

Elmina Castle, Central Region of Ghana

Source: Journal of Coastal Research, 38(5)

Published By: Coastal Education and Research Foundation

URL: <https://doi.org/10.2112/0749-0208-38.5.i>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Journal of

Coastal Research

VOL. 38, NO. 5 • CERF • September 2022



Official Publisher

An International Forum for the Littoral Sciences
Christopher Makowski, Ph.D.
Editor-in-Chief



Year of Service

JOURNAL OF COASTAL RESEARCH

An International Forum for the Littoral Sciences

CHEF-HERAUSGEBER

313 S. Braeside Court
Asheville, NC
28803, U.S.A.

EDITOR-IN-CHIEF EMERITUS

Charles W. Finkl
Coastal Education and Research
Foundation, Inc. (CERF)
313 S. Braeside Court
Asheville, NC 28803, U.S.A.
cfinkl@cerf-jcr.com

EDITOR-IN-CHIEF

Christopher Makowski, Ph.D.

Coastal Education and Research Foundation, Inc. (CERF)

Editorial Offices:
7570 NW 47th Avenue
Coconut Creek, FL
33073, U.S.A.

EDITORIAL ASSISTANT

Barbara Russell
Coastal Education and Research
Foundation, Inc. (CERF)
7570 NW 47th Avenue
Coconut Creek, FL 33073, U.S.A.
barbara@cerf-jcr.com

BOOK REVIEW EDITOR

Luciana S. Esteves
Faculty of Science and Technology
Bournemouth University
Dorset, England, U.K.
lesteves@bournemouth.ac.uk

RÉDACTEUR-EN-CHEF

(Business Office, Coconut Creek)
Website: www.CERF-JCR.org
E-mail: cmakowski@cerf-jcr.com

WEB DESIGN & DEVELOPMENT

Jon Finkl
Media Mine
17600 River Ford Drive
Davidson, NC 28036, U.S.A.
jon@mediamine.net

