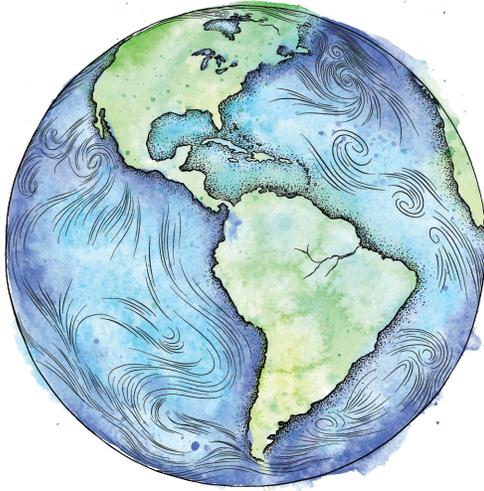


# The Caribbean Sea Digital Twin Prototype (CSDTp) Data Workshop and Hackathon Report



Ministerie van Infrastructuur  
en Waterstaat



## Acronyms

---

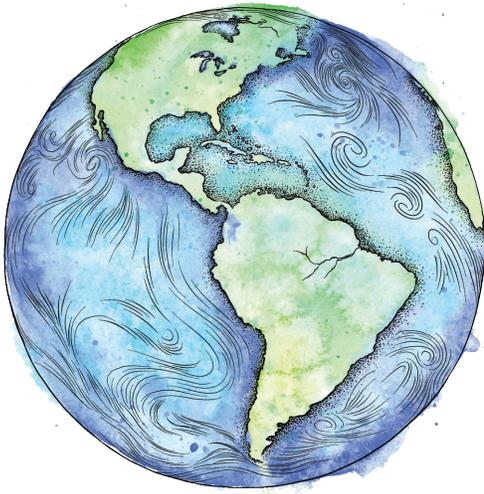
CARICOM	Caribbean Community
CSDTp	Caribbean Sea Digital Twin Prototype
COP	Conference of Parties
DTO	Digital Twin(s) of the Ocean
GEMS Ocean	Global Environmental Monitoring Services for the Ocean and Coast
LMMA	Locally Managed Marine Area
MSP	Marine Spatial Planning
OECM	Other Effective Area-Based Conservation Measure
SDG	Sustainable Development Goal (as set forth by the UN in 2015)

## Acknowledgements

---

The Caribbean Sea Digital Twinning prototype (CSDTp), Data Workshop/Hackathon has been organised by UNEP-Global Environment Monitoring Systems on Ocean and Coasts (GEMS-Ocean) with the support of UNEP's Cartagena Convention Secretariat/Caribbean Environment Programme (CEP) and the UNESCO-IOC (IOCARIBE). The Breda University of Applied Sciences (BUas), facilitated the workshop with the Marine Spatial Planning (MSP) Challenge simulation platform and board game ([www.mspchallenge.info](http://www.mspchallenge.info)).

The Netherlands Ministry of Infrastructure and Water Management (IWM) provided the financial support. This report has been prepared by the Early Career Ocean Professionals (ECOPs), Ali Leisel Hochberg (Bermuda), Genesis Lopez (Puerto Rico) and Osatohanmwun Dianna Iyehen (Barbados) who participated in the workshop with the guidance of the Secretariat.



# Contents

---

Executive Summary & Key Learnings	1
Introduction	2
<b>Outcomes</b>	
Potential Use Cases	3
Lessons Learned	5
Action Items and Next Steps	5
Participant Feedback	6
Recommendations for Future Topics	6
Areas of Improvement	6
Participant Profiles	7
List of Resources	16

# Executive Summary

---

Marine Spatial Planning (MSP) is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that have been specified through a political process.<sup>1</sup> MSP is not an end in itself but a practical way to create and establish a more rational use of marine space and the interactions among its uses, to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes in an open and planned way.<sup>2</sup>

There are many tools that resource managers, coastal planners, stakeholders and policymakers can use in the MSP process; however, an emerging technology that aims to facilitate the integration of regional data resources and improve understanding of the impacts of management decisions is the concept of creating a digital twin. By consolidating a variety of ecological and human use data layers into a single interactive platform, a digital twin offers users the ability to create models and simulations that assess the impact of human activities, management decisions and user interactions. At the same time, there is a growing global movement to create Digital Twins of the Ocean (DTOs), including the DITTO mission,<sup>3</sup> which is a programme under the UN Decade of Ocean Science.

To demonstrate the potential of this technology for regional MSP purposes and to identify use cases for the wider Caribbean region, the Global Environmental Monitoring Services for the Ocean and Coasts (GEMS Ocean) Programme convened a two-and-a-half day Hackathon as part of a larger Caribbean Sea Digital Twin Prototype (CSDTp) initiative.

Participants investigated an MSP simulation platform through a series of scaffolded co-learning and critical thinking exercises. The results, including the initial design for a digital twin of the wider Caribbean Sea and recommendations for next steps, were presented at the High-Level meeting of the responsible ministers at the 2023 Conference of Parties (COP) for the Cartagena Convention on 6 October, 2023.

