



Integrated coastal zone management in the context of COVID-19

Gerardo M.E. Perillo^{a,b,c}, Camilo M. Botero^{a,d}, Celene B. Milanes^{a,e,*}, Carla I. Elliff^{a,f}, Omar Cervantes^{a,g}, Seweryn Zielinski^{a,h}, Briana Bombana^{a,i}, Bruce C. Glavovic^j

^a Member of the Ibero-American Beach Management and Certification Network - PROPLAYAS, Colombia

^b Instituto Argentino de Oceanografía, Camino a la Carrindanga km 7, B8000FWB, Bahía Blanca, Argentina

^c Departamento de Geología, Universidad Nacional del Sur, Av Alem 1253, 2 Piso of 202, B8000CTX, Buenos Aires, Argentina

^d School of Law, Sergio Arboleda University, Santa Marta, Colombia

^e Civil and Environmental Department, Universidad de la Costa, Barranquilla, Colombia

^f Oceanographic Institute, University of São Paulo, Brazil

^g Faculty of Marine Sciences, University of Colima, Manzanillo, Mexico

^h Department of Hospitality and Tourism Management, Sejong University, 209 Neungdong-ro, Gwangjin-gu, 05006, Seoul, Republic of Korea

ⁱ Grup de Recerca SGR-Interfase, Universitat Autònoma de Barcelona, Carrer de la Fortuna s/n, 08193, Cerdanyola del Valles, Spain

^j School of People, Environment and Planning, Massey University, New Zealand

ARTICLE INFO

Keywords:

Integrated coastal zone management
COVID-19

ABSTRACT

With the increasing need for and emergence of research on ocean and coastal issues in the context of the COVID-19 pandemic, the Ocean & Coastal Management journal presents this Special Issue with relevant articles within the scope of Coastal Management in times of COVID-19. This Special Issue received 43 tentative abstracts, 29 manuscripts were submitted, and finally, 12 articles were accepted. We provide a wide panorama of those twelve articles that integrate the special issue, covering a diverse range of topics regarding coastal management in the COVID-19 pandemic. Seven papers are studies that discuss environmental and social problems during this time in coastal zones, while the other five explore the use of technology to face COVID-19 on beaches. These twelve articles give some insights to improve coastal management, focused on tourist beaches, natural disasters, and fisheries. In sum, this special issue offers an organized compendium of high-level articles, as a contribution to evolve towards the better ocean and coastal management within the rapid emerging of publications about COVID-19.

1. Introduction

COVID-19 has become what may be the most troubling and complex pandemic that humanity has endured. The pandemic has dramatically impacted prevailing social and economic systems and practices, and triggered profound human health, development and socio-psychological impacts on individuals, families, social groups, enterprises and nations around the world (Alcántara-Ayala et al., 2021; Acuto, 2020; Nathan et al., 2020; Schipper et al., 2020; Wells et al., 2020). We have already grown accustomed to hearing that we live in a “new normality”, though in fact there is no such thing as normality in the present situation, but rather a transition towards reconfigured social and human-environment interactions. These changes and associated uncertainties have global ramifications, with significant impacts and implications for coastal cities and settlements, including how to manage coastal and marine activities.

This Special Issue explores the impacts and coastal management implications of COVID-19, including beach management, tourism, fisheries, shipping, and other coastal activities impacted by the pandemic.

The COVID pandemic brings to the fore the complex interconnections between human and social-ecological system health and coastal governance in an age of climate and global change. Responding to the pandemic and planning for sustainable coastal development needs to account for this complexity and the associated uncertainties that shape policy provisions and processes (e.g., Walker et al., 2003). These uncertainties take different forms: 1) *Technical and methodological uncertainty*: For example, the statistical and methodological uncertainties inherent in modelling Sars-Cov-2 aerial transmission on beaches and the determination of a safe distance between beach users; 2) *Epistemological uncertainty*: For example, limited data and knowledge for prioritizing one set of management actions above others, such as whether or not to

* Corresponding author. Civil and Environmental Department, Universidad de la Costa, Barranquilla, Colombia.

E-mail address: cmilanes1@cuc.edu.co (C.B. Milanes).