MITHERAUSGEBER

Edward J. Anthony
Coastal Geomorphology
Dunkerque, France

Patrick Barnard
Coastal Geomorphology
Santa Cruz, California

Gary A. Buchanan
Invertebrates, Pollution
Trenton, New Jersey

Natalia Bugajny
Coastal Geomorphology
Szczecin, Poland

M. Paula Bunicentro
Coastal Geomorphology
Buenos Aires, Argentina

David M. Bush
Coastal Geology & Hazards
Carrollton, Georgia

Ilya V. Buynevich
Coastal Geology
Philadelphia, Pennsylvania

Javier A. Carrió
Sediment Processes
Valencia, Spain

Insik Chun
Coastal Engineering
Seoul, Republic of Korea

Vanda Claudino-Sales
Coastal Dynamics, Dunes
Ceará, Brazil

Omar Defeo
Sandy Beach Ecology
Montevideo, Uruguay

Joseph F. Donoghue
Coastal Morphology & Hazards
Orlando, Florida

Jean T. Ellis
Aeolian Sediment Transport
Columbia, South Carolina

Hany Elwany
Coastal Engineering,
Oceanography
La Jolla, California

Luciana Esteves
Coastal Flooding & Erosion
Bournemouth, England, UK

Niki Evelpidou
Sea-Level Change,
Palaeogeography
Athens, Greece

Oscar Manuel Ferreira
Storm Impacts
Faro, Portugal

Duncan M. FitzGerald
Sediment Transport
Boston, Massachusetts

Kazimierz K. Furmańczyk
Marine Cartography
Szczecin, Poland

Allen Gontz
Geophysics, Stratigraphy
San Diego, California

Gary B. Griggs
Coastal Engineering & Hazards
Santa Cruz, California

Pramod Hanamgond
Coastal Geomorphology
Belgaum, India

Hans Hanson
Coastal Protection
Lund, Sweden

Simon Haslett
Paleoceanography
Swansea, Wales, UK

Michael Hilton
Dune Geomorphology & Ecology
Dunedin, New Zealand

James R. Houston
Sea-Level Change
Vicksburg, Mississippi

Wenrui Huang
Coastal Hydrodynamics
Tallahassee, Florida

Federico I. Isla
Sea-Level Change
Mar Del Plata, Argentina

Nancy L. Jackson
Coastal Geomorphology
Newark, New Jersey

Markes E. Johnson
Paleoshores, Coastal Sand Dunes
Williamstown, Massachusetts

Timothy Kana
Coastal Science & Engineering
Columbia, South Carolina

Dieter H. Kelleter
Coastal Geomorphology
Essen / Cologne, Germany

Joseph T. Kelley
Sea-Level Change
Orono, Maine

Björn Kjerfve
Physical Oceanography, Wetlands
College Station, Texas

Nobuhisa Kobayashi
Coastal Engineering
Newark, Delaware

ASSOCIATE EDITORS

Vladimir N. Kosmynin
Coral Reefs, Coastal Ecology
Tallahassee, Florida

Michael J. Lace
Coastal Landforms & Processes
West Branch, Iowa

Stephen P. Leatherman
Barrier Islands, Beach Erosion
Miami, Florida

Jay Jooyong Lee
Rip Currents, Coastal Hazards
Busan, Republic of Korea

Charles Lemckert
Environmental Fluid Dynamics
Bruce, ACT, Australia

Hak Soo Lim
Hydrodynamics, Coastal
Engineering
Busan, Republic of Korea

Ioannis Liritzis
Geophysical Proxy Data,
Archaeometry
Rhodes, Greece

J. Paul Liu
Sea-Level Change, Deltas
Raleigh, North Carolina

Joshua H. Long
Sediments, Marine Geology
Reston, Virginia

Serena Lucrezi
Coastal Tourism, Marine Ecology
Potchefstroom, South Africa

Michel M. de Mahiques
Sediment Processes
São Paulo, Brazil

Gonzalo C. Malvárez
Beach Morphodynamics
Seville, Spain

Nobuo Mimura
Environmental Engineering
Ibaraki, Japan

Norberto C. Nadal-Caraballo
Coastal Hazards
Vicksburg, Mississippi

Fatima Navas
Coastal Morphodynamics
Seville, Spain

Robert Nicholls
Global Climate Change
Southampton, England, UK

Julian Orford
Gravel Beaches, Storm Events
Belfast, Northern Ireland, UK

Phil D. Osborne
Sediment Dynamics
Vancouver, BC, Canada

Hugh Parker
Airborne Lidar Bathymetry
Adelaide, SA, Australia

Kiki Patsch
Coastal Geomorphology
Camarillo, California

Charitha B. Pattiaratchi
Physical Oceanography
Crawley, WA, Australia

Carlos Pereira da Silva
Coastal Zone Management
Lisbon, Portugal

Michael Phillips
Coastal Geomorphology
Doha, Qatar

Orrin H. Pilkey, Jr.
Coastal Geology
Durham, North Carolina

Nobert P. Psuty
Coastal Geomorphology
New Brunswick, New Jersey

Giovanni Randazzo
Beach Management
Messina, Italy

Tiffany Roberts Briggs
Coastal Geomorphology
Boca Raton, Florida

Kirt Rusenko
Sea Turtles, Dune Restoration
Hampstead, North Carolina

Daniele Scarponi
Marine Paleocology
Bologna, Italy

Anja Scheffers
Coastal Hazards,
Palaeoclimatology
Lismore, NSW, Australia

Vic Semeniuk
Mangroves
Perth, WA, Australia

Douglas J. Sherman
Coastal & Aeolian Geomorphology
Tuscaloosa, Alabama

Andrew D. Short
Coastal Geomorphology
Sydney, NSW, Australia

Pravi Shrestha
Coastal Engineering
Irvine, California

Tom Spencer
Biogeomorphology
Cambridge, England, UK