## Key Learnings

---

- Understanding the different needs of each user and the assignment of uses for those users is highly important.
- As participants learned how to use the MSP digital game and how it relates to the real-world situations, it became evident that the countries presenting on their MSP challenges have similar problems with implementation and can therefore learn from each other.
- There can be better planning and utilization of the resources in the marine environment with the use of a proper Marine Spatial Planning tool such as the one created by Breda University. With the right data, Digital Twinning can be integral in Marine Spatial Planning which can help tackle various challenges being experienced in the marine and coastal ecosystems.
- The MSP simulation platform can help address key areas that facilitate food security and associated job security while at the same time facilitating other marine economic and social activities in a manner that mitigates the potential for conflict.
- A Digital Twin of the Caribbean Sea would have to be capable of showing the different scales of planning at national and regional levels since the plans are made nationally but are impacting and impacted by what happens in the region. There is a strong lack of data fit for purpose (right scale, relevant attributes, and temporal extent) and a centralized data lake would be of benefit for the regional

---

1 <https://www.ioc.unesco.org/en/marine-spatial-planning>

2 Ibid

3 <https://ditto-oceandecade.org/>

# Introduction

---

The Caribbean Digital Twin Prototype (CSDTp) Data Workshop and Hackathon was held from 3-5 October, 2023 in Oranjestad, Aruba and brought together around 20 participants with varying backgrounds and expertise in the Caribbean Community (CARICOM), including data experts, fisheries scientists, hydrologists, marine spatial planners, policymakers and other stakeholders.

By exploring and investigating the components and capabilities of the online Marine Spatial Planning Challenge simulation platform,<sup>4</sup> participants worked in small groups to achieve the following objectives:

1. Develop (together) a first basic concept and value proposition of a (future) Caribbean DTO.
2. Design (together) one or more prototypes of a (future) Caribbean DTO using the MSP Challenge simulation platform as a canvas (sketch board).
3. Identify and sketch (together) possible use cases for an MSP Challenge Caribbean edition.
4. Identify and sketch (together) the critical design elements of an MSP Challenge Caribbean edition: data layers, models and simulations, and user interaction.
5. Identify (together) the key actors and actions needed to develop a (future) Caribbean Sea DTO/ MSP Challenge Caribbean edition.
6. Initiate a Caribbean community of practice that can support regional initiatives for developing a (future) Caribbean DTO/MSP Challenge Caribbean edition.

Over the course of two-and-a-half days, participants engaged in a variety of activities designed to introduce them to the concept of digital twinning and familiarize them with the MSP Challenge simulation platform. The event began with an introduction to the MSP Challenge Board Game<sup>5</sup> which uses a fictional sea basin (the RICA Sea) and adjacent countries to ask players a real-world question: by adopting the role of various stakeholders, can you jointly develop an MSP for the RICA Sea while addressing a variety of potentially conflicting ecosystem, geopolitical and human use interests?

Following this, workshop leaders gave an overview and demonstration of the MSP Challenge simulation platform, which led directly into small-group interactive sessions with the participants allowing them to explore the platform's capabilities and limitations. Throughout the Workshop and Hackathon, there were also participant-led presentations on MSP activities in Aruba, Barbados, Bermuda, Cuba, St. Kitts and Nevis, and Trinidad and Tobago. The event closed with a brainstorming session to draft outcomes and next steps for presentation at the 2023 Conference of Parties (COP) for the Cartagena Convention.



---

4 <http://www.mspchallenge.info/>

5 <https://www.mspchallenge.info/the-board-game.html>

# Outcomes: Potential Use Cases

A variety of potential use cases for an MSP Challenge Caribbean edition were identified by participants, covering environmental/ecological monitoring and forecasting, land-use planning and management, habitat conservation and restoration, blue economy development, public education and policymaking purposes.

Specific use cases identified by participants that fall under these categories are identified below. Some examples co-occur under multiple categories; however, for the sake of brevity they appear in only one category - these are designated with an asterisk.

## Environmental/Ecological Monitoring and Forecasting

- Coral bleaching/mortality observations and predictions
- Monitoring of pollution sources and predicting fate and transport pathways of potential pollution for response and mitigation purposes
- Long-term observation of critical habitat changes - declines or recovery\*
- Monitoring of coastal shoreline stabilization and renourishment projects\*

## Land-Use Planning and Management

- Development of comprehensive MSPs that minimise user conflict while maximising blue economy benefits\*
- Identification of areas that would benefit from nature-based solutions\*
- Identification of areas in which traditional grey infrastructure could be replaced by green-gray infrastructure

## Habitat Conservation/Restoration

- Identification of priority restoration and conservation areas
- Creation of marine protected areas (MPAs), other effective area-based conservation measures (OECMs) and locally managed marine areas (LMMAs)\*
- Identification of areas in which critical habitat (coral/mangroves/seagrass) could be created or expanded to increase positive biodiversity impacts

“

The aspects I found most beneficial were playing the physical game and mapping the uses for each stakeholder. Having been able to interact with the digital MSP challenge game was quite intriguing as it showed that you can't just take a wind farm and place it anywhere you like without first doing adequate research to see how its placement will affect others. Hacking was our path to the future MSP.

