JOURNAL OF COASTAL RESEARCH

An International Forum for the Littoral Sciences

CHEF-HERAUSGEBER

EDITOR-IN-CHIEF Charles W. Finkl, Jnr.

EDITEUR-EN-CHEF

Coastal Education and Research Foundation, Inc. [CERF] 4310 NE 25th Avenue Fort Lauderdale, FL 33308, USA

BOOK REVIEW EDITOR

S. Brian McCann

Department of Geography, McMaster University

Hamilton, Ontario L8S 4K1, Canada

JCR PUBLICATIONS MANAGER

Karen Hickey

P.O. Box 1897, Lawrence, KS 66044

Telephone: (913) 843-1235/FAX (913) 843-1274

MARINE GEOLOGY

Terry R. Healy

MIT-HERAUSGEBER

ASSOCIATE EDITORS

COMITÉ DE REDACTION

BIOLOGICAL SCIENCES Clinton J. Dawes Tampa, Florida OCEANOGRAPHY **David Huntley**

ENGINEERING & TECHNOLOGY Per Bruun Hilton Head, South Carolina COASTAL GEOLOGY

POLICY & MANAGEMENT James R. Broadus Woods Hole, Massachusetts GEOMORPHOLOGY

Orson van de Plassche Amsterdam, The Netherlands

Hamilton, New Zealand CONSULTING EDITOR Rhodes W. Fairbridge New York, New York

REDAKTIONSKOMMISSION

José F. Arava Santiago, Chile Cecile Baeteman

Brussels, Belgium Daniel F. Belknap Orono, Maine

Plymouth, England

Eric C.F. Bird Parkville, Victoria, Australia

Charles Birkeland Mangilao, Guam Donald R. Coates Binghamton, New York F. Vasco Costa

Lishon Portugal Anthony J. Davy Norwich, England Elliot W. Dawson Wellington, New Zealand

Richard V. Dingle Cape Town, South Africa Jean-Claude Dionne Québec, Canada Robert Dolan

Charlottesville, Virginia Keith R. Dyer Plymouth, England Lionel N. Eleuterius

Ocean Springs, Mississippi Donald L. Forbes Dartmouth, Canada

EDITORIAL BOARD

Shoii Fuiii Toyama City, Japan D.F. Geritsen Honolulu, Hawaii Edgardo D. Gomez Quezon City. Philippines Gary B. Griggs Santa Cruz, California André Guilcher Brest, France Ali Günbak Ankara, Turkey David Hopley
Townsville, Olds., Australia

Joseph T. Kelley Orono, Maine

O.G. Houmb Trondheim, Norway

Paul Kaplin Moscow, USSR **Dieter Kelletat** Essen, W. Germany Vic Klemas Newark, Delaware N. Kobayashi

Newark. Delaware Nicholas C. Kraus Vicksburg, Mississippi Néstor W. Lanfredi La Plata, Argentina

Pierre Lasserre Paris, France Miguel A. Losada Santander, Spain

M. Anwar Maun London, Ontario, Canada B. Mazurkiewicz

Gdansk, Poland C. Peter McRoy Fairbanks, Alaska Ashish J. Mehta

Gainesville, Florida Robert A. Morton Austin, Texas

M.R. Nayak Dona Paula, India P. Nielsen Hornsby, NSW, Australia

Roland P. Paskoff Le Chesnay, France Orrin H. Pilkey, Jr. Durham, N. Carolina Paolo A. Pirazzoli

Paris, France Norbert P. Psuty New Brunswick, New Jersey

Ren Mei-e Nanjing, China

COMMISSION DE PUBLICATION Michael R. Rampino

New York, New York William Sackinger Fairbanks, Alaska Bernard Salvat Paris. France Toru Sawaragi Osaka, Japan Carlos Schubert Caracas, Venezuela Maurice L. Schwartz Bellingham, Washington Andrew D. Short Sydney, NSW, Australia H.B. Sørensen Lemvig, Denmark P. Tryde Lyngby, Denmark F. van der Meulen Amsterdam, Netherlands Herman Th. Verstappen Enschede, The Netherlands John T. Wells Chapel Hill, N. Carolina Niels West Kingston, Rhode Island

Xu Jizu

Tianjin, China

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by the Coastal Education and Research Foundation (CERF). This authorization is extended to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$US 1.00 per copy of the article plus \$US 0.10 per page is paid directly to the Copyright Clearance Center, 27 Congress Street, Salem, MA 01970. For those organizations that have been granted a License with the Copyright Clearance Center, a separate system of payments has been arranged. Please contact the Copyright Clearance Center to determine whether the License fee arrangement covers your organization. This consent does not extend to other kinds of copying, such as copying for general distributions, for creating new collective works, or for resale. Fees for past articles are the same as those shown for current articles. The Item Fee-Code for users of the Transactional Reporting Service is 0749-0208/1989 \$US 1.00 + 0.10.

It is a condition of publication that manuscripts submitted to this journal have not been published, nor will they be simultaneously submitted or published elsewhere. By submitting a manuscript, the authors agree that the copyright for their article is transferred to the publisher if the article is accepted for publication. Assignment of copyright is not required, however, from authors who work for organizations which do not permit such assignment. The copyright covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of a similar nature, and translations. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying, recording or otherwise, without permission in writing from the copyright holder.

