

Review

The Gulf of California: Review of ecosystem status and sustainability challenges

Salvador E. Lluch-Cota ^{a,*}, Eugenio A. Aragón-Noriega ^a,
Francisco Arreguín-Sánchez ^b, David Aurióles-Gamboa ^b,
J. Jesús Bautista-Romero ^a, Richard C. Brusca ^c,
Rafael Cervantes-Duarte ^b, Roberto Cortés-Altamirano ^d,
Pablo Del-Monte-Luna ^b, Alfonso Esquivel-Herrera ^e, Guillermo Fernández ^d,
Michel E. Hendrickx ^d, Sergio Hernández-Vázquez ^a, Hugo Herrera-Cervantes ^f,
Mati Kahru ^g, Miguel Lavín ^h, Daniel Lluch-Belda ^b, Daniel B. Lluch-Cota ^a,
Juana López-Martínez ^a, Silvio G. Marinone ^h, Manuel O. Nevárez-Martínez ⁱ,
Sofía Ortega-García ^b, Eduardo Palacios-Castro ^f, Alejandro Parés-Sierra ^h,
Germán Ponce-Díaz ^a, Mauricio Ramírez-Rodríguez ^b, Cesar A. Salinas-Zavala ^a,
Richard A. Schwartzlose ^{g,1}, Arturo P. Sierra-Beltrán ^a

^a Centro de Investigaciones Biológicas del Noroeste (CIBNOR), P.O. Box 128, La Paz, Baja California Sur 23000, Mexico

^b Centro Interdisciplinario de Ciencias Marinas (CICIMAR-IPN), P.O. Box 592, La Paz, Baja California Sur 23000, Mexico

^c Arizona-Sonora Desert Museum, Tucson, AZ 85743, USA

^d Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Unidad Académica Mazatlán,

P.O. Box 818, Mazatlán, Sinaloa 82040, Mexico

^e Universidad Autónoma Metropolitana (UAM-Xochimilco), Departamento El Hombre y Su Ambiente, Calzada del Hueso 1100,
Col. Villa Quietud, D.F. 04960, Mexico

^f Centro de Investigación Científica y Educación Superior de Ensenada, Unidad Baja California Sur (CICESE-La Paz),
Miraflores 334, Frac. Bella Vista, La Paz, B.C.S. 23050, Mexico

^g Scripps Institution of Oceanography, University of California, San Diego, CA 92093, USA

^h Centro de Investigación Científica y Educación Superior de Ensenada (CICESE), P.O. Box 2732, Ensenada,
Baja California 22800, Mexico

ⁱ Instituto Nacional de la Pesca, Centro Regional de Investigaciones Pesqueras (INP-CRIP) Calle 20 No. 605 sur,
Centro, Guaymas, Sonora 85400, Mexico

Revised 12 December 2006; accepted 2 January 2007

Available online 30 January 2007

Abstract

The Gulf of California is unique because of its geographical location and conformation. It hosts diverse ecosystems and important fisheries that support industry and provide livelihood to coastal settlements. It is also the site of interests and

* Corresponding author. Tel.: +52 612 1238484; fax: +52 612 1238522.

E-mail address: sluch@cibnor.mx (S.E. Lluch-Cota).

¹ Present address: 1047 Highland Dr. Del Mar, CA 92014-3902, USA.

problems, and an intense interaction among managers, producers, and conservationists. In this report, we scrutinize the abiotic (hydrography, climate, ocean circulation, and chemistry) and biotic (phyto- and zooplankton, fish, invertebrates, marine mammals, birds, and turtles) components of the marine ecosystem, and some particular aspects of climate variability, endemisms, harmful algal blooms, oxygen minimum layer, and pollution. We also review the current conditions and conflicts around the main fisheries (shrimp, small and large pelagic fishes, squid, artisanal and sportfishing), the most important human activity in the Gulf of California. We cover some aspects of management and conservation of fisheries, especially the claimed overexploitation of fish resources and the ecosystems, and review proposals for creating networks of marine protected areas. We conclude by identifying main needs for information and research, particularly the integration of data bases, the implementation of models and paleoreconstructions, establishment of monitoring programs, and the evaluation of fishing impacts and management actions.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Ecosystem; Fisheries; Conservation; Management; Mexico; Gulf of California

Contents

1.	Introduction	2
2.	Ecosystem description	3
2.1.	Physical environment	4
2.2.	Enrichment and primary production	5
2.3.	Non-exploited fauna	6
2.3.1.	Zooplankton	6
2.3.2.	Non-commercial benthos	6
2.3.3.	Marine mammals	7
2.3.4.	Marine birds	8
2.3.5.	Marine turtles	9
2.4.	Climate variability	9
2.5.	Special issues	11
2.5.1.	Oxygen minimum layer	11
2.5.2.	Harmful algal blooms	11
2.5.3.	Endemism	12
2.5.4.	Pollution and habitat degradation	13
3.	Fisheries	14
3.1.	Shrimp	14
3.2.	Small pelagic fishes	15
3.3.	Squid	16
3.4.	Large pelagic fishes	17
3.5.	Artisanal fisheries	17
3.6.	Sport fishing	17
4.	Management and conservation	18
4.1.	Marine Protected Areas	18
4.2.	Ecosystem overfishing	19
5.	Summary	20
	Acknowledgements	20
	References	21

1. Introduction

The Gulf of California (Fig. 1) is the only inland sea in the Eastern Pacific, the most important fishing region in Mexico, and one of the marine systems most closely watched by the worldwide conservation sector. It has been subject of research and exploration for decades. Some isolated evaluations of the climate variations and human-

Download English Version:

<https://daneshyari.com/en/article/4553934>

Download Persian Version:

<https://daneshyari.com/article/4553934>

[Daneshyari.com](https://daneshyari.com)