Kadean Nadeisha Blake, Department of Marine Resources, St. Kitts and Nevis Meteorology and Hydrology

”



# Outcomes: Potential Use Cases, cont.

## Blue Economy Development

- Identification of potential aquaculture/mariculture development areas
- Identification of habitat areas that could be further developed to increase carbon sequestration/blue carbon potential\*
- Investment in MPAs, OEMS, and LMMAs for sustainable marine tourism development, blue finance, or sustainable fishing (depending on the level of protection)

## Public Education and Policymaking

- Using outcomes created by the MSP Challenge simulation platform to communicate with stakeholders, including visuals for community members and reports for government decision-makers
- Assisting Large Ocean States meet national and regional 30x30 targets
- Assisting Large Ocean States meet national and regional SDG targets
- Facilitating the development of regional MSP agreements



“

The MSP Challenge Board Game was an amazing opportunity for participants to see marine spatial planning take place in an interactive setting, allowing for conversations about real-world priorities and challenges that resource managers and policy-makers face during the MSP process. The simulation platform took this further by allowing users to manipulate environmental and human-use data layers and then seeing the immediate impacts of their decisions, which is a capability that many MSP tools currently don't offer.

Ali Hochberg, National Coordinator, Bermuda Node, ECOP Programme

”

# Outcomes: Lessons Learned

---

The second set of outcomes focused on the lessons that participants learned during the Workshop and Hackathon that should be shared both with their ministers and ministries as well as with regional counterparts after the conclusion of the event. The lessons learned centered on themes such as the breadth and depth of requirements for a regional MSP Challenge platform; geopolitical contexts that need to be taken into consideration; and current gaps in capacity that would prevent effective implementation of a regional MSP Challenge simulation platform. Specific lessons learned identified by participants that fall under these categories are identified below.

## Requirements for a Regional MSP Challenge Platform

- Significant numbers of high-quality environmental and human-use data layers and data analysis at locally/regionally useful resolution
- Feasibility studies, risk assessments
- Ongoing and iterative stakeholder consultation

## Geopolitical Contexts and Considerations

- Each country has its own sovereignty; bilateral/regional agreements would be required
- Scope of the MSP Challenge platform should be the wider Caribbean Sea

## Gaps in Capacity

- Lack of financing for data collection and analysis efforts
- Lack of financing to train and retain individuals to use the MSP Challenge simulation platform
- Data are collected in different formats, often not made freely available to various ministries within the same country

# Outcomes: Action Items and Next Steps

---

The final set of outcomes focused on actionable items and next steps in order to develop a (future) Caribbean Sea DTO/MSP Challenge Caribbean edition. Many of the action items focused on data, including identifying local and regional data gaps, conducting a data inventory and a list of data platforms, developing a standardized approach to data collection, and establishing data sharing agreements-including the potential alignment of national data sharing legislation, policies and strategies across the region. Other action items focused on how to build necessary capacity, including the development of a community of practice to guide the process, anchoring efforts to create a Caribbean Sea DTO/MSP Challenge Caribbean edition within regional processes (such as the Caribbean Ocean Coordination Mechanism), identifying regional champions and leads to promote and advocate for the project, and developing and implementing “train the trainers” programmes for the MSP Challenge simulation platform.

# Participant Feedback: The Experience

---

Participants provided the following top comments when asked about the highlights of the event; they had fun mapping the marine space with the digital game and the challenge as a whole. It was also a great opportunity to collaborate on idea generation with other participants. Once it was clear that there were some conflicts, this brought the bigger picture to life and how the different challenges can be tackled. The presentations from the other countries regarding their Marine Spatial Planning were really informative to the process of coming up with ideas for a digital doppelganger of the Caribbean Sea.

## Recommendations for Future Topics

---

- Marine and coastal management for large ocean states
- Marine workshops that deal with laws to protect the region's ecosystem
- Data availability, accessibility and aggregation in the region
- The need to have participants use real-world data from the region and the countries participating
- The implementation of Marine Protected Areas
- Discussions on the decisions that are taken in the region and how they impact the ecosystem and other activities. Are there already models that simulate these; if not, how could we build them, where is the knowledge needed, do we have to conduct more research or are there resources we could use?

## Areas of Improvement for Future Hackathons

---

- Everyone having prior knowledge of the specific features needed to have the game on their own devices would give them a better understanding when playing the game rather than watching it being played.
- There can be more interactive activities to allow participants to have more ownership and participate better.
- Work on more innovative platforms like the MSP data challenge game to have various comparisons
- It would be beneficial to have more country presentations in future workshops.
- The social component of this workshop is essential for people to make friends in such a short period of time. These relationships will help foster collaboration in the future.
- It would have been better to stay in the city centre or somewhere with accessibility to post-workshop activities and sites.