<https://doi.org/10.1016/j.ocecoaman.2021.105687>

Received 24 April 2021; Accepted 29 April 2021

Available online 14 May 2021

0964-5691/© 2021 Elsevier Ltd. All rights reserved.

(re)open, partially or not, beaches or should take advantage of this moment to promote environmental recovery of these systems?; and 3) *Ontological uncertainty (indeterminacy)*: For example, our lack of understanding about coastal dynamics and the multitude of ways in which people interact with and within coastal social-ecological systems and consequent implications for decision-making in the face of indeterminacy, especially in the long term (e.g., Funtowicz and Ravetz, 1993; Kovacic, 2015; Bombana et al., 2021). In the face of such uncertainties and complexity, this Special Issue shines a light on a critical question for coastal managers and governors: *What are the key coastal governance challenges in this age of COVID-19?*

This Special Issue was triggered by the Ibero-American Beach Management and Certification Network (PROPLAYAS), when, at start of the pandemic, several network members came together to reflect on the effects of the COVID-19 crisis on beaches and their management. Botero et al. (2020a,b) provides an overview of these reflections by more than forty experts about the challenges for coastal management before, during, and after the pandemic. The interest and debate sparked by this publication led to a request by PROPLAYAS for *Ocean & Coastal Management* to set up this Special Issue, and the subsequent invitation to coastal scholars around the world to share their reflections on coastal management in the face of COVID-19. As a result, 70 scholars from 12 countries in the Americas, Europe and Asia contributed to this Special Issue.

2. A range of perspectives on coastal management and COVID-19

There are divergent perspectives on the interconnections between coastal management and COVID-19. The editors initially received 43 abstracts expressing interest in this Special Issue, and 29 articles were finally submitted. Only twelve articles were selected after the independent peer-review process. The special issue is organized into two main thematic categories discussed below.

2.1. Technology and beach management in the face of COVID-19

Data collection and field work have been challenging during the pandemic. The use of technology has been crucial to overcome obstacles and provide information about how beaches can be managed safely during this pandemic. In some cases, studies relied on indirect measurements, like using cameras, and analytical and numerical models. Surveys of stakeholders and decision-makers also helped to provide background information and real-time insights into the challenge's coastal managers face.

Kane et al. (2021) tackle an important question in their study: though virus transmission has been found to be lower in outdoor settings, how does the behavior of beachgoers affect the likelihood of infection? To answer this question, the authors used publicly available beachcam video data and images obtained with an unmanned aerial vehicle (UAV) over the course of 24 days in Virginia Beach, USA. These data was then examined relative to local public health guidance regarding social distancing, use of masks and other measures to contain the pandemic. Their results shed light on how beach management strategies can be used to reduce the spread of COVID-19, while also addressing local economic needs. For instance, they provided data regarding frequency of beach use, and how many of beach users actually comply with regulations and advisories. Real-time data provided to decision-makers could facilitate vigilance in areas and at times where concentrations are worrisome.

Two other articles address the issue of beach carrying capacity. This approach has long been recognized as an important tool to enable sustainability and enhance the quality of the user's experience at recreational beaches. In the context of the pandemic, this methodology can provide valuable information to manage beach access taking into consideration that, due to density restrictions, there need to be control

measures to regulate the number of visitors in each sector, and also to help them to redirect visitors to other sectors that have yet to reach their capacity. Bustos et al. (2021) evaluated the carrying capacity for the 2020/2021 austral summer season in Pehuén Co Beach, Argentina. The economy of this small town is essentially based on tourism, with numerous second homeowners. Key stakeholders were surveyed through an online questionnaire to understand their perceptions of beach use. Moreover, images captured by a set of cameras installed at the Coastal Environmental Monitoring Station (EMAC) were obtained to assess tidal behavior, beach geomorphology, and daily and hourly beach use. The authors were able to estimate a maximum number of beach users during different tidal conditions while maintaining safe social distancing. The effect of the tide on beach occupancy appears to be an issue that it is often disregarded. However, in meso- and macro-tidal beaches, especially if their width is relatively small, the degree of available occupancy varies significantly. Bustos et al. (2021) show that in some segments of a beach during a high tide, the available beach width may be only 5 m on a beach that has an average width of 140 m in other conditions. This means that to follow social distancing measures and provide a safe beach conditions during COVID-19, managers must take into account the dynamic nature of this environment and its implications for carrying capacity and consequently social distancing.

