S., most focus has been on the Atlantic and Pacific coasts; and ironically, more attention has been paid to much smaller bodies of water, such as Chesapeake Bay and the Great Lakes. In Mexico, most attention has focused on the Pacific coast, and particularly the Gulf of California in recent years, as well as the Meso-American Barrier Reef System along Mexico's Caribbean coast. In Cuba, one of the least studied and known regions is that area facing the Gulf of Mexico from the western tip of the island to the capitol city of Havana.

The good news is that focus is now finally shifting towards the Gulf of Mexico, both in regards to its value and its problems. Economic values include vast oil and gas production and reserves; highly productive fisheries; excellent tourism destinations; and ecologically valuable natural habitats such as seagrass beds, oyster reefs, coastal wetlands, sandy beaches, coral reefs, submerged banks, deep coral areas, and more. Environmental pressures and impacts on these natural systems are generally caused by increasing population levels and the infrastructure to support the above-mentioned economic values (oil and gas impacts, overfishing, coastal development). Catastrophic damage from hurricanes in 2004-2005 in all three countries has also focused attention on the Gulf.

Recent major reports/commissions have pointed out the value of our coasts and oceans, as well as vast problems needing attention (Pew Ocean Commission, 2003, and U.S. Ocean Commission, 2004). The U.S. President's Ocean Action Plan (Committee on Ocean Policy, 2004) subsequently proposed approaches to accomplish major parts of the U.S. Ocean Commission Report, one of which was a regional approach; and he singled out the Gulf of Mexico as an example. Most recently, Mexico released its new document regarding Mexico's environmental policy towards oceans and coasts, *Política Ambiental Nacional para el Desarrollo Sustentable de Océanos y Costas de México: Estrategias para su Conservación y uso Sustentable* (National Environmental Policy for the Sustainable Development of Oceans and Coasts: Strategies for their Conservation and Sustainable Use; SEMARNAT 2006). The newly established Harte Research Institute for Gulf of Mexico Studies is developing as a research center of excellence with a mission to support and advance the long-term sustainable use and conservation of the Gulf of Mexico (Tunnell and Earle 2004). One of our main goals at HRI is trilateral cooperation and collaboration, as well as dissemination of knowledge between the U.S., Mexico, and Cuba in regards to the Gulf of Mexico large marine ecosystem. To that end we joined with the Instituto Nacional de Ecología (National Institute of Ecology in Mexico) to co-sponsor their *Diagnóstico Ambiental del Golfo de México* conference in Veracruz, 22-23 August 2003, and the subsequent release of the two volume publication of the same name in late 2004.

Exequiel Ezcurra, then President of INE, and I made an agreement to publish this important and highly relevant work in English, since it contained information and new knowledge about the Gulf that was not readily available to scientists, managers, and policy

makers in the United States. The two volumes contain 38 chapters grouped in five sections: physical and chemical characteristics, biota, ecosystems, coastal zone management, and socioeconomic aspects. The new English Edition of this environmental analysis will be made widely available to U.S. scientists, students, educators, and natural resource managers.

John W. Tunnell, Jr.
Summer 2007

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ACKNOWLEDGEMENTS

(English Edition)

Dr. Exequiel Ezcurra, former President of the Instituto Nacional de Ecología (National Institute of Ecology; INE) sponsored the *Diagnóstico Ambiental del Golfo de México* (*Environmental Analysis of the Gulf of Mexico*) Workshop in Veracruz during 20-22 August 2003, as well as the publication of the resulting papers. He is also responsible for agreeing to fund the translation of the Spanish edition into English. Margarita Caso and Irene Pisanty, both of INE, were instrumental in compiling all the papers for the Spanish edition, and Margarita managed all the translations during 2005 to accomplish receipt of all 38 chapters in English. Both are sincerely thanked for their efforts in this process.

