

JOURNAL OF COASTAL RESEARCH

An International Forum for the Littoral Sciences

CHEF-HERAUSGEBER

EDITOR-IN-CHIEF

EDITEUR-EN-CHEF

Charles W. Finkl, Jr.

Coastal Education and Research Foundation, Inc. [CERF]

4310 NE 25th Avenue

Fort Lauderdale, FL 33308, USA

INTERNET and BITNET online address: "finkl@acc.fau.edu."

BOOK REVIEW EDITOR

Gregory W. Stone
Louisiana State University
Baton Rouge, LA, U.S.A.

JCR PUBLICATIONS MANAGER

Karen Hickey
P.O. Box 1897, Lawrence, KS 66044
Telephone: (913) 843-1235/FAX (913) 843-1274

EDITORIAL ASSISTANT

Marilyn Whetzel
CERF, Inc.
Boca Raton, FL 33431

MITHERAUSGEBER

BIOLOGICAL SCIENCES

Clinton J. Dawes
Tampa, Florida

OCEANOGRAPHY

Kerry Black
Melbourne, Australia

ASSOCIATE EDITORS

ENGINEERING & TECHNOLOGY

Per Bruun
Hilton Head, South Carolina

COASTAL GEOLOGY

Jeffrey H. List
St. Petersburg, Florida

MANAGEMENT

Niels West
Kingston, Rhode Island

GEOMORPHOLOGY

Orson van de Plassche
Amsterdam, The Netherlands

COMITÉ DE REDACTION

MARINE GEOLOGY

Terry R. Healy
Hamilton, New Zealand

CONSULTING EDITOR

Rhodes W. Fairbridge
New York, New York

REDAKTIONSKOMMITEE

Troels Aagaard
Copenhagen, Denmark

José F. Araya
Santiago, Chile

Cecile Baeteman
Brussels, Belgium

Daniel F. Belknap
Orono, Maine

Eric C.F. Bird
Black Rock, Vic., Australia

Charles Birkeland
Mangilao, Guam

Jindrich Brezina
Caracas, Venezuela

Donald R. Coates
Binghamton, New York

F. Vasco Costa
Lisbon, Portugal

Anthony J. Davy
Norwich, England

Ron DeLaune
Baton Rouge, Louisiana

Reinhard Dieckmann
Bremerhaven, Germany

Richard V. Dingle
Cape Town, South Africa

Jean-Claude Dionne
Québec, Canada

Robert Dolan
Charlottesville, Virginia

Lionel N. Eleuterius
Ocean Springs, Mississippi

EDITORIAL BOARD

Duncan M. FitzGerald
Boston, Massachusetts

Donald L. Forbes
Dartmouth, Canada

Shoji Fujii
Toyama City, Japan

Cyril Galvin
Springfield, Virginia

F. Gerritsen
Hilton Head, South Carolina

Edgardo D. Gomez
Quezon City, Philippines

Gary B. Griggs
Santa Cruz, California

Bruce Hayden
Charlottesville, Virginia

David Hopley
Townsville, Qlds., Australia

Saskia Jelgersma
Bergen, The Netherlands

Paul Kaplin
Moscow, USSR

Dieter Kelleat
Essen, Germany

Joseph T. Kelley
Orono, Maine

Gary Klee
San Jose, California

Vic Klemas
Newark, Delaware

N. Kobayashi
Newark, Delaware

Nicholas C. Kraus
Corpus Christi, Texas

Pierre Lasserre
Paris, France

Miguel A. Losada
Santander, Spain

M. Anwar Maun
London, Ontario, Canada

B. Mazurkiewicz
Gdansk, Poland

C. Peter McRoy
Fairbanks, Alaska

Robert A. Morton
Austin, Texas

P. Nielsen
Brisbane, Qlds., Australia

Randall W. Parkinson
Melbourne, Florida

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

Ulrich Radtke
Cologne, Germany

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

Gregory W. Stone
Baton Rouge, Louisiana

F. van der Meulen
Amsterdam, The Netherlands

Herman Th. Verstappen
Enschede, The Netherlands

H.J. Walker
Baton Rouge, Louisiana

John T. Wells
Chapel Hill, N. Carolina

Niels West
Kingston, Rhode Island

Eric Wolanski
Townsville, Qlds, Australia

P.L. Woodworth
Merseyside, England

COPYRIGHT

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 consent does not extend to other kinds of copying, such as copying for general distributions, for creating new collective works, or for resale.

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 1994 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 from files."

©1994, the Coastal Education & Research Foundation [CERF]. Printed by Allen Press, Inc., Lawrence, Kansas, USA.