COMITÉ DE REDACTION

Marcel J.F. Stive
Coastal Hydrodynamics
Delft, The Netherlands

Vallam Sundar
Coastal Engineering
Chennai, India

Terri Sutherland
Phytoplankton, Aquaculture
West Vancouver, BC, Canada

Ana Teodoro
Remote Sensing
Porto, Portugal

E. Robert Thieler
Marine Geology
Woods Hole, Massachusetts

Hannes Tõnisson
Coastal Evolution
Tallinn, Estonia

Arthur C. Trembanis
Coastal Morphodynamics
Newark, Delaware

Frank van der Meulen
Coastal Zone Management
Delft, The Netherlands

Ana Vila Concejo
Coastal Morphodynamics
Sydney, NSW, Australia

Ian J. Walker
Coastal Dunes & Sediments
Santa Barbara, California

Ping Wang
Beach Morphodynamics
Tampa, Florida

Phil J. Watson
Sea-Level Change
Gosford, NSW, Australia

Harry F. Williams
Paleotemperature
Denton, Texas

Colin D. Woodroffe
Coastal Geomorphology
Wollongong, NSW, Australia

Zhaoping Yang
Hydrodynamic Modeling
Seattle, Washington

Robert S. Young
Coastal Processes
Cullowhee, North Carolina

Guoliang Yu
Sediment Transport
Shanghai, China

Saiyu Yuan
Water Flow, Sediment Transport
Nanjing, China



THE JOURNAL OF COASTAL RESEARCH (JCR) (ISSN 0749-0208) IS PUBLISHED BIMONTHLY FOR \$115.00 FOR INDIVIDUAL US CERF MEMBERS, \$125.00 FOR INDIVIDUAL INTERNATIONAL CERF MEMBERS, \$519.00 FOR US INSTITUTIONS, AND \$541.00 FOR INTERNATIONAL INSTITUTIONS BY THE COASTAL EDUCATION AND RESEARCH FOUNDATION, INC. (CERF), 7570 NW 47TH AVENUE, COCONUT CREEK, FL 33073-2723. PERIODICALS POSTAGE PAID AT FORT LAUDERDALE, FL AND ADDITIONAL MAILING OFFICES. **POSTMASTER:** SEND ADDRESS CHANGES TO JOURNAL OF COASTAL RESEARCH, ALLEN PRESS ASSOCIATION MANAGEMENT, P.O. BOX 1897, LAWRENCE, KS 66044-3018.

© 2022 Coastal Education and Research Foundation, Inc. [CERF].

© This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).



JOURNAL OF COASTAL RESEARCH

An International Forum for the Littoral Sciences

Supporting Scientific Institutions



- Consorzio Nazionale Interuniversitario per le Scienze del Mare (Co.N.I.S.Ma.) [Rome, Italy; www.conisma.it/]
- Delft University of Technology [Department of Hydraulic Engineering, Delft, The Netherlands; <http://www.citg.tudelft.nl/over-faculteit/afdelingen/hydraulic-engineering/>]
- Duke University [Earth and Ocean Sciences Division, Durham, North Carolina, U.S.A.; <https://nicholas.duke.edu/marinelab>]
- Griffith University [Center for Infrastructure Engineering and Management, Southport, Queensland, Australia; <https://www.griffith.edu.au/>]
- Ibaraki University [Center for Water Environmental Studies, Mito, Japan; <http://www.cwes.ibaraki.ac.jp/>]
- International Geographical Union (IGU) [Commission on Coastal System (CCS); <http://www.igu-ccs.org/>]
- Royal Belgian Institute of Natural Sciences [Management Unit of the North Sea Mathematical Models (MUMM), Brussels, Belgium; <http://www.mumm.ac.be/EN/index.php>]
- Rutgers University [Institute of Marine and Coastal Sciences (IMCS), New Brunswick, New Jersey, U.S.A.; <http://marine.rutgers.edu/main/>]
- Universidad de la República [Marine Science Unit, Montevideo, Uruguay; <http://www.imber.info/Science/National-Network/URUGUAY/>]
- Universidade Nova de Lisboa [e-Geo Center for Geographical and Regional Planning Studies, Lisbon, Portugal; <http://e-geo.fcsh.unl.pt/>]
- University of California, Santa Cruz [Institute of Marine Sciences, Santa Cruz, California, U.S.A.; <http://ims.ucsc.edu/>]
- University of Delaware [School of Marine Science and Policy, Newark, Delaware, U.S.A.; <http://www.ocean.udel.edu>]
- University of Maine [Climate Change Institute, Orono, Maine, U.S.A.; <http://climatechange.umaine.edu/>]
- University of Sydney [Coastal Studies Unit, Sydney, New South Wales, Australia; <http://sydney.edu.au/>]
- University of Szczecin [Institute of Marine and Coastal Science, Szczecin, Poland; <http://www.wnoz.ztikm.szczecin.pl/en/1/inom/structure/>]
- University of Ulster [Environmental Sciences Research Institute, Coleraine, Northern Ireland; <http://www.ulster.ac.uk/es/research/>]
- University of Wales, Trinity Saint David [Swansea Metropolitan University, Mount Pleasant, Swansea, South Wales, U.K.; <http://www.uwtsd.ac.uk/>]
- U.S. Army Corps of Engineers [Coastal and Hydraulics Laboratory (CHL), Vicksburg, Mississippi, U.S.A.; <http://chl.erdc.usace.army.mil/>]
- U.S. Geological Survey [National Wetlands Research Center, Lafayette, Louisiana, U.S.A.; <http://www.nwrc.usgs.gov/>]

