

Gulf of Mexico Origin, Waters, and Biota

Volume 1, Biodiversity



Harte Research Institute for Gulf of Mexico Studies Series

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John W. Tunnell Jr., General Editor

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Edited by

Darryl L. Felder and

David K. Camp

Texas A&M University Press
College Station

Cover: The orange-cup coral, *Tubastraea coccinea* Lesson, 1829. The beautifully delicate live polyps featured here represent a nonindigenous species of current concern, exemplifying the urgent need for the biodiversity baseline provided in this volume. Native to the Indo-Pacific region, this species has been introduced into the Western Atlantic and the Gulf of Mexico by the activities of man (Global Invasive Species Database, www.issg.org/database). Photograph by Harley Moody.

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Foreword: 50-Year Update of Bulletin 89

John W. Tunnell Jr., Darryl L. Felder, and Sylvia A. Earle

Just over 50 years ago, a group of prominent marine scientists of their day agreed to begin work on a digest of existing knowledge on the Gulf of Mexico. The effort was proposed by Lionel A. Walford of the U.S. Fish and Wildlife Service and Waldo L. Schmitt of the U.S. National Museum of Natural History, during a meeting of the Gulf and Caribbean Fisheries Institute in Miami. Paul S. Galtsoff of the Fish and Wildlife Service agreed to coordinate the project, the magnitude of which he subsequently found far exceeded his expectations. However, 3 years of effort by 55 contributors and additional months of editing resulted in the 1954 publication of a classic reference work entitled *Gulf of Mexico—Its Origin, Waters, and Marine Life* as Fishery Bulletin 89, Fishery Bulletin of the Fish and Wildlife Service, volume 55 (Galtsoff 1954). The table of contents for the volume appears at the end of this foreword. On the title page of the work is an explanatory note that it was “Prepared by American scientists under the sponsorship of the Fish and Wildlife Service, United States Department of the Interior” and that the effort was “Coordinated by Paul S. Galtsoff,” who is generally indicated as the editor in bibliographic references to the volume.

For more than 50 years this reference volume—commonly referred to simply as “Bulletin 89” by hosts of marine scientists, agency personnel, and students familiar with it—has provided a benchmark on which to build. Chapters on the history of exploration, geology, meteorology, physical and chemical oceanography, biota, and pollution remain extremely valuable as reference works, some now primarily for historical context. Counted

among the contributors were the most distinguished North American marine scientists of their day, and visibility for a number of them was further enhanced by the extensively cited chapters they contributed to this volume. The group included the most qualified federal agency scientists, museum curators, marine laboratory investigators, and university professors who could be assembled. It broadly represented taxonomic authorities selected to cover almost every possible biotic group, with acknowledged omission of some groups for which willing expertise could not be found.

The original Bulletin 89 was heavily slanted toward biology, reflecting the focus of that era. A page count by topic reveals 63% biology (plant and animal communities, 10%; biota, 53%), oceanography 11%, geology 9%, history 6%, pollution 4%, meteorology 2%, and the index 5% (see table of contents).

At the time of this writing, only one of the 55 original contributors remains alive. However, all the original contributors, and especially the far larger number of students they mentored, have contributed to a massive body of information on the Gulf of Mexico since 1954. In addition to this core group, a number of other workers—many now in laboratories, agencies, and university programs that did not exist 50 years ago—have made tremendous contributions to the baseline knowledge of the Gulf of Mexico since publication of the original volume.

In September 2000, Ed Harte, former owner of the *Corpus Christi Caller-Times* and Harte-Hanks Publishing, gave Texas A&M University–Corpus Christi (TAMU–CC)

a \$46 million endowment to establish a research institute to study and conserve the Gulf of Mexico. Soon afterward, then-President Robert Furgason obtained an additional \$18 million from the state of Texas for a building to house the institute. Sylvia Earle, whose book *Sea Change* (Earle 1995) had inspired Harte's gift, was invited to chair the Advisory Council. She and Bob Furgason then began establishing a world-class Advisory Council of leaders in science, academics, conservation, government, and industry. John W. ("Wes") Tunnell Jr. was subsequently asked to serve as associate director to assist in guiding the institute development process, to coordinate construction of the new building, and to develop a new doctoral-level graduate program with other TAMU-CC faculty. This newly developing organization was given the name Harte Research Institute (HRI) for Gulf of Mexico Studies (Tunnell and Earle 2004). Further information about HRI and TAMU-CC can be found at their respective websites (www.hartheresearchinstitute.org and www.tamucc.edu).