The platform can help address key areas that facilitate food security and associated job security while at the same time facilitating other marine economic and social activities in a manner that mitigates the potential for conflict.

Dr. David Farrell, Principal of the Caribbean Institute for Meteorology and Hydrology



# Participant Profiles

---

**Dr. Rahanna Juman**



Dr Rahanna Juman is the Deputy Director Research at the Institute of Marine Affairs. She holds a PhD in Zoology (2004) from the University of the West Indies, St Augustine, Trinidad, and a Bachelor of Law (2015) from the University of London. Dr Juman has been conducting research on coastal ecosystems including mangrove forests and seagrass beds for the past 25 years, and has published in international peer review journals, and has authored two books on coastal wetlands. Dr Juman was a Hubert Humphrey fellow from 2010-2011, a Watson International Scholars of the Environment Fellow (2008), an American Fellow (2006) and a UNESCO/ L'OREAL Fellow (2002) and has done internship at the USEPA and NOAA in the United States. She chaired the Caribbean Sea Commission from 2021-2023 and is a member of the GESAMP Working Group 41 on Ocean Interventions for Climate Change Mitigation. Dr Juman has led efforts to develop and implement an Integrated Coastal Zone Management Policy Framework for Trinidad and Tobago and is leading efforts to implement Marine Spatial Planning.

**Ms. Osato Iyahun**



Ms. Osato Iyahun has more than 14 years of experience in fields including sustainable energy, the ocean economy and climate change with organisations including the Inter-American Development Bank, the International Renewable Energy Agency, the United Nations Development Programme and the United Kingdom's Department for International Development. Ms. Iyahun was educated in Nigeria, Barbados, the United Kingdom, France, and the USA, and has experience in Latin America, the Caribbean, the Pacific, Indonesia, Germany, the United Arab Emirates and Japan. Marine Spatial Planning. As the Coordinator of the Sustainable Development Goals Fund's Blue Economy Financing for Small Island Developing States Joint Programme, in coordination with the United Nations Environment Programme and the Food and Agriculture Organization, Ms. Iyahun led the implementation of this Joint Programme, which had an emphasis on the development of an enabling environment for the financing of all sectors of the Blue Economy in the Caribbean through measures such as the identification of policy and regulation gaps; methodologies to identify key Blue Economy project opportunities; and the definition of specific financing mechanisms for Blue Economy initiatives to achieve resilient growth. Barbados, Grenada and St. Vincent and the Grenadines were covered within this Joint Programme. In addition, as a Consultant and Technical Advisor for the Blue Pacific Economic Strategy, Ms. Iyahun was part of a team which led the development of the regional Blue Economy strategies to strengthen sustainable economic development while supporting the restoration and maintenance of the region's marine ecosystems. Ocean economy trends, gaps and opportunities were assessed, and the concept note for the Blue Pacific Economic Strategy was finalised and approved by regional ministers.

# Participant Profiles

---

Mr. Courtney Forde



After graduating from the University of the West Indies Cave Hill campus with a Bachelor of Science degree in Ecology with Earth Science, I started at the Caribbean Institute for Meteorology and Hydrology (CIMH) as an intern, supporting academic staff in number of tasks and projects. After completing the Hydrological Technicians course at the CIMH, I was promoted to Hydrological assistant where I performed data quality checks and analysis, and managed the hydrological database, assisted in installing and maintaining hydrometeorological equipment, and supported academic staff with research, projects, and teaching. In 2018, I applied for, and received a fellowship from the World Meteorological Organisation (WMO) through the CIMH, to pursue a Master of Science degree in Water Science and Engineering, specialising in Hydroinformatics - Modelling and Information Systems for Water Resource Management at IHE Delft Institute for Water Education in Delft, Netherlands. On completion of my MSc., I was invited to submit my thesis research, entitled 'Forecasting Water Level using Artificial Neural Networks to Support Water Resource Management and Ecosystem Restoration: A Case Study in the Florida Everglades', to be included as a chapter in a book to be published by the American Geophysical Union in 2023 with the title 'Advances in Hydroinformatics: Machine Learning and Optimization for Water Resources'. Upon my return to the CIMH, I assumed the position of Technical Officer in the Hydrology department responsible for hydrological and hydrodynamic modelling, machine learning applications, and data analytics, utilizing drones for hydrological and meteorological applications including LiDAR, visual, and multispectral surveys, and field assessments, along with some previous responsibilities including supporting the installation of equipment and their maintenance. More recently, I have additionally been involved in the marine science programme that the CIMH has initiated, which includes modelling of ocean dynamics and parameters such as temperature, salinity, currents, and waves, among others.