Epelde et al. (2021) used a similar approach to study 14 beaches along the Basque Country, Spain. However, they focused on counting beach users applying machine learning on real-time images. Applying this technique, they could provide information to the local authorities on the occupancy level (full, high, medium, or low) of every beach through a web/mobile app, and special warnings as well, to allow them to take action in cases where carrying capacity limits were about to be reached. The app was downloaded more than 50,000 times and was considered a successful alternative to using extensive polls of beach users to gather data. The authors found that beaches were in higher demand during COVID-19 than in the previous year, which was attributed to local tourism being promoted, the reduction of other recreational activities, and that users saw beaches as safe places that allow social distancing (the latter being the focus of the study by Kane et al., 2021). Regarding density ratios for adequate distancing, the results of Bustos et al. (2021) and Epelde et al. (2021) vary only slightly: 6 m²/person and 8 m²/person, respectively.

These foregoing articles took into consideration the tide as a major variable in defining beach occupancy, based on real data, whereas Dragani et al. (2021) modeled the available space to beach users by applying an analytical formulation that incorporated predicted tides, beach width/slope and air temperature. Their model was applied to a stretch of about 150 km along the micro-tidal coast of Buenos Aires Province (Argentina). Although the tidal range in the area is relatively small, the narrow width and low slope of these beaches produce a similar reduction of available width for beach users as identified by Bustos et al. (2021).

Finally, McKinley et al. (2021) focused on the advantages and disadvantages of using digital tools when seeking community engagement. In their case study in Ireland and Wales, the COVID-19 pandemic disrupted the ongoing Coastal Communities Adapting Together (CCAT) initiative, which focuses on climate change adaptation. One of the highlights of the study is that, while there are benefits in applying digital tools, these should not be viewed as a one-size-fits-all strategy for engagement. Nonetheless, the authors point out that new technologies can enhance adaptation and improve resilience during and after the COVID pandemic and enable better and faster responses to change and broadening community participation.

2.2. Environmental and social problems at the coast in face of the COVID-19 pandemic

This section comprises seven articles. Prazini (2021) explores the relationship between population decline and reduced sediment input

into rivers causing deltaic erosion during past pandemic events. Pranzini explores how historical changes in inland demography and associated activities can result in significant alterations to coastal geomorphology and the configuration of the coast. This article demonstrates how linkages between geomorphology and sociology, art, and historical considerations can inform contemporary coastal management. Moreover, this article suggests that historical and perhaps future pandemics can be traced by the dynamic configurations of the coastal zone.

Two articles highlight the importance of 3S tourism in COVID-19 times. Pereira et al. (2021) analyzed the management of beach tourism during the pandemic through the evaluation of decrees and using a semi-structured questionnaire applied to field surveys. Issues such as public health and security measures adopted by local authorities were analyzed. Bathers' perceptions and the reality of recreational activities on two popular beaches along the Amazon coast of Brazil were described through direct observation and photographic studies conducted in July 2020. The study showcases the low perception of risk to COVID-19 by bathers on both beaches. The authors recognized that the security measures adopted by local authorities have been ineffective and, therefore, this could have contributed to the peak of infections and deaths registered in some coastal municipalities after the holiday period analyzed. This article lays the foundation for the research developed by Milanés et al. (2021), who proposes a set of recommendations for coastal planning and beach management in this era of COVID-19. This analysis was carried out for two scenarios - during and after the COVID-19 pandemic. The authors reviewed international literature on measures implemented at beaches around the world during this pandemic. Good and bad practices were identified in the study and a set of operational beach management recommendations were proposed. These recommendations were grouped into seven categories and include measures that are accepted by the World Health Organization (WHO). The article makes 27 recommendations for enabling effective coastal planning and beach management during and after the COVID-19 pandemic. Recommendations provide in this research, can be adapted according to the economic, social, cultural, and technological contexts of coastal countries that implement it.