After 2 HRI Advisory Council meetings, Wes Tunnell was encouraged to develop some "early" projects during the formative years of HRI in order to get a jump start on its mission of developing a cooperative and collaborative research institute focused on the long-term sustainable use and conservation of the Gulf of Mexico. From that emerged a multi-year, tri-national initiative called *The Gulf of Mexico—Past, Present, and Future* (Tunnell, Felder, and Earle 2004). The initiative had 9 components, all of which included participation by the 3 countries surrounding the Gulf of Mexico: Cuba, Mexico, and the United States. Three of the 9 components centered on determining current knowledge about the Gulf of Mexico ecosystem: (1) State of Knowledge Workshop, (2) Biodiversity of the Gulf of Mexico Project (Tunnell 2005), and (3) preparation of a 50-year update of Bulletin 89. The biodiversity and Bulletin 89 projects were initially conceived and discussed by Sylvia Earle, Wes Tunnell, and Darryl Felder in late 2001 and early 2002. Concept development continued through early 2003, when a steering committee was formed to develop ideas further and establish an implementation strategy. Steering Committee members included Fernando Álvarez, Bill Bryant, Ernesto Chávez, Luis Cifuentes, Steve Dimarco, Quenton Dokken, Sylvia Earle (co-chair), Elva Escobar, Ernie Estevez, Darryl Felder, Suzanne Fredericq, María Elena Ibarra, Chuck Kennicutt, Paul Montagna, Marion Nipper, Worth Nowlin, Manuel Ortiz, David Pawson, Nancy Rabalais, Wes Tunnell (chair), and Gene Turner.

Overall objectives for the projects were as follows:

- To produce an updated Bulletin 89
- To provide a benchmark work by the leaders in the field at the beginning of the 21st century
- To provide a synthesis of all work to date to the scientific, management, business, and policy communities to encourage an ecosystem view of the Gulf of Mexico
- To encourage cooperation and collaboration among U.S., Mexican, and Cuban scientists working in the Gulf of Mexico
- To determine information gaps in knowledge of the Gulf of Mexico, so targeted research can be encouraged to fill those gaps

The State of Knowledge Workshop, held 14–16 October 2003, became the kickoff for the biodiversity and Bulletin 89 projects. The 50-year update of Bulletin 89 grew from one volume to 7, broadly including geology, physical and chemical oceanography, biota, anthropogenic issues, ecosystem-based management, and socioeconomics. Likewise, the effort was expanded from 55 authors in 1954 to more than 200 for the new effort. Most of the knowledge gained and presented in the original Bulletin 89 was from research cruises and expeditions to the Gulf during the late 19th and early 20th centuries and from a few fledgling marine science labs and oceanography programs started in the early to mid-1900s, but massive efforts have followed in their wake.

At the dawning of a new century, researchers at marine labs and universities encircle the Gulf in Cuba, Mexico, and the United States (see www.gulfbase.org), and instrumentation, technology, and communication have greatly expanded our knowledge of the Gulf. The U.S. Environmental Protection Agency's Gulf of Mexico Program has identified priority problems affecting the northern Gulf of Mexico, and the agency recently published the research needs of that region (EPA 2002). A network of United Nations organizations has declared the Gulf of Mexico as one of 64 large marine ecosystems in the world (Kumpf, Steidinger, and Sherman 1999). The U.S. Commission on Ocean Policy released its report, *An Ocean Blueprint for the 21st Century*, in August 2004, listing 212 recommendations for actions to better care for and manage U.S. coasts and oceans. President George W. Bush subsequently issued his Ocean Action Plan response in December 2004, singling out the Gulf of Mexico as a region of special concern.

Next, HRI sponsored the first State of the Gulf of Mexico Summit. This 3-day summit, held 26–30 March 2006, was attended by 450 invited guests from the United States and Mexico, and it focused on governance, catastrophic events, sustainability, economics, public health, and the environment (Tunnell and Dokken 2006). Future summits are planned at regular intervals, perhaps every 3 years, at key locations around the Gulf of Mexico.

While the challenge was daunting, an update of Bulletin 89 was long overdue. As the 50th anniversary of its publication has passed, the range and scope of primary literature sources on the Gulf of Mexico have become so expansive as to be all but unmanageable for most workers. For almost all subject areas, no authoritative digests centered on the Gulf of Mexico have appeared since Bulletin 89. Yet many treatments in that work are clearly outdated and are of limited value except as historical starting points. Furthermore, it was urgent to begin compilations for this updated digest before the marine science community sustained further loss of continuity in expertise. We have already lost all but one of the original contributors to Bulletin 89, the passage of 50 years has claimed a large number of the subsequent generation of workers, and others are late in their careers. This is perhaps most evident in what has become a very limited pool of qualified systematists to draw upon for expertise concerning diversity and taxonomy of the Gulf of Mexico biota. It is noteworthy that one remarkable scientist who contributed to the original effort, the late Frederick M. (Ted) Bayer, also co-authored a chapter for one volume (*Biodiversity*) immediately prior to his passing.