There were eight different translators used in translating the original works from Spanish to English, and we acknowledge each for their effort (listed in alphabetical order with the chapter number(s) they translated after their name):

1. Cecilia Autrigue 21
2. Mark Blackman 6, 9, 10, 13, 14, 15, 16, 17, 19, 20, 25, 30, 36
3. Alvaro Caso 5
4. Susan Beth Kapilian 18, 31, 34, 37, 38
5. Christel Kopp 12
6. Marian Ortega 32
7. Frederick Rogers 24, 35, Executive Summary
8. Mary Williams 1, 2, 3, 4, 7, 8, 22, 23, 27, 28

There were also two anonymous reviewers for each of the 38 chapters before it was published in Spanish. Each of them is gratefully acknowledged.

FOREWORD TO THE SPANISH EDITION

Nature is a complex system with multidimensional interactions. Given that management is a type of interference with nature, responsible and effective management requires knowledge of nature's interactive mechanisms. Therefore, the fundamental mission of the Instituto Nacional de Ecología (National Institute of Ecology; INE) is to generate scientific and technical information regarding environmental problems, in order to inform society, support decision-making, promote environmental protection and sustainable use of natural resources.

Natural resources derived from the sea have particular characteristics and complex problems that involve their use and protection. The range and interconnectivity of coastal and marine ecosystems, as well as their inaccessibility, contribute to difficulty in studying these marine natural resources.

The Gulf of Mexico is practically an interior sea, partially connected with the Atlantic Ocean through the Florida Strait and with the Caribbean through the Yucatán Channel. Its water mass is bordered in the south by six Mexican states, in the north by five states of the United States and in the east by Cuba.

The area receives important freshwater inflows from the main rivers of North America: the Mexican section receives 60% of the national river discharges and contains 75% of the surface of the country's estuarine environments (Botello *et al.* 1998); on the United States side the Mississippi River discharges and average of 580 km³ freshwater/year in the northern Gulf of Mexico and is responsible for approximately 90% of the freshwater flow into the Gulf (Day *et al.* 2004; Rabalais 2004).

A great diversity of highly productive habitats occurs in the coastal zone of the Gulf of Mexico, such as bays, deltas, coastal lagoons and estuaries, salt marshes, seagrass beds and coral reefs.

Coastal environments are strongly affected by a large number of activities that are frequently incompatible with each other. Currently, human activities are the main direct or indirect cause of changes in marine biodiversity, whose effects are almost always irreversible, unlike natural perturbations that have existed continuously through time in the ocean (National Research Council 1995). The majority of current and potential threats to marine biodiversity occurs in the coastal zone and is the result of demographic trends of the human population. It is estimated that almost 70% of the world's population lives on the coast or at less than 60 km from it. This percentage keeps increasing, and the total population may double in less than 30 years (Norse 1994).

In response to the complex problems of this ecosystem, shared by three countries, it is necessary to deal with it in a joint, trans-boundary and disciplined manner. This will contribute to the prevention, decrease and control of degradation of the coastal and marine environments, with the objective of maintaining and even improving their productive capacity. This situation brings the necessity of performing an environmental diagnosis of the Gulf of Mexico, which includes identifying: 1) trans-boundary problems; 2) geographic areas that require priority attention in an integrated manner; 3) available information; and, 4) threats that exist in the Gulf of Mexico.

Through the workshop *Diagnóstico Ambiental del Golfo de México (Environmental Analysis of the Gulf of Mexico)* held in the city of Veracruz in August 2003, we promoted a meeting of experts on various environmental aspects of the Gulf of Mexico. The main objective was to increase and strengthen academic exchange among environmental authorities of the

federal government and researchers from different institutions, working in different fields and with a broad knowledge of the Gulf of Mexico. The international character of the event fostered increasing collaborative links among the three countries that share the resources of this important ecological region. The publication of this book peaks this effort. We consider this as a first step to establish a medium- and long-term action plan to increase regional cooperation mechanisms and to advance the sustainable and integrated development of the Gulf of Mexico.