Alfonso et al. (2021) evaluate one of the key emerging threats to ocean health, potentially compounded by COVID-19: plastic waste pollution. Single-use plastic and waste mismanagement have been in the spotlight in recent discussions about the pandemic. The authors focused on beach regulations in Latin America and the Caribbean (LAC) to suggest possible measures to alleviate this problem. The current leading global LAC regulations for beaches are analyzed and conclusions drawn about a set of governance measures to reduce this problem. These proposals focus on unifying fragmented and overlapping policies for controlling plastic pollution, focusing attention on plastic industry regulations, enabling a circular economy, and improving public awareness and risk perceptions about marine plastic pollution.

Houser and Vlodychuk (2021) studied the incidence of drownings to explore how COVID-19 impacts beach safety. Daily drowning data is used to compare historical trends of drownings pre-COVID-19 relative to the current condition. Their study quantifies the impact of COVID-19 on drownings worldwide and can be used to inform beach safety measures in a post-COVID era.

Ahmed and Pandey (2021) conducted a spatial socio-ecological assessment of the effects of the cyclone Amphan on Indian coastal communities and measures to mitigate and manage hydrometeorological extremes during a pandemic. The areas most affected by COVID-19 were characterized by slow evacuations, delays in medical support, and a concomitant increase in loss of life. The major challenge was to protect vulnerable people in emergency shelters, shielding them from Cyclone Amphan as well as COVID-19. This is a novel risk assessment case in which the authors integrated the superimposed consequences of both a natural phenomenon and the COVID-19 pandemic. The study underscores the complex interconnections between coastal hazard risk, public health, community development and social-ecological change,

and the imperative to address these interconnections in coastal management efforts, including risk reduction and preparedness actions.

Although focused on a small-scale artisan fishery in the Bahía Blanca Estuary (Argentina), Truchet et al. (2021) touch on a problem that has worldwide importance and is being compounded by COVID-19 (Bennett et al., 2020; FAO, 2020). In the specific case of Bahía Blanca, fishers and their families are not considered essential workers and, therefore, no specific social welfare provisions (i.e., healthcare, social and economic measures) are available to this group. Even so, fishers continue their livelihood activities despite the risk of infection and with reduced demand for fish in markets and from cold store factories. The authors call the attention of decision-makers to the plight of the fishers and their communities, and the need to develop medium- to longer-term solutions.

3. Concluding remarks

COVID-19 has abruptly changed the world and impacted all dimensions of society, including coastal activities and their management. Fear of infection, and travel and meeting restrictions have dramatically reduced the use of coastal areas (especially beaches) for tourism, resulting in major socio-economic and livelihood impacts. This Special Issue sheds light on some of the coastal management ramifications after only one year of the COVID pandemic. Notwithstanding the global vaccination campaigns already underway, the impacts and implications of this pandemic will continue to unfold in uncertain ways for many years to come. As Pranzini (2021) suggests, pandemics have had significant impacts throughout human history, some of which can be discerned, for example, in the configurations of coastal geomorphology. It remains to be seen how pandemic risk and realities will shape the future of coastal management. Innovative coastal governance strategies are necessary to secure beach safety and facilitate sustainable coastal livelihoods. The articles in this Special Issue show some of the impacts and implications of COVID for coastal management. New technologies and social media, like real-time video controls and the use of mobile apps, will be at the forefront of efforts to improve beach safety and foster sustainable coastal development.

We hope this Special Issue will contribute to better understanding of this 'New Normality' and assist coastal managers and governors in tackling the complexities and uncertainties compounded by the COVID pandemic. Coastal managers are navigating turbulent times, when statistics (*technical and methodological uncertainty*), limited data and knowledge (*epistemological uncertainty*) and indeterminacy (*ontological uncertainty*) are pronounced. The articles in this Special Issue shed light on ways to improve coastal management, focused on beach tourism and safety, natural disasters, and small-scale fisheries.

Ethical statement

The present manuscript has never been published before, and it is not under consideration by any other publisher. Its publication has been approved by all authors and, if accepted, it will not be published by other editors, nor in other languages without written authorization by the holder of the author's rights.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Partial financial support for this research was provided to the third author by Universidad de la Costa [grant numbers INV.1106-01-002-15] by the project named "Cultural practices and environmental

certification of beaches: a contribution for the sustainable development in the insular states.