We collectively thank all contributors to this immense effort, especially the editors and coordinators of each volume for their multi-year commitments to this project. Many users will benefit for decades to come because of their dedicated efforts. We especially thank Ed Harte for putting in place the infrastructure needed to undertake a project of this magnitude, and we offer these volumes as an early step in response to his charge, “make a difference.”

John W. Tunnell Jr.
Darryl L. Felder
Sylvia A. Earle

Bulletin 89: 50-Year Update Series Coordinators

Bulletin 89 Table of Contents (Abbreviated)

Gulf of Mexico—Its Origin, Waters, and Marine Life

Paul S. Galtsoff, Coordinator

Fishery Bulletin 89, 1954

I. Historical sketch by Paul S. Galtsoff (34 pp.)

II. Geology

Shorelines and coasts of the Gulf of Mexico by
W. Armstrong Price (27 pp.)

Geology of the Gulf of Mexico by S. A. Lynch
(20 pp.)

III. Marine meteorology by Dale F. Leipper (10 pp.)

IV. Physics and Chemistry

Tides and sea level in the Gulf of Mexico by
H. A. Marmer (18 pp.)

Physical oceanography of the Gulf of Mexico by Dale F.
Leipper (19 pp.)

Light penetration in the Gulf of Mexico by William S.
Shoemaker (3 pp.)

Distribution of chemical constituents by Robert H.
Williams (9 pp.)

The recovery of minerals by C. M. Shigley (7 pp.)

V. Plant and animal communities

Phytoplankton by Charles C. Davis (7 pp.)

Zooplankton by Hilary B. Moore (2 pp.)

Red tide by Reuben Lasker and F. G. Walton Smith
(4 pp.)

Marine algal vegetation of the shores by William
Randolph Taylor (16 pp.)

Flowering plants by Robert F. Thorne (10 pp.)

Bottom communities by Joel W. Hedgpeth (12 pp.)

VI. Bacteria, fungi, and unicellular algae

Marine bacteria and fungi by Claude E. ZoBell (6 pp.)

Dinoflagellates by Herbert W. Graham (4 pp.)

Diatoms by Paul Conger (6 pp.)

VII. Protozoa

Foraminifera by Fred B. Phleger and Frances L. Parker
(7 pp.)

Protozoa by Victor Sprague (14 pp.)

VIII. Sponges, coelenterates, and ctenophores

Porifera by J. W. Tierney (3 pp.)

Commercial sponges by F. G. Walton Smith (4 pp.)

Hydroids by Edward S. Deevey Jr. (6 pp.)

Hydromedusae by Mary Sears (2 pp.)

Siphonophores by Mary Sears (2 pp.)

Scyphozoa by Joel W. Hedgpeth (2 pp.)

Anthozoa: Alcyonaria by Frederick M. Bayer (6 pp.)