Aims and Scope of the *Journal of Coastal Research* (JCR)

Journal of Coastal Research (JCR), 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.

Abstracting, Editorial, and Subscription Information

Editorial Office: All advertising and editorial correspondence should be sent to Dr. Chris Makowski, Editor-in-Chief, *Journal of Coastal Research*, 7570 NW 47th Avenue, Coconut Creek, FL 33073, U.S.A. PHONE: (+1) 954-899-8416. E-MAIL: cmakowski@cerf-jcr.com WEBSITE: www.cerf-jcr.org

Subscription Information: The *Journal of Coastal Research* is a bimonthly publication. Calendar-year (2022) print and online subscription prices for the JCR are: \$115.00 for US CERF members / \$125.00 for International CERF members (\$95.00 for online only), and \$519.00 for US institutions / \$541.00 for International institutions (\$437.00 for online only). Additional surface charges may apply to subscribers located outside of the USA. For additional membership and subscription forms and information, please go to www.cerf-jcr.org. To obtain a membership or subscription form by mail, please send request to *Journal of Coastal Research*, P.O. Box 7065, Lawrence, KS 66044. Back Issues and Special Issues of the JCR, when available, can be directly requested at: cerf.jcr@gmail.com.

Abstracting Information: The *Journal of Coastal Research* (JCR) is currently surveyed in: *Web of Science (WoS) Core Collection* / *Web of Knowledge (Clarivate Analytics)*; *Science Citation Index Expanded*; *SCOPUS (Elsevier)*; *BioOne Complete*; *JSTOR*; *EBSCO*; *ProQuest*; *Charlesworth*; *BIOSIS Previews*; *Zoological Record*; *Biological Abstract*; *H.W. Wilson Company*; *Thomson Reuters (ISI)*; *Cabells Scholarly Analytics*; *Essential Science Indicators*; *Chemical Abstracts Service (CAS)*; *Gale Group (Gale / Cengage Learning)*; *Copyright Clearance Center, Inc. (CCC)*; *Current Contents - Physical, Chemical & Earth Sciences*; and *Current Contents - Agriculture, Biology & Environmental Sciences*.



www.JCRonline.org

COVER PHOTOGRAPH



www.cerf-jcr.org



Elmina Castle, Central Region of Ghana. This picture shows the Atlantic coast and Elmina Castle in Ghana, formerly known as the Gold Coast. The castle was built by the Portuguese from 1482 to 1486, originally as São Jorge da Mina (St. George of the Mine), and is currently located in present-day Elmina town. The Dutch seized control of the castle from the Portuguese in 1637, and in 1872, it became a possession of the British Empire. It is the oldest European structure in existence in sub-Saharan Africa. Today, it is a popular historical and tourist site that is recognized by UNESCO as a World Heritage Site. There has been a high rush for gold along the Elmina beach in recent times by small scale miners, which has the potential to impact the coastal environment and the fishing industry. The uncontrolled and haphazard manner of collecting beach sand has the tendency to render the beach highly vulnerable to erosion. This is a worrying situation since the sea level is rising currently over 2 mm/year in Ghana. Destruction of the beach will also open up the coastal area to intrusion by waves and flooding from storm surges, which could affect many settlements within the adjacent lands. In response, the government is spending a significant amount of resources to build up sea defense structures along the shoreline in various parts of the country. (Photograph taken in October 2012 by Dr. Frank van der Meulen, UNESCO IHE-Delft Institute for Water Education, and Deltares, Delft, The Netherlands, and by Prof. Kwasi Appeaning Addo, Institute of Environment and Sanitation Studies, University of Ghana.)