Dr. Innis Lorna Veronica



The marine science and governance career of Dr Lorna Veronica Inniss spans more than 30 years, and covers academia, national, regional, and global ocean governance. At present, she is the Regional Coordinator of UNESCO's Secretariat of the Intergovernmental Oceanographic Commission for the Tropical Americas and Caribbean. She was previously the Coordinator of the Cartagena Convention and Acting Director of the Coastal Zone Management Unit, Government of Barbados. She was one of two Coordinators of the Group of Experts to deliver the First World Ocean Assessment to the UN General Assembly. Dr Inniss was one of several architects of the Caribbean Tsunamis and Coastal Hazards Warning System helped develop, and lectured in, the M.Sc. and Post-Graduate Diploma programmes in Coastal Engineering and Management at the University of the West Indies, St Augustine, Trinidad and Tobago. Her work spans the three oceans of SIDS - Caribbean, Indian and Pacific, and she has trained and provided technical advice to several continental coastal countries.

# Participant Profiles

---

**Joana Akrofi**



Joana Akrofi is a Programme Management Officer at the United Nations Environment Programme (UNEP), Science Division, Big Data Branch. She is currently leading the co-design of the Global Environment Monitoring System on ocean (GEMS ocean) with partners to make available relevant data, analysis, and information guiding action to conserve and sustainably use the ocean and coasts. This includes the coordinating the building and convening of a global Community of Practice across experts and society at large to provide capacity, analysis, innovation and synthesized information to decision and policy makers, civil society, international organizations worldwide in a holistic approach to keep the global ocean and coasts healthy and productive. GEMS Ocean promotes and convenes a transdisciplinary partnership approach including UN and civil society partners, data providers, observing systems and knowledge asset holders to translate the collective ocean and coastal knowledge and expertise into sustained, targeted information for decision-makers, and to trigger transformative action at scale focused on sustainable coastal and ocean use and ecosystem health as well as informing developments such as sustainable blue economy and marine spatial planning. Her assignment in the Science Division since 2005 has also included scientific assessments of the marine and coastal environment being part of the Global Environment Outlook (GEO), the World Oceans Assessment (WOA) and the GEF Transboundary Waters Assessment (GEF-TWAP). She is also the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) Technical Secretary for UNEP and the Focal Point for the World Ocean Assessment (WOA). She is a product of the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana and the University of Hull, United Kingdom.

**Mr. Daison Lowe**



I am Daison Lowe, an IT Specialist employed at the Caribbean Institute for Meteorology & Hydrology situated in Barbados. In my current role, I bear the responsibility for overseeing computer network management and software development. Furthermore, my expertise lies in the following key areas:

1. Proficient in the development and maintenance of Big Data platforms.
2. Experienced in designing and crafting software applications tailored to facilitate and enhance meteorological and hydrological operations.
3. Profoundly skilled in the creation and deployment of machine learning models, contributing to advanced data-driven decision-making processes.
4. Data management of Weather, Hydrological and Climate assets.
5. Building and maintaining High Performance cluster networks used for producing numerical weather predictions within the Caribbean.

My professional endeavours are dedicated to driving technological innovation and efficiency within the realm of meteorology and hydrology.

# Participant Profiles

---

Igor Mayer



Igor Mayer is a professor (lector) of Serious Games, Innovation & Society at Breda University of Applied Sciences, the Netherlands. Since January 2021, he is also an endowed professor (0.2fte) “Playful Organizations and Learning Systems” in the department of Organization Studies, Faculty of Social and Behavioral Sciences, Tilburg University. Since 2015, he is an annual visiting professor at Dalian, University of Technology, Dalian, China. One featured R&D project is the MSP Challenge ([www.mspchallenge.info](http://www.mspchallenge.info)) with pending EU / Interreg funded projects in the North Sea, Baltic Sea, Celtic, Mediterranean and Caribbean Sea regions, and invited game-play sessions around the globe. He is a partner in EU ILIAD Digital Twin of the Ocean <https://www.ocean-twin.eu/>, and Digishape - Digitwin Noordzee, <https://www.digishape.nl/projecten/digitwin-noordzee>. You can find him on LinkedIn at <https://www.linkedin.com/in/igormayer/?originalSubdomain=nl>

.

Magali Goncalves



Magali Goncalves is an Environmental Engineer passionate about environmental education and geographical data. Magali is currently doing a Master’s in Geographical Information Management and Applications in the Netherlands and has worked at Breda University of Applied Sciences since late 2016, where she contributed to developing the MSP Challenge Simulation Platform. She did research regarding the geo-data to be included in the simulation platform and worked on its implementation. She also had a crucial role in connecting the simulation platform to a food-web model (Ecopath with Ecosim) to help users understand the potential impacts of their plans in the ecosystem. The platform is constantly developing, and Magali supports the research and innovation process. Previously, Magali contributed to developing SiGAP, an Environmental and Port Management System. She also supported Albufeira’s municipality environment department by managing recycling programs and assisting in wastewater management in Albufeira (Portugal), where she facilitated several Environmental Education activities for young children.