Supporting Scientific Organizations

Library
Boca Raton, FL

- 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].

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, Jr., Editor-in-Chief, 4310 NE 25th Avenue, Fort Lauderdale, Florida 33308 USA. Telephone and FAX: (305) 565-1051. All certified or registered mail should be sent to Dr. Charles W. Finkl, Jr., Editor-in-Chief, Journal of Coastal Research, Department of Geology, Florida Atlantic University, Boca Raton, FL 33431 USA.

Advertising and Promotion Office: Ralph DeSoignie, 1041 New Hampshire Street, Lawrence, KS 66044. Telephone: (913) 843-1235. FAX: (913) 843-1274.

Subscriptions Office: Karen Hickey, P.O. Box 1897, Lawrence, KS 66044 USA. Telephone: (913) 843-1235. FAX: (913) 843-1274.

Published Quarterly in January, March, June, and September. *Annual Subscription Rate (1993):* \$US 48.00 (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*; *Civil Engineering Hydraulics Abstracts*; *Current Awareness in Biological Sciences*; *Current Contents/Agriculture*; *Biology & Environmental Sciences*; *Ecology Abstracts*; *FLUIDEX (British Hydromechanics Research Association)*; *Focus on: Global Change*; *GeoAbstracts (Geographical Abstracts: Physical Geography)*; *Ecological Abstracts*; *Geological Abstracts*; *GEOBASE*; *GeoScience Contents*; *Institute of Scientific Information (USSR)*; *Marine Science Contents Tables*; *Meteorological and Geostrophysical Abstracts*; *Oceanic Abstracts*; *Oceanographic Literature Review*; *Physics Abstracts*; *Pollution Abstracts*; *Selected Water Resources Abstracts (U.S. Geological Survey)*; *Wetland Values Database (U.S. Fish & Wildlife Service)*; and *SciSearch*.

JOURNAL OF COASTAL RESEARCH

SUBSCRIPTION INFORMATION

The **JOURNAL OF COASTAL RESEARCH (JCR)**, official publication of the Coastal Education & Research Foundation (a non-profit corporation), acts as a basic world publication for coastal research. The journal publishes original contributions that deal with theory, methodology, techniques, and field or applied studies on inter-disciplinary topics. All aspects of coastal research are considered in the fields of **biology, geology, oceanography, environmental (resource) management, engineering, and planning**, among others. JCR is surveyed in: *Aquatic Sciences and Fisheries Abstracts; Current Awareness in Biological Sciences; Civil Engineering Hydraulics Abstracts; Current Contents/ Agriculture, Biology and Environmental Sciences; Ecology Abstracts; FLUIDEX (British Hydromechanics Research Association); GeoAbstracts; USSR Institute of Scientific Information; FAO Marine Science Contents Tables; Oceanic Abstracts; Oceanographic Literature Review; Physics Abstracts, and Pollution Abstracts.*

Published quarterly in English, with about 1200 volume pages. Special Issues available separately.

FOUNDATION MEMBERSHIP BENEFITS

- Our scientific journal
- Participation and sharing with a distinguished international group of scholars and scientists
- Foundation newsletter
- Notices of meetings
- State-of-the-art reviews
- Reports of meetings
- Technical communications
- Book reviews
- News from affiliated societies
- Coastal calendar of events

ISSN No. 0749-0208.

Please enroll me as a member in the Coastal Education & Research Foundation [CERF]

My payment is enclosed for the category marked below.

1994 Volume 10, Numbers 1- 4 inclusive

- Regular membership and subscription (1 year) \$48.00/\$58.00 foreign*
- Student* membership and subscription (1 year) \$43.00/\$53.00 foreign

*Surface postage is included in the membership and subscription rates.

FOR LIBRARIES, SCHOOLS & ORGANIZATIONS

(Subscriptions when not for personal use)

SUBSCRIPTION (U.S.A.— LIBRARY) \$125.00

SUBSCRIPTION (OTHER COUNTRIES) \$135.00

(ADVANCE PAYMENT IN US DOLLARS REQUIRED)

PLEASE MAKE CHECK PAYABLE TO: CERF

Checks should be in U.S. funds on U.S. or Canadian bank

NAME OF APPLICANT _____ DEGREE _____

ADDRESS FOR MAIL _____

City _____ State or Province _____ Zip Code _____ Country _____

Position or Title _____ Phone _____

*Student Status Certified by _____ Dept. Head _____

MAIL TO: 

JOURNAL OF COASTAL RESEARCH

P.O. BOX 1897

LAWRENCE, KS 66044, USA