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ACRONYM LIST

ASFA – Aquatic Sciences and Fisheries Abstracts
ASOCEAN – Asociación de Oceanólogos de México, A.C. (Mexican Association of Oceanographers)
CARICOMP – Caribbean Coastal Marine Productivity Program
CBD – Convention on Biological Diversity
CCAR – Colorado Center for Astrodynamic Research
CFE – Comisión Federal de Electricidad (Federal Electricity Commission)
CICOLMA – Centro de Investigaciones Costeras La Mancha (La Mancha Center of Coastal Research)
CINVESTAV-IPN – Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Center for Advanced Studies and Research of the National Polytechnic Institute)
CIPAMEX – La Sección Mexicana del Consejo Internacional para la Preservación de las Aves, A.C (Mexican Section of the International Council for Bird Preservation)
CIQRO – Centro de Investigaciones de Quintana Roo (Center for Investigations of Quintana Roo)
CITES – Convention on International Trade in Endangered Species
CNA – Comisión Nacional del Agua (National Water Commission)
CONAFOR – Comisión Nacional Forestal (National Forestry Commission)
CONABIO – Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (National Commission for the Knowledge and Use of Biodiversity)
CONACYT – Consejo Nacional de Ciencia y Tecnología (National Council for Science and Technology)
CONAFOR – Comisión Nacional Forestal (National Forestry Commission)
CONANP – Comisión Nacional de Áreas Naturales Protegidas (National Commission for Protected Natural Areas)
CONAPESCA – Comisión Nacional de Acuacultura y Pesca (National Commission of Aquaculture and Fisheries)
CONAPO – Consejo Nacional de Población (National Council on Population)
CTMRG – Grupo Regional para la Investigación y Manejo de las Tortugas Marinas del Caribe (Regional Group for the Investigation and Management of Caribbean Turtles)
CYTED – Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (Latin American Program for the Development of Science and Technology)
CZCS – Coastal Zone Color Scanner
DGAPA – Dirección General de Asuntos del Personal Académico (General Direction of Academic Affairs)
DOF – Diario Oficial de la Federación (Federal Register)
ECOSUR – El Colegio de la Frontera Sur (Association of the Southern Frontier)
EEZ – Exclusive Economic Zone
ENEU – Encuesta Nacional de Empleo Urbano (National Survey of Urban Employment)
EIA – Environmental Impact Assessment
EPOMEX - Centro de Ecología, Pesquerías y Oceanografía del Golfo de México (Center for Gulf of Mexico Ecology, Fisheries and Oceanography [Universidad Autónoma de Campeche])

FAO – Food and Agriculture Organization
 FMCN – Fondo Mexicano para la Conservación de la Naturaleza A.C. (Mexican Fund for the Conservation of Nature)
 FONATUR – Fondo Nacional de Fomento al Turismo (National Trust Fund for Tourism Development)
 FONAPO – Fondo Nacional de Habitaciones Populares (National Fund for Popular Housing)
 GEF – Global Environment Facility
 GOMSA – Gulf of Mexico States Accord
 GSTP – Global System of Trade Preferences
 ICGC – Instituto Nacional de Geodesia y Cartografía (National Institute of Geodesy and Cartography)
 ICZM – Integrated Coastal Zone Management
 INE – Instituto Nacional de Ecología (National Institute of Ecology)
 INECOL – Instituto de Ecología, A.C. (Ecology Institute [Universidad Veracruzana])
 INEGI – Instituto Nacional de Estadística, Geografía e Informática (National Institute of Statistics, Geography and Informatics)
 INIBP – Instituto Nacional de Investigaciones Biológico Pesqueras (National Institute of Biological and Fisheries Research)
 INP – Instituto Nacional de la Pesca (National Fisheries Institute)
 IPN - Instituto Politécnico Nacional (National Polytechnic Institute)
 IUCN – International Union for the Conservation of Nature and Natural Resources
 IW – International Waters Program
 LCWCRTF – Louisiana Coastal Wetland Functions and Values
 LFPCCA – Ley Federal para Prevenir y Controlar la Contaminación Ambiental (Federal Law for the Prevention and Control of Environmental Contamination)
 LGEEPA – Ley General de Equilibrio Ecológico y la Protección al Ambiente (General Law on Ecological Balance and Environmental Protection)
 MIZC Golfo/Caribe – Manejo Integrado de la Zona Costera del Golfo de México y Mar Caribe (Integrated Management of the Coastal Zone of the Gulf of Mexico and the Caribbean Sea)
 MPA – Marine Protected Area
 NMFS – National Marine Fisheries Service
 NOAA – National Oceanic & Atmospheric Administration
 NOM – Norma Oficial Mexicana (Official Mexican Standard)
 OECD – Organisation of Economic Co-operation and Development
 PDF-B – Project Development Fund
 PEMEX – Petróleos Mexicanos (National Mexican Petroleum Company)
 PEP – PEMEX Exploración y Producción (PEMEX Exploration and Production Unit)
 PET – Programa de Empleo Temporal (Temporary Employment Program)
 PNA – Protected Natural Area
 PRC – Programa de Recursos Costeros (Coastal Resources Program)
 PRODERS – Programa de Desarrollo Rural Sustentable (Sustainable Rural Development Program)
 PROFEPA – Procuraduría Federal de Protección al Ambiente (Federal Ministry for Environmental Protection)
 PROMEP – Programa de Mejoramiento de Profesorado (Program for the Improvement of Teaching Staff)