COASTAL EDUCATION AND RESEARCH FOUNDATION (CERF)

7570 NW 47th Avenue
Coconut Creek, FL 33073, U.S.A.

Officers of the Foundation

Founded in 1983 by: Charles W. Finkl, Sr. (Deceased),
Charles W. Finkl, Jr., Rhodes W. Fairbridge (Deceased),
and Maurice L. Schwartz (Deceased)

President &

Executive Director:

Charles W. Finkl

Secretary:

Heather M. Vollmer

Senior Vice President &

Assistant Director:

Christopher Makowski

Executive Assistant:

Barbara Russell

CERF-JCR Regional Vice Presidents

North America

Gary B. Griggs
James R. Houston
Timothy W. Kana
Norberto C. Nadal-Caraballo

Western Europe

Luciana S. Esteves
Carlos Pereira da Silva
Marcel J.F. Stive

Eastern Europe

Niki Evelpidou
Kazimierz K. Furmanczyk

Oceania

Charles Lemckert
Anja Scheffers
Vic Semeniuk
Andrew D. Short

Southeast Asia

Hak Soo Lim
Nobuo Mimura

South America

Vanda Claudino-Sales
Omar Defeo

Middle East and N. Africa

Michael Phillips

Board of Directors (Trustees)

Vanda Claudino-Sales	Joseph T. Kelley	Vic Semeniuk
Jean T. Ellis	Stephen P. Leatherman	Douglas J. Sherman
Charles W. Finkl	Charles Lemckert	Andrew D. Short
Duncan M. FitzGerald	Gonzalo C. Malvárez	Daniel J. Stanley
Gary B. Griggs	Christopher Makowski	Marcel J.F. Stive
James R. Houston	Carlos Pereira da Silva	Ping Wang
Robert Huff	Michael Phillips	Phil J. Watson
Timothy W. Kana	Norbert P. Psuty	

Lifetime Members

Camilo M. Botero	Victor V. Klemas	Nelson G. Rangel-
Frédéric Bouchette	Tetsuya Kusuda	Buitrago
Adam Michael Brook	Stephen P. Leatherman	Yoshiki Saito
David M. Bush	Charles Lemckert	Anja Scheffers
Yong-Sik Cho	J. Paul Liu	Andrew D. Short
Insik Chun	Gonzalo C. Malvárez	Rodolfo Silva
Nicholas K. Coch	Ashish J. Mehta	Jean-Daniel Stanley
Jean T. Ellis	Norberto C. Nadal-	Marcel J.F. Stive
Hany Elwany	Caraballo	Charles Thibault
Kazimierz K.	Fatima Navas	Arthur Trebanis
Furmanczyk	Philip D. Osborne	Frank van der Meulen
Allen Gontz	Carlos Pereira da Silva	Erik van Wellen
Gary B. Griggs	Michael Phillips	Ya Ping Wang
Werner Hennecke	Orrin H. Pilkey, Jr.	Allan T. Williams
Carl H. Hobbs, III	Norbert P. Psuty	Jae-Seon Yoon
James R. Houston	Antonietta Quigg	Robert S. Young
Paul S. Kench	Elijah W. Ramsey, III	Wei Zhang
Björn Kjerfve		

Patron Members

Lindino Benedet	John W. Jenson
Georges Chapalain	Timothy W. Kana

CERF-JCR Society Information

The Coastal Education and Research Foundation (CERF) is a non-profit research society dedicated to the advancement of the coastal sciences and serves as the official publisher of the international *Journal of Coastal Research* (JCR). CERF-JCR is devoted to the multi-disciplinary study of complex problems related to the coastal zone. Our purpose is to help in the translation and interpretation of coastal issues for the public and to assist professional and academic research programs by supporting and encouraging field and laboratory studies on a local, national, and global basis. Through printed scientific publications, current online content, and renowned international symposiums, CERF-JCR brings accurate information to both the public and researchers alike on all aspects of coastal issues in an effort to maintain and improve the quality of shoreline resources.