- Anthozoa: The anemones by Joel W. Hedgpeth (6 pp.)
Madreporaria by F. G. Walton Smith (5 pp.)
Ctenophores by Mary Sears (1 p.)
- IX. Free-living flatworms, nemerteans, nematodes, tardigrades, and chaetognaths**
Free-living flatworms (Turbellaria) by L. H. Hyman (2 pp.)
Nemerteans by Wesley R. Coe (7 pp.)
Echinoderida by B. G. Chitwood (1 p.)
Free-living nematodes by B. G. Chitwood and R. W. Timm (11 pp.)
Tardigrades by B. G. Chitwood (1 p.)
Chaetognatha by E. Lowe Pierce (3 pp.)
- X. Parasitic worms**
Parasitic helminths by Asa C. Chandler and Harold W. Manter (2 pp.)
Trematoda by Harold W. Manter (16 pp.)
Cestoda by Asa C. Chandler (3 pp.)
Acanthocephala by Asa C. Chandler (1 p.)
Nematoda by Asa C. Chandler (2 pp.)
- XI. Bryozoa, Brachiopoda, Phoronida, and Entero-pneusta**
The Bryozoa by Raymond C. Osburn (2 pp.)
Brachiopoda by G. Arthur Cooper (3 pp.)
Phoronida by Joel W. Hedgpeth (1 p.)
Enteropneusta by Joel W. Hedgpeth (1 p.)
- XII. Echinoderms**
Echinoderms (other than holothurians) by Austin H. Clark (7 pp.)
Holothurians by Elisabeth Deichmann (30 pp.)
- XIII. Annelids and miscellaneous worms**
Polychaetous annelids by Olga Hartman (5 pp.)
Miscellaneous vermes by Joel W. Hedgpeth
Echiurida (1 p.)
Sipunculida (1 p.)
- XIV. Arthropods**
Xiphosura by Joel W. Hedgpeth (1 p.)
Pycnogonida by Joel W. Hedgpeth (3 pp.)
Ostracoda by Willis L. Tressler (9 pp.)
Copepoda by Waldo L. Schmitt (4 pp.)
Cirripedia (barnacles) by Dora P. Henry (4 pp.)
Mysidacea and Euphausiacea by Albert H. Banner (2 pp.)
Stomatopoda by Fenner A. Chace Jr. (2 pp.)
Decapoda by Ellinor H. Behre (5 pp.)
Commercial shrimps by Milton J. Lindner and William W. Anderson (5 pp.)
Spiny lobster by F. G. Walton Smith (3 pp.)
- XV. Mollusks**
Mollusks by Harald A. Rehder (6 pp.)
Cephalopoda by Gilbert L. Voss (4 pp.)
Oyster Biology by Philip A. Butler (11 pp.)
Oyster reefs by W. Armstrong Price (1 p.)
- XVI. Tunicates and lancelets**
Tunicata by Willard G. Van Name (3 pp.)
Lancelets by Joel W. Hedgpeth (1 p.)
- XVII. Fishes and sea turtles**
Fishes by Luis R. Rivas (3 pp.)
Commercial fishes by George A. Rounsefell (6 pp.)
Sea turtles by F. G. Walton Smith (3 pp.)
- XVIII. Birds by George H. Lowery Jr. and Robert J. Newman (22 pp.)**
- XIX. Mammals by Gordon Gunter (9 pp.)**
- XX. Pollution of water (21 pp.)**

References

- Earle, S. 1995. *Sea Change: A Message of the Oceans*. Ballantine Books, New York.
- Environmental Protection Agency (EPA). 2002. *Critical Scientific Research Needs Assessment for the Gulf of Mexico*. Prepared by the Research Subcommittee of the Monitoring, Modeling, and Research Committee for the Gulf of Mexico Program Office.
- Galtsoff, P. S. 1954. *Gulf of Mexico, Its Origin, Waters, and Marine Life*. Fishery Bulletin 89, Fishery Bulletin of the Fish and Wildlife Service, Volume 55. Washington, D.C.
- Kumpf, H., K. Steidinger, and K. Sherman, editors. 1999. *The Gulf of Mexico Large Marine Ecosystem*. Blackwell Science, Malden, Massachusetts.
- Tunnell, J. W. Jr. 2005. *Biodiversity of the Gulf of Mexico project*. Pp. 285–286 *in* P. Miloslavich and E. Klein, eds. *Caribbean Marine Biodiversity: The Known and the Unknown*. DEStech Publications, Lancaster, Pennsylvania.
- Tunnell, J. W. Jr., and Q. R. Dokken, editors. 2006. *Proceedings of the State of the Gulf of Mexico Summit*. Corpus Christi, Texas, 28–30 March 2006. Corpus Christi: Harte Research Institute for Gulf of Mexico Studies, Texas A&M University–Corpus Christi.
- Tunnell, J. W. Jr., and S. A. Earle. 2004. *Harte Research Institute for Gulf of Mexico Studies: Initiatives in Marine Science Research*. Pp. 132–141 *in* R. L. Creswell, ed. *Proceedings of 55th Annual Gulf and Caribbean Fisheries Institute*, Xel-Ha, Quintana Roo, Mexico. Gulf and Caribbean Fisheries Institute, Fort Pierce, Florida.
- Tunnell, J. W. Jr., D. L. Felder, and S. A. Earle. 2004. *El Golfo de*

México-Pasado, presente, y futuro: Una colaboración entre Estados Unidos de América, México y Cuba. Pp. 361–371 *in* M. Caso, I. Pisanty, and E. Ezcurra, eds. Diagnóstico ambiental del Golfo de México. Instituto Nacional de Ecología, (INECOL A.C.) and Harte Research Institute for Gulf of Mexico Studies TAMU–CC, 2 vols. Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), México City.

U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century. Final Report. U.S. Commission on Ocean Policy, Washington, D.C.

U.S. Ocean Action Plan: The Bush Administration's Response to the U.S. Commission on Ocean Policy. 2004. Washington, D.C.