June Masters



June Masters has over 24 years of working in the field of Fisheries Management in the Caribbean, beginning as a Fisheries Officer at the Jamaica Fisheries Division and culminating at the regional fisheries body, Caribbean Regional Fisheries Mechanism (CRFM), where she has worked for the past 15 years as the Statistics and Information Analyst. June holds a Master of Philosophy (Zoology) degree from the UWI Mona Campus. At the CRFM Secretariat she works with the Secretariat’s programme to improve the management of the fish and marine resources of the Caribbean, specifically providing technical assistance to Member States in fisheries data interpretation, analysis, stock assessment and fisheries management.

# Participant Profiles

---

Allison Wiggins



Allison Wiggins is development expert with more than twenty years' experience in development planning and coastal zone management. Allison started her career at the Town and Country Planning Department in Barbados before joining the staff of the Coastal Zone Management Unit as a Coastal Planner in 2005. In 2007, Allison was able to use her skills in development planning to prepare the national Physical Development Plan for the Government of the British Virgin Islands. She returned to Barbados in 2009 and to the position of Coastal Planner. Since 2012 she has been the Deputy Project Manager for the Coastal Risk Assessment and Management Programme which was a US\$42 million project funded by the Inter-American Development Bank and the Government of Barbados. She is presently working on a Technical Cooperation project which is funded by the Government of Japan and administered by the Inter-American Development Bank. She was the team leader for the finalization of the Barbados Integrated Coastal Zone Management Plan 2021-2031 which was approved by the Government of Barbados at the end of 2021. Allison is also undertaking the planning for the Barbados Marine Spatial Plan. Allison holds a bachelor's degree in Geography and a master's degree in City and Regional Planning. She is a Chartered Town Planner. Allison also has both a Postgraduate Certificate in Law and a Postgraduate Diploma in Law as well as a Diploma in Theology. In her spare time, Allison reads extensively and is an avid hiker.

David Farrell



Dr. David Farrell has been the Principal of the Caribbean Institute for Meteorology and Hydrology (CIMH), the technical Organ of the Caribbean Meteorological Organisation, since 2006. As Principal, he has been transforming the CIMH to take a holistic and integrated approach to mitigating the current and future weather, climate, water, and marine challenges the Caribbean region will experience. Under his tenure, the CIMH's training programmes have been expanded and are sought after by persons from around the world. Weather and climate observation and early warning networks across the region have been enhanced and expanded with many reporting in near real-time. To enhance and expand the region's multihazard early warning systems, the WMO-designated Regional Climate Centre for the Caribbean, the Caribbean Centre for Climate and Environmental Simulations, the Caribbean Regional Marine Forecast Support Centre, and the Pan American Node of the WMO Sand and Dust Storm Warning Advisory and Assessment System (WAS-SAS), were established at the CIMH. Dr. Farrell has over 30 years of experience working on a range of water resources, environmental and geological hazard and risk assessment projects in the USA, Canada and the Caribbean. He was previously employed initially as a Research Scientist and later a Senior Research Scientist in the Center for Nuclear Waste Regulatory Analyses at Southwest Research Institute, San Antonio, Texas, USA from 1998-2006. Dr. Farrell has both a Ph.D. (1997) and an M.Sc. (1993) in Hydrogeology from the University of Manitoba, Canada and received a B.Sc. (Hons.) in Geophysics from the University of Western Ontario, Canada in 1989.

# Participant Profiles

---

Gensis Lopez



I am Génesis López Hernández, a graduate of the University of Puerto Rico- Humacao Campus. I graduated with a Bachelor of Science with a major in Marine Biology and Magna Cum Laude honours. I was born and raised in Río Grande, Puerto Rico. Río Grande is a town that is known as the city of the El Yunque, since this is the main entrance to the forest. I am currently teaching science classes to a community of low-income middle and high school students. I aspire to continue with graduate studies related to science, among these are ecology and optometry. I am a very diverse person and I love to do and learn about everything. I consider myself multifaceted because everything new attracts my attention and that is why I am curious to learn it. I am a true believer that I can be a scientist, a teacher or a doctor because I believe that everything in science is integrated. I love science and I do not visualize myself in any other environment than that, which is why I am passionate about contributing my knowledge and learning from the range of scientists and professionals around me. During my career as a professional, I have worked with several projects and among these is SurfRider Organization. I was working with scientific research on the monitoring of invertebrate species, coral reefs and fish in Aguadilla Bay, Puerto Rico. This project was carried out with the purpose of identifying the diversity of invertebrates, coral reefs and fishes in Aguadilla Bay, Puerto Rico. The project was developed with the purpose of identifying the diversity of species that inhabit the area and to create awareness about the importance of the area for the purpose of creating a nature reserve. I live to teach and learn, but above all to leave a legacy of the importance of the ecological values that surround us. I believe in the importance of educating with practice so that new generations are formed with a thirst to discover, explore and conserve our greatest treasure, planet Earth.