SAGARPA – Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Secretariat of Agriculture, Ranching, Rural Development, Fisheries and Nutrition)
SAP – Strategic Action Plan
SARH – Secretaría de Agricultura y Recursos Hidráulicos (Secretariat of Agriculture and Hydrologic Resources)
SCT – Secretaría de Comunicaciones y Transporte (Secretariat of Communication and Transportation)
SE – Secretaría de Economía (Secretariat of Economy)
SECTUR – Secretaría de Turismo (Secretariat of Tourism)
SEDENA – Secretaría de la Defensa Nacional (Secretariat of National Defense)
SEDESOL – Secretaría de Desarrollo Social (Secretariat of Social Development)
SEDUMA – Secretaria de Desarrollo Urbano y Medio Ambiente (Secretariat of Urban Development and Environment)
SEGOB – Secretaría de Gobernación (Secretariat of the Interior)
SEMAR – Secretaría de Marina (Secretariat of the Navy)
SEMARNAP – Secretaría de Medio Ambiente, Recursos Naturales y Pesca (Secretariat of Environment, Natural Resources and Fisheries)
SEMARNAT – Secretaría del Medio Ambiente y Recursos Naturales (Secretariat of Environment and Natural Resources)
SENER – Secretaría de Energía (Secretariat of Energy)
SEP – Secretaría de Educación Pública (Secretariat of Public Education)
SEPESCA – Secretaría de Pesca (Secretariat of Fisheries)
SHCP – Secretaría de Hacienda y Crédito Público (Secretariat of Finance and Public Credit)
SIGOLFO – Sistema Regional de Investigación del Golfo de México (Gulf of Mexico Regional Research System)
SINAP – Sistema Nacional de Áreas Naturales Protegidas (National System of Protected Natural Areas)
SRE – Secretaría de Relaciones Exteriores (Foreign Relations Secretariat)
SSA – Secretaría de Salud (Secretariat of Health)
TDA – Transboundary Diagnostic Analysis
UC MEXUS – (The University of California Institute for Mexico and the United States)
UMA – Unidades de Manejo para la Conservación de la Vida Silvestre (Management Units for Wildlife Conservation)
UNAM – Universidad Nacional Autónoma de México (National Autonomous University of Mexico)
UNCED – United Nations Conference on Environment and Development
UNCLOS – United Nations Convention on the Law of the Sea
UNESCO – United Nations Educational, Scientific and Cultural Organization
UNFCCC – United Nations Framework Convention on Climate Change
USACE – U.S. Army Corps of Engineers
USEPA – U.S. Environmental Protection Agency
USFWS – U.S. Fish and Wildlife Service
ZEE – Zona Economica Exclusiva (Exclusive Economic Zone)
ZOFEMAT – Zona Federal Marítimo Terrestre (Federal Maritime Terrestrial Zone)
ZOFEMATAC – Zona Federal Marítimo Terrestre y Ambientes Costeros (Federal Maritime Terrestrial Zone and Coastal Environments)