The JOURNAL OF COASTAL RESEARCH (ISSN 0749-0208) is published quarterly by the Coastal Education & Research Foundation (CERF), 810 East 10th St., Lawrence, KS 66044, USA. Subscription rates for 1991 are \$US 125.00 for institutions, \$US 58.00 for individuals and \$US 43.00 for students. Members of the Coastal Education and Research Foundation (CERF) receive the journal for \$US 48.00. All subscribers outside the USA please add \$US 10.00 for surface postage. Single back issues and parts are available at current subscription rates. Second class postage paid at Lawrence, KS. POSTMASTER: Send address changes to JOURNAL OF COASTAL RESEARCH, P.O. Box 368, Lawrence, KS 66044.

Claims for Missing Issues: No claims allowed for (1) insufficient notice of address change; (2) issues lost in mail unless claimed within (a) 90 days for USA, or (b) 120 days for other countries, from last day of month of publication; or (3) such reasons as "missing

[©] 1991, the Coastal Education & Research Foundation (CERF). Printed by Allen Press, Inc., Lawrence, Kansas, USA.

Journal of Coastal Research

An International Forum for the Littoral Sciences

Supporting Organizations

- International Union for Quaternary Research (INQUA): Commission on Quaternary Shorelines, The Holocene Commission, and The Neotectonics Commission.
- International Geological Correlation Program (IGCP) (supported by the International Union of Geological Sciences and UNESCO): Project No. 274 — Quaternary Coastal Evolution: Case Studies, Models and Regional Patterns.
- The International Geographical Union (IGU): Commission on the Coastal Environment
- International Institute for Aerial Survey and Earth Sciences (ITC)[Enschede, The Netherlands]
- International Association for Biological Oceanography (IABO)
- International Association of Meiobenthologists (IAM)

• International Post-Graduate Training Courses on Fundamental and Applied Quaternary Geology (IFAQ) [Brussels, Belgium]

JAN 20 1991

 $F_{I_{i}}$, r = 1

Aims and Scope of the Journal

Journal of Coastal Research, an International Forum for the Littoral Sciences, is dedicated to all aspects of coastal research. These include geology, biology, geomorphology (physical geography), climate, littoral oceanography, hydrography, coastal hydraulics, environmental (resource) management, engineering, and remote sensing. Although each field functions effectively within its own purview, the cross-disciplinary nature of coastal studies requires familiarity with other fields as well. Hence, the scope of topics is necessarily broad in order to address the complexity of coastal biophysical and socio-economic interactions. Because of the wide range of interrelated topics, the journal invites original contributions and manuscripts dealing with theory, methodology, techniques, and field or applied topic studies on interdisciplinary coastal issues.

The journal encourages the dissemination of knowledge and understanding of the coastal zone by promoting cooperation and communication between specialists in different disciplines. Natural scientists, for example, are encouraged to collaborate with professionals in other fields to prepare contributions relating to the coastal zone that foster increased appreciation of coastal environments and processes. By means of this journal, with its scholarly and professional papers, systematic review articles, book and symposia reviews, communications and news, and special topical issues, an international forum for the development of integrated coastal research is provided.

Subscription Information

Editorial, Advertising and Publishing Office: Dr. Charles W. Finkl, Jnr., Editor-in-Chief, 4310 NE 25th Avenue, Fort Lauderdale, Florida 33308 USA. Telephone: (305) 565-1051, (305) 564-5653. FAX (305) 565-1051. All certified or registered mail should be sent to: Dr. Charles W. Finkl, Jnr., Editor-in-Chief, P.O. Box 8068, Charlottesville, VA 22906 USA.

Published Quarterly in January, March, June, and September. *Annual Subscription Rate* (1991): \$US 43.00 (Student), \$US 58.00 (Personal), \$US 125.00 (Institution). Subscribers outside of the USA please add \$US 10.00 for surface postage or \$US 45.00 for airmail postage and handling. Back issues (from Volume 3 onwards) are available at current subscription rates.

THE JOURNAL OF COASTAL RESEARCH is surveyed in Aquatic Sciences and Fisheries Abstracts; Current Awareness in Biological Sciences; Current Contents/Agriculture; Biology & Environmental Sciences; Ecology Abstracts; FLUIDEX (British Hydromechanics Research Association); GeoAbstracts; GeoScience Contents; Institute of Scientific Information (USSR); Marine Science Contents Tables; Oceanic Abstracts; Oceanographic Literature Review; Physics Abstracts; and Pollution Abstracts.



View of East Pass Inlet, Florida. East Pass, the only tidal inlet between Choctawhatchee Bay and the Gulf of Mexico, is located along the Florida Panhandle between Pensacola and Panama City. This image, taken towards the southeast from about 1500 feet altitude, shows the city of Destin in the upper left and the Gulf of Mexico in the upper right. The undeveloped beach in the lower right is the eastern end of Santa Rosa Island and is part of the large flood tidal shoal. The jetties were built by the U.S. Army Corps of Engineers in 1967 and 1968. The sand spit along the east side of the inlet, known as Norriego Point, is a recent feature (1935) and has experienced significant erosion lately; nevertheless, condominiums have been built on it. The body of water in the upper left of the seene is Old Pass Lagoon and represents East Pass's pre-1928 route to the Gulf of Mexico. Distance between the tips of the jetties is 900 feet. (Photograph by Andrew Morang, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS 39180-6199. Date of photo: 17 May 1989).