References

- Acuto, Michele, 2020. Engaging with global urban governance in the midst of a crisis. *Dialogues Human Geogr.* 10 (2), 221–224. <https://doi.org/10.1177/2043820620934232>.
- Ahamed, K.K.B., Pandey, A.C., 2021. Characterization and impact assessment of super cyclonic storm AMPHAN in the Indian subcontinent through space borne observations. *Ocean Coast Manag.* 205, 105570. <https://doi.org/10.1016/j.ocecoaman.2021.105532>.
- Alfonso, M.B., Arias, A.H., Menéndez, M.C., Ronda, A.C., Harte, A., Piccolo, M.C., Assessing goals, agreements, and measures for plastic pollution abatement under COVID-19 in LAC coastal environments. *Ocean Coast Manag.* 208, 105613. DOI 10.1016/j.ocecoaman.2021.105613.
- Alcántara-Ayala, Irasema, Burton, Mansilla Elizabeth, Lavell Allan, Andrew, Maskrey, Anthony, Oliver-Smith, Fernando, Ramírez-Gómez, 2021. Editorial: root causes and policy dilemmas of the COVID-19 pandemic global disaster. *Int. J. Disaster Risk Reduct.* 52, 101892. January 2021.
- Bennett, Nathan J., Finkbeiner, Elena M., Ban, Natalie C., Belhabib, Dyhia, Jupiter, Stacy D., Kittinger, John N., Mangubhai, Sangeeta, Scholtens, Joeri, Gill, David, Christie, Patrick, 2020. The COVID-19 Pandemic, Small-Scale Fisheries and Coastal Fishing Communities. *Coastal Management* 48 (4), 336–347. <https://doi.org/10.1080/08920753.2020.1766937>.
- Bennett, Nathan J., Finkbeiner, Elena M., Ban, Natalie C., Belhabib, Dyhia, Jupiter, Stacy D., Kittinger, John N., Mangubhai, Sangeeta, Scholtens, Joeri, Gill, David, Christie, Patrick, 2020. The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. *Coast. Manag.* 48 (4), 336–347. <https://doi.org/10.1080/08920753.2020.1766937>.
- Bombana, B., Garcia-Lozano, C., Pintó, J., Ariza, E., 2021. Multi-Dimensional assessment of Beach systems on the Catalan coast from a pragmatic and epistemological perspective. *Ecol. Complex.* 45, 100907 <https://doi.org/10.1016/j.jenvman.2019.03.100>.
- Botero, Camilo M., Cabrera, J.A., Mercadé, S., Bombana, B., 2020a. El turismo de sol y playa en el contexto de la COVID-19. Escenarios y recomendaciones. *Red Iberoamericana Proplayas, Santa Marta, Colombia*.
- Botero, Camilo M., Cabrera, J.A., Mercadé, S., Bombana, B., 2020b. O Turismo De Sol E Praia No Contexto Da Covid-19. *Red Iberoamericana Proplayas, Santa Marta, Colombia*.
- Bustos, M.L., Zilio, M.I., Ferrelli, F., Piccolo, M.C., Perillo, G.M.E., van Waarde, G., Mavo Manstretta, G.M., 2021. Tourism in the COVID-19 context in mesotidal beaches: carrying capacity for the 2020/2021 summer season in Pehuén Co, Argentina. *Ocean Coast Manag.* 206, 105584. <https://doi.org/10.1016/j.ocecoaman.2021.105584>.
- Dragani, W., Bacino, G., Alonso, G., 2021. Variation of population density on a beach: a simple analytical formulation. *Ocean Coast Manag.* 208, 105589. <https://doi.org/10.1016/j.ocecoaman.2021.105589>.
- Epelde, I., Liria, P., de Santiago, I., Garnier, R., Uriarte, A., Picón, A., Galdrán, A., Arteche, J.A., Lago, A., Corera, Z., Puga, I., Andueza, J.L., Lopez, G., 2021. Beach carrying capacity management under COVID-19 era on the Basque coast by means of automated coastal videometry. *Ocean Coast Manag.* 208, 105588. <https://doi.org/10.1016/j.ocecoaman.2021.105588>.