The *Journal of Coastal Research* (JCR) is one of the leading international journals for coastal studies and processes, and is published bi-monthly by the Coastal Education and Research Foundation (CERF). By covering the entire field of coastal research, the JCR encompasses all subjects relevant to natural and engineered environments (*i.e.* freshwater, brackish, or marine) and the protection/management of their resources in the vicinity of coastlines around the world. Even though the journal broadly focuses on immediate shoreline zones, the JCR also embraces those coastal environments that either reach some indefinite distance inland or that extend seaward beyond the outer margins of the sublittoral (neritic) zone. We encourage you to visit www.cerf-jcr.org for more information and invite you all to be a part of our CERF-JCR coastal research society.



CERF-JCR MEMBERSHIP

Society members are those individuals that support the aims of CERF and the JCR. More information is available at: www.cerf-jcr.org. CERF-JCR Memberships are available in different categories with certain privileges and can be viewed at: <https://cerf.allenpress.com/cerf/MEMBERSHIP.aspx>

Subscription information is available upon request by writing to: cerf.jcr@gmail.com. The CERF-JCR subscriptions office is located at: Allen Press, Inc., P.O. Box 1897, Lawrence, KS 66044, U.S.A.

Editor-in-Chief

Christopher Makowski, Ph.D.

Dr. Christopher Makowski is the Senior Vice President and Co-Executive Director of the Coastal Education and Research Foundation (CERF), the official publisher of the international *Journal of Coastal Research* (JCR). He received B.Sc. (Marine Biology), M.Sc. (Marine Ecosystem Diversity), and Ph.D. (Coastal Geoscience and Remote Sensing of Biogeomorphological Resources) degrees from Florida Atlantic University of Boca Raton, Florida, USA, and has worked for over 25 years in the coastal research community, holding titles of Assistant Director (Coastal Planning & Engineering's Marine Science and Biological Research Department), Principal Marine Scientist (Collier County, Florida, USA), and Senior Advisor (International Coastal Symposium [ICS]). Dr. Makowski has published numerous peer reviewed papers, authored multiple chapters, and co-edited various volumes in Springer's Coastal Research Library (CRL) Series and Encyclopedia of Earth Sciences Series (EESS). In addition to these accomplishments, he is professionally recognized by the American Academy of Underwater Sciences (AAUS) and is certified as a Master Scuba Diver Trainer through the Professional Association of Diving Instructors (PADI), having logged over 2,000 underwater dives on six different continents. Other professional registrations, certifications, and accreditations include: Coastal Education and Research Foundation (CERF) Board of Directors (Trustees), BioOne Board of Directors, International Society for Reef Studies (ISRS) Member, Florida Association of Environmental Professionals (FAEP) Chapter Member, American Academy of Underwater Sciences (AAUS) Registered Diving Safety Officer, American Association for the Advancement of Science (AAAS) Member, National Marine Fisheries Service (NMFS) Certified Marine Mammal and Protected Species Observer, Professional Association of Diving Instructors (PADI) Open Water Scuba Diver Instructor, PADI Enriched Air Nitrox Specialty Instructor, Emergency First Responder (CPR/FirstAid/AED) Instructor, PADI Specialty Underwater Photographer Instructor, and Divers Alert Network (DAN) Sustaining Member.

For more information, please visit Dr. Makowski's home page at:

www.cerf-jcr.org

International Coastal Symposium (ICS) Official Meeting of CERF-JCR

The International Coastal Symposium (ICS) was originally set up by Per Bruun (deceased) and Charles W. Finkl as the official meeting of the Coastal Education and Research Foundation (CERF) and the *Journal of Coastal Research* (JCR), with one of the first meetings being held in Hilton Head, South Carolina, in 1993. After the repeated success of these meetings, CERF-JCR moved the ICS to an international platform by holding these conferences in conjunction with local sponsors in the United States, Australia, Brazil, Iceland, New Zealand, Northern Ireland, Poland, Portugal, Spain, and South Korea. The ICS brings together delegates from all over the world to collaborate and discuss the most current coastal research studies and projects. During the ICS 2014, which was held in Durban, South Africa, a grand celebration took place to mark the 30th Anniversary of CERF and the JCR. For more information, please visit www.cerf-jcr.org.