Mrs. Kadean Blake



Mrs Kadean Blake-Smith is enthusiastic about the sustainable use, protection, and conservation of our oceans as she believes that healthy oceans are vital to our existence. The oceans resources provide food, Jobs and employment to approximately 3 billion people worldwide. Approximately 85% of the goods we use in our daily lives are transported by the ships; without our oceans, this is not possible. Mrs Blake-Smith has B.Sc. in Logistics and Supply Chain Management and a M.Sc. in Maritime Affairs with a specialization in Maritime Education and Training. She has over 7 years' experience working within the Maritime/Marine sector. Presently she is a fisheries officer with the Department of Marine Resources in St Kitts and Nevis. Currently she is tasked with helping to create a Blue economy Strategy plan for St Kitts and Nevis which will be used to help to reduce overexploitation and support sustainable economic growth through ocean related activities and related sectors. Mrs Blake-Smith aspires to have the younger generation fully aware and enthused about the best practices and sustainable uses of our oceans through education and awareness.

# Participant Profiles

---

Pavel Morales



Pavel Morales Díaz. B.Sc. Director of Research and Development at Inversiones GAMMA S.A. Public company attached to the Ministry of Science, Technology, and Environment of Cuba (CITMA).

Degree in Meteorology at the High Institute of Applied Sciences and Technology (InSTEC), Havana, 2012. Gold Title, Best Graduate, and Best Graduate in the field of Research, of his class. Diploma in Climate and Ecological Risk Assessment and Environmental Impact. University of Alicante, Spain. Other postgraduate studies in subjects related, fundamentally, to coastal processes and beach management and rehabilitation.

Responsible, since 2016 for the actions developed in Varadero beach, within the framework of the Cuban National Beach Rehabilitation Program, including coastal dynamics and monitoring studies, as well as dune rehabilitation and artificial sand nourishment projects. Participant in other studies, projects designs, and technical supervision for the rehabilitation engineering actions at different mean Cuban beaches. Head of the Rehabilitation Project for Runaway Bay Beach, Antigua & Barbuda, under contract with the Association of Caribbean States in the framework of the “Sandy Shorelines” project (2022). Involved in other studies related to his field, under contract with governmental institutions in The Bahamas and El Salvador. Author and Lecturer of the Training Course “Applications of Meteorology to the study of Coastal Processes in Beaches”. Participant in the Meetings of Environmental Authorities of Provinces, Regions and States of Latin America and the Caribbean in Brazil 2019, Paraguay 2020 and Colombia 2018 and 2022. Lecturer at “Varaplayas 2019”, scientific congress that take place in Varadero, Cuba. Participant in different editions of the Convention about Environment and Development, as well as MARCUBA and Meteorology Congresses, in Havana, among other scientific events in Cuba. Participant in the Workshop “Flood Prevention in Havana” (2019) Organized by UNESCO, the Embassy of the Kingdom of the Netherlands in Havana, and the Cuban Ministry of Science, Technology and Environment (CITMA)

Carolyn Savodelli



Carolyn is a Senior Research Associate on ocean data within WRI’s Sustainable Ocean Initiative. Through leadership of ocean data and technology projects, she seeks to improve how we turn data into action towards a sustainable and equitable ocean economy. She engages with data users from around the world to pursue research that supports human-centered ocean management and planning. Prior to this role, Carolyn supported WRI’s Research, Data, and Innovation team in managing the institute’s commitment to open data and the development of a collaborative open geospatial data platform. As an ecologist, she has contributed to domestic and international research projects from limpet evolutionary biology in Panama to aquatic acidification mitigation in the Adirondacks. Most recently, she investigated sea level rise and storm surge impact on the salt marsh-forest ecotone in Connecticut. Carolyn holds a BA in Environmental Biology from Colgate University, MEd from Yale University, and a Graduate Certificate in GIS.

# Participant Profiles

---

Sonia Gautreau



Sonia Gautreau is a Senior Project Officer for the new UNDP/GEF Pro-caribe+ Project, which focuses on promoting enhanced ocean governance in support of the development of an inclusive, climate-resilient, sustainable ocean economy in the Wider Caribbean. Sonia played a key role in the project development phase and was a core member of the Project Coordination Unit of the previous GEF-funded project for the region called CLME+. Sonia has a long-standing track record of supporting governments with advancing their ocean agendas through her work at the UN Secretariat of the Convention on Biological Diversity, the Canadian Government, and the German International Cooperation Agency, GIZ. She has also worked as an independent consultant for a diverse portfolio of clients such as the IOC of UNESCO, Grid Arendal and UNDP. Sonia holds a master's degree in Biology and a Post-Graduate Diploma in Sustainable Development from the University of London. While she is currently based in Atlantic Canada, she has worked almost a decade in Latin America.

Naviel Lue



Naviel Lue is a dedicated environmental researcher with over a decade of experience in the field. His commitment to environmental conservation and his expertise in Geographic Information Systems (GIS) have made him a vital asset to the Directorate of Environment and Nature in Aruba. Naviel Lue holds a bachelor's degree in environmental science, which he earned at the University of Avans in Breda, the Netherlands. This academic foundation has been instrumental in shaping his career as a leading environmental researcher. Over the past ten years, Naviel Lue has been at the forefront of environmental research in Aruba. He has been a driving force behind numerous projects, including his role in the formalization of the 2019 Spatial Planning Development in Aruba. Naviel's approach in setting up ArcGIS databases for environmental data have consistently delivered actionable insights for the betterment of Aruba's natural environment. One of Naviel's most notable contributions is his active involvement as a pillar planet member on the SDG-indicator Working Group for the Government of Aruba. The SDG-indicator Working Group has played a pivotal role in producing the reports on Aruba's Sustainable Development Goals (SDGs) Indicators in 2018 and 2021. These comprehensive reports provide a thorough analysis of various SDG indicators and baselines, offering valuable insights into new baselines, time series data, and trend analyses related to the SDGs. While Naviel Lue thoroughly enjoys fieldwork, collecting critical flora and fauna data first-hand, his specialization in Geographic Information Systems, particularly through ArcGIS, has set him apart. His ability to leverage GIS technology facilitates seamless data visualization and collaboration among colleagues in various government departments, enabling more informed decision-making and driving environmental conservation efforts forward. For inquiries or collaborations, Naviel Lue can be reached at [naviel.lue@dnm-aruba.org](mailto:naviel.lue@dnm-aruba.org).

# Participant Profiles

---

Ali Hochberg

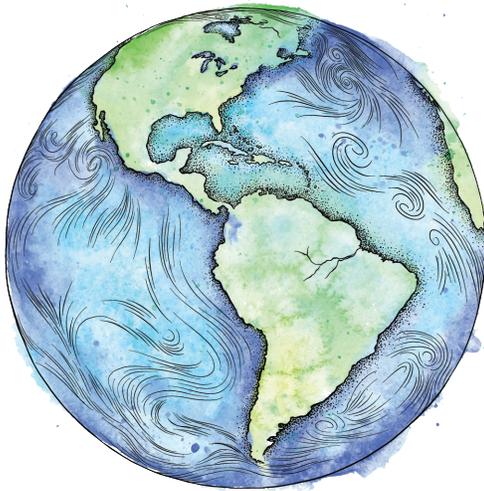


I'm a scientist, science communicator and educator experienced in developing, implementing, and managing strategic communication, marketing, and stakeholder engagement plans. I'm skilled at identifying opportunities to create new partnerships and build long-term working relationships with diverse stakeholders that leverage resources to achieve common goals. I'm also passionate about working at the intersection of conservation, education, ocean science, and climate finance. I recently became a sustainability consultant specializing in helping small businesses reduce GHG emissions, achieve net zero goals and create opportunities for sustainable investments and client relationships. I currently work as the Outreach Manager for the Bermuda Ocean Prosperity Programme (BOPP), a government and community-led initiative to develop a blue economy strategy and marine spatial plan (MSP) for Bermuda. Within the MSP, the Government committed to protecting 20% of the island's waters as fully protected marine protected areas. In my capacity, I help with the development and implementation of communication and outreach plans, and I assist with the technical writing of the MSP. I'm the National Coordinate for the Bermuda Node of the Early Career Ocean Professionals (ECOP) Programme and I was recently asked to head the Bermuda Chapter of InnSure Corps, which is a membership program to connect and empower the next generation of leaders at the intersection of insurance, adaptation, and energy transition ecosystems to accelerate the insurance-based response to climate change.

Chris Corbin



Mr. Christopher Corbin is the Coordinator of the United Nations Environment Programme (UNEP), Cartagena Convention Secretariat based in Kingston, Jamaica. He assumed these duties as of September 1st, 2022. Chris has been with UNEP since September 2004 at the Secretariat in the capacity of Programme Manager for its Assessment and Management of Environmental Pollution (AMEP) Sub-Programme. Since 2015, he has also managed the Secretariat's Communication, Education, Training and Awareness (CETA) sub-programme. Chris facilitated the development of and co-authored the region's first Regional Marine Litter Action Plan and Regional Marine Litter Strategy as well as the first State of Convention Area Report on Marine Pollution. Mr Corbin, a Saint Lucian national born in Barbados, has over 30 years of national and regional programme and project management experience and has been involved in several intergovernmental processes and discussions for improving oceans governance and water resources management in the Wider Caribbean Region. Ongoing and new projects being executed through the Secretariat are currently promoting the use of circular economy approaches for the management of wastewater and solid waste including plastics



## Additional Resources

---

Marine Spatial Challenge (MSP) Simulation Platform:  
<http://www.mspchallenge.info/>

Information on the MSP Challenge Board Game:  
<https://www.mspchallenge.info/the-board-game.html>

[Video of the CSDTp Hackathon and Workshop 3-5 October 2023, Aruba](#)