- FAO, 2020. The Impact of COVID-19 on Fisheries and Aquaculture – A Global Assessment from the Perspective of Regional Fishery Bodies: Initial Assessment, May 2020. No. 1. Rome. <https://doi.org/10.4060/ca9279en>.
- Funtowicz, S.O., Ravetz, J.R., 1993. Science for the post-normal age. *Futures* 25, 739–755. [https://doi.org/10.1016/0016-3287\(93\)90022-L](https://doi.org/10.1016/0016-3287(93)90022-L).
- Houser, C., Vlodarchyk, B., 2021. Impact of COVID-19 on drowning patterns in the great lakes region of north America. *Ocean Coast Manag.* 205, 105570. <https://doi.org/10.1016/j.ocecoaman.2021.105570>.
- Kane, B., Zajchowski, C.A.B., Allen, T.R., McLeod, G., Allen, N.H., 2021. Is it safer at the beach? Spatial and temporal analyses of beachgoer behaviors during the COVID-19 pandemic. *Ocean Coast Manag.* 205, 105533. <https://doi.org/10.1016/j.ocecoaman.2021.105533>.
- Kovacic, Z., 2015. *Complexity Theory in Quality Assessment: Case Studies in Sustainability Science for Governance*. Universidad Autonoma de Barcelona.
- McKinley, E., Crowe, P.R., Stori, F., Ballinger, R.C., Brew, T., Blacklaw-Jones, L., Cameron-Smith, A., Crowley, S., Cocco, C., O'Mahony, C., McNally, B., Power, P., Foley, K., 2021. Going digital - lessons for future coastal community engagement and climate change adaptation. *Ocean Coast Manag.* 208, 105629. <https://doi.org/10.1016/j.ocecoaman.2021.105629>.
- Milanés, C.B., Pérez O., M., Cabrera, J.A., Cuker, B., 2021. Recommendations for coastal planning and beach management in Caribbean insular states during and after the COVID-19 pandemic. *Ocean Coast Manag.* 208, 105575. <https://doi.org/10.1016/j.ocecoaman.2021.105575>.
- Pereira, L.C.C., Felix, R.C.S., Dias, A.B.B., Pessoa, R.M.C., Silva, B.R.P., Baldez, C.A.C., Costa, R.M., Silva, T.S., Assis, L.F.A., Jimenez, J.A., 2021. Beachgoer perceptions on health regulations of COVID-19 in two popular beaches on the Brazilian Amazon. *Ocean Coast Manag.* 206, 105576. <https://doi.org/10.1016/j.ocecoaman.2021.105576>.
- Pranzini, E., 2021. Pandemics and coastal erosion. *Ocean Coast Manag.* 208 <https://doi.org/10.1016/j.ocecoaman.2021.105614>.
- Schipper, E.L.F., Eriksen, S.E., Fernandez Carril, L.R., Glavovic, B.C., Shawoo, Z., 2020. Turbulent transformation: abrupt societal disruption and climate resilient development. *Clim. Dev.* <https://doi.org/10.1080/17565529.2020.1799738>.
- Truchet, Daniela M., Buzzi, Natalia S., Noceti, M. Belén, 2021. A "new normality" for small-scale artisanal fishers? The case of unregulated fisheries during the COVID-19 pandemic in the Bahía Blanca estuary (SW Atlantic Ocean). *Ocean Coast Manag* 208 (2021), 105585.
- Walker, W.E., Harremoës, P., Rotmans, J., van der Sluijs, J.P., van Asselt, M.B.A., Janssen, P., Krayer von Krauss, M.P., 2003. Defining uncertainty: a conceptual basis for uncertainty management in model-based decision support. *Integrated Assess.* 4, 5–17. <https://doi.org/10.1076/iaij.4.1.5.16466>.
- Wells, Peter, Abouarghoub, Wessam, Pettit, Stephen, Anthony, Beresford, 2020. A socio-technical transitions perspective for assessing future sustainability following the COVID-19 pandemic. *Sustain. Sci. Pract. Pol.* 16 (1), 29–36. <https://doi.org/10.1080/15487733.2020.1763002>.