Journal of Coastal Research (JCR)

VOL. 38, NO. 5 (pages 885–1074)

September 2022

ISSN 0749-0208

RESEARCH ARTICLES

Ground Penetrating Radar of Paleoblowouts and Transgressive Dunes, Younghusband Peninsula, South Australia.....	Abbey L. Warner, Patrick A. Hesp, Robert Keane, and Allen M. Gontz	885
Storm-Driven Morphodynamics of a Sandy Beach in Florida.....	Felix Jose and Frank Carlin	896
Classification of Coastal Belts in the Argentine Subpolar Southeast Coast of Tierra del Fuego using the BCCS (Biophysical Cross-shore Classification System).....	Charles W. Finkl and Christopher Makowski	908
Assessment of Sea-Area Benchmark Pricing: Using Chinese Aquaculture to Evaluate and Revise the Price Structure of Resources.....	Hao Kong, Jiawen Shen, Yuning Zhao, and Qinjin Sun	925
Predicting Shoreline Change for the Agadir and Taghazout Coasts (Morocco).....	Abdelhaq Aangri, Mounir Hakkou, Yann Krien, and Aïcha Benmohammadi	937
The Vegetation of the United Arab Emirates Gulf Coast: Description and Analysis.....	Paloma Leandro, Sandra L. Knuteson, and Aaron Bartholomew	951
Comparing the Growth Performance and Fatty Acid Profile of Brown Trout (<i>Salmo trutta macrostigma</i>) and Rainbow Trout (<i>Oncorhynchus mykiss</i>) Reared in Concrete Ponds and Net Cages.....	Serhat Engin and Ozgur Altan	968
Long-Term Evolution of the Guadeloupean Shoreline (1950–2017).....	Eléa Giraud-Renard, Franck Dolique, Antoine Collin, Dorothée James, Emma Gairin, Marine Courteille, Océane Beaufort, Malika René-Trouillefou, Maguy Dulormne, Matthieu Jeanson, and David Lecchini	976
Dredging of the Shenzhen-Zhongshan Link in the Pearl River Estuary, China: Short-Term Siltation Mechanism for a Trial Trench ...	Zhiyuan Han, Huaiyuan Li, Hualiang Xie, Hua Yang, Qunan Ouyang, and Shengsheng Gong	988
Acute and Chronic Toxicity Effects of the Heptachlor Pesticide on Tilapia (<i>Oreochromis mossambicus</i>): Impact to Behavioral Patterns and Histopathological Responses.....	Durairaj Manimekalai, Arasan Srinivasan, Pandurengan Padmavathy, Paulraj Jawahar, Rosalind George, and Ulaganathan Arisekar	999
Monitoring Yearly Change Patterns of the Surface Tidal Trail (STT) in Tidal Flats: A Novel Morphological Indicator Extracted from a Near-Infrared Terrestrial Laser Scanner.....	Yujian Zhan, Stefan G.J. Aarninkhof, Zhengbing Wang, and Yunxuan Zhou	1011
Mid- and Short-Term Monitoring of Sea Cliff Erosion based on Structure-from-Motion (SfM) Photogrammetry: Application of Two Differing Camera Systems for 3D Point Cloud Construction.....	Jae Jin Yu, Dong Woo Kim, Eun Jung Lee, and Seung Woo Son	1021
An Empirical Study on the Environmental Carrying Capacity of Marine Resources Based on the Entropy-Weight TOPSIS Model.....	Siwei Yang, Lili Ren, and Lufeng Gou	1037
Deciphering the Dynamics of Reproduction and Diet for Bigeye Ilisha (<i>Ilisha megaloptera</i>) from the Saurashtra Coast, Northeastern Arabian Sea.....	Shubhadeep Ghosh and Vinaykumar Vase	1050

REVIEW ARTICLES

Biological Flora of Coastal Wetlands: <i>Sporobolus cynosuroides</i> (L.) P.M. Peterson & Saarela.....	Richard Stalter and Robert I. Lonard	1061
--	--------------------------------------	------

BOOK REVIEWS

<i>The National Institute for Marine Research and Development “Grigore Antipa” Constanta: Historical Highlights</i> by A.S. Bologa.....	Charles W. Finkl	1070
<i>Challenges in Estuarine and Coastal Science</i> by J. Humphreys and S. Little (eds.).....	Christian T. K.-H. Stadtländer	1072



www.cerf-jcr.org

An International Forum for the Littoral Sciences
Christopher Makowski, Ph.D.
Editor-in-Chief



www.